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PROCEEDING BOOK

26-29 APRIL 2018



INTERNATIONAL CONGRESS ON ENGINEERING AND LIFE SCIENCE
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KASTAMONU - TURKEY



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INTRODUCTION

We are honoured to welcome you in Turkic World Culture Capital 2018 Kastamonu for International Congress on Engineering and Life Sciences hosted by our university.

Worthy Guests

Another action as important as production of new information in order to constitute basis of new researches. Accordingly, the most important activities are conferences, congresses and symposiums.



International Congress on Engineering and Life Sciences inaugurated today is an important organization that gathered different disciplines which have high level of scientific information validity and interaction between.

There will be 131 oral presentation and 3 poster presentation sessions during our congress that will last three days in the field of Engineering, Agriculture, Veterinary Medicine, Forestry and Fundamental Sciences

We will have presenters from Philippines to Bosnia erzegovina, from Lithuania to Cameroon. 550 Scientists from 15 different countries will present 655 oral and 148 poster presentations. On that sense our congress will give participants the scientific pleasure at maximum levels and also it will give participants opportunity to know Turkic World Culture Capital 2018 Kastamonu well through its rich social and cultural programme. As it will allow room to taste far-famed local tastes such as Banduma, Tirit, Etli Ekmek it will also enable to visit Küre Mountains National Park which includes lots of natural beauty such as Valla canyon and Ilıca waterfall.

Dear Guests, As you know, making these kind of organizations are considerably toilsome. In this context, I would like to thank organizing committee and my colleagues, our scientific committee that evaluated scientific researches, our precious administrative staff those who contributed to every single stage of organization, Partner universities of our congress; Mindanao State University, State Agrarian University of Moldova, Southern Federal University of Russia, S. Seifullin Kazakh Agrotechnical University and Bogor Agricultural University.



I also thank our invited speakers who will give scientific feast to participants dear Prof. Dr. Muhammed Haşimi BİNTORO, dear Dr. Caludiu SUTAN and finally dear Prof. Dr. Mükerrer KAYA who has momentous contributions about designing scientific programme.

I also express my thanks to the foundations Agricultural Engineers Association Erzurum Branch, Göktuğ Advertising, Hilal Stationery, Doğuş Machines, Kastamonu University Youth and Sports Society Association, Kastamonu Project Education and Research Cooperative that supported us financially.

Finally

On behalf of me and my organizing committee I thank exemplary person with his support to scientific activities alongside his successful municipal work, Mayor of Kastamonu Province Tahsin BABAŞ who contributed financially and actual from beginning to end at every stage, Prime Ministry Turkish Collaboration and Coordination Agency Presidentship, Kuzey Su Ürünleri Board Chairman dear Osman PARLAK and Kastamonu University Technology Transfer Office.

Dear scientists, I wish these 4 days you will spend in Kastamonu will ensure you a congress nameable socially and scientifically, my organizing committee and I are at your service 24/7.

By indicating that we are glad to host you here once again, accept the assurance of my highest consideration.

Assoc. Prof. Dr. Adem Yavuz SÖNMEZ
General Coordinator of Congress

We are honored to host you here at Kastamonu University for International Engineering and Life Sciences Congress.

Our university has been established in a city which has been a home to many civilizations and has a rich historical and cultural progress. In this consciousness, it has a mentality that sustains and conserves national, cultural and moral values. Therefore, we have hosted many national and international scientific symposia, congresses, panels in the fields of theology, history, aquaculture, tourism, literature, forestry, and development of Kastamonu and that of the Turkic and Islamic world so far.



Also, comprehensive efforts have been made in order to be a university that can cooperate with universities at international level. In this context, we have organized symposia in different countries such as Azerbaijan, Kyrgyzstan, Kazakhstan, Turkish Republic of Northern Cyprus and Serbia.

Today, we are carrying out one of the international activities that contributes Kastamonu University to be a world university under the mission of 2018 The Cultural Capital of Turkic World.

900 papers will be presented by 550 academics from 15 different countries during 4 days of the congress. Not only will you enjoy scientific feast, but also you will have the chance of enjoying historical and cultural sides of Kastamonu in a broad perspective from The Seljuk Empire to Ottoman Empire and from Sheikh Şaban-ı Veli to Mehmet Feyzi.

Dear distinguished guests,

Today, with its 13 faculties, 3 Schools, 13 Vocational Schools, 3 Institutes, 20 Research Centers, approximately 800 academics and 29500 students, Kastamonu University has already taken its place among the recognized and respected universities of Turkey. It has also become a scientific center preferred by 2250 international students from 49 different countries.



The use and development of technology is of great importance to keep up with the level of contemporary civilizations. The vital role of universities in research and development cannot be ignored. With this objective in mind, we have always supported the academic research of our academics since the day we came to the office and this support has been on a continued increase. The registration of our 8 patents in machinery, energy, aqua culture and forestry fields and 1 industrial design certificate are the fruitful outcomes of such endeavors. Apart from these, we have 6 patents, 4 of which in process of research and 2 in application. They will also be registered in a very short time. In our university, we have established Coordinatorship of Technology and Transfer Office and Science, Industry and Technology Application and Research Center. Our fully equipped Central Research Laboratory that meets the needs of the region is also active. Now we are a university that produces technology.

Today, Kastamonu University has attained a level where it benefits from scientific activities it has been working on for years. In this direction, our university is on the point of starting of manufacturing its patents in cooperation with industry. Thus, all scientific activities have started to become meaningful as a result of our commercial ventures. We are now establishing an industrial facility to produce three domestic brands of our university. The most obvious example of what we have already covered is that we are about to actualize the prototype of 12.5 tons weight and 142 horsepower Earth Cylinder. We are also preparing to manufacture breaking card and reducer.

We are trying to contribute to our university, Kastamonu, our country, Turkic and Islamic world. From now on, these and similar activities will continue with your support and contribution in accordance with the goals of our State 2023, 2053, 2071.

I would like to express my gratitudes to Inland Water and Sea Fishes Production, Application and Research Center Administration, academic and organizing committee of the congress, The Municipality of Kastamonu, Turkish Cooperation and Coordination Agency and Mr Osman PARLAK, the Chairman Kuzey Aqua Products.

I would also like to extend my thanks and appreciation to Prof. Dr. Habib MACOYONG, the Rector of Mindanao State University, Muhammed Haşimi BİNTORO, the Vice Rector of



Indonesia Bogor Agricultural University, prominent deans, and academics from all over the world.

I wish that the International Congress of Engineering and Life Sciences will make a contribution to the whole world, especially Turkic and Islamic geography, and bring goodwill and I wholeheartedly wish that such scientific gatherings will continue to bring us together in the forthcoming occasions.

With my kindest regards

Prof. Dr. Seyit AYDIN

Rector- Hanorary President of Congress



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ORAL PRESENTATIONS

Traditional Foods and Food Safety

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Abstract: Traditional foods constitute an important part of cultural heritage as well as being important contributors to the product diversity. The demands for traditional foods, which are perceived by the consumers as more credible and healthier foods, are increasing day by day. Increased human mobility in a globalized world increases awareness of such foods and quick dissemination of information about traditional foods over the Internet enables formation of new markets for these foods. This situation has a positive impact on production as studies on industrializing the production of traditional foods while preserving their specific characteristics are gaining momentum. Nevertheless, the inclusion of new methods into the production processes of these foods for fast production particularly increases concerns about food safety. Moreover, it is also frequently reported that products marketed as “traditional product” do not reflect typical characteristics of that particular traditional product. Therefore, traditional products are protected in many countries by specific regulations, thereby aiming to produce more reliable products as well as to contribute to the economies of small-and-middle sized enterprises. Although there is a high demand for traditional foods, determining food safety criteria for all stages from production to consumption of traditional foods and providing control of such foods with related regulations are important issues for consideration. In this respect, there is a need for extensive research on the chemical composition of each traditional food along with studies on physical, chemical and biological hazards that are important for that specific product. However, it should be kept in mind that monitorability is as important for efficient and sustainable food safety as regulations. An evaluation of traditional Turkish foods in terms of food safety will have a positive impact on their production as well as on their marketability in global markets by making them known to a greater number of consumers. In this study, the studies on traditional Turkish foods and their adaptation into industrial production are investigated from the point of view of food safety, taking into account different product groups, and some recommendations are made.

Keywords: Traditional foods, traditional Turkish foods, food safety, regulations, industrial products

1. INTRODUCTION

Traditional foods are an important part of cultural heritage. They are defined as foodstuffs which are shaped by the effects of climate, geography and traditional lifestyle; produced by using traditional methods and passed on from one generation to the next. Traditional foods, which have a significant impact on the recognizability of a specific geographic region and culture, differ from other foods with their sensory characteristics such as taste and flavor. Traditional foods also play an important role in passing on the culinary cultures of societies to the next generations. The reputation and characteristics of these products stem from the natural conditions specific to that region, or the knowledge, skills, methods and techniques that have been developed by the producers of the product in that region for a very long time (Altuntaş and Gülçubuk, 2014). These foods are also referred as safer and healthier foods for consumers.

Traditional products carry an economic value resulting from an economic activity at the end of a production process (Altuntaş and Gülçubuk, 2014). Traditional foods have been recently considered as an important tool in rural tourism and in rural development (Rinaldi, 2017). Rural development aims the utilization of potential resources by protecting the natural and cultural assets, and harmonization of rural living conditions with urban life and enhancing the economic and social well-being as well as the quality of life of the individuals living in rural areas (Kuşat, 2012; Narin and İnanöz, 2016).

The demand for natural products, which are less processed and contain fewer additives due to the concerns for a healthy life, increases the interest in traditional foods and hence makes a significant contribution to rural development. People develop rural tourism with their curiosity for different flavors and tastes. The recognizability of traditional foods, which also makes a significant contribution to product diversity, increases with increasing human mobility in a globalizing world, and thus new markets are created for these products (Demirbaş et al., 2006; Kuşat, 2012; Taşdan et al., 2017). In many countries, traditional products are protected by legal regulations and thus it is aimed to produce more reliable products and contribute to the economy of small- and- medium-sized enterprises.

Traditional Foods and Regulations

Important regulations have been made for traditional foods in the EU. Activities are carried out to promote traditional foods as products subjected to inspection and certification, compliant with the food legislation and traceable (Demirbaş et al., 2006).

Traditional products which are estimated to be around 2500 in our country include sucuk, pastırma, yoghurt, tarhana, Civil cheese, Kars kaşar cheese as well as local dishes and desserts. These products can be registered with geographic indicators.

Traditional Foods-Innovation

Innovative activities have been carried out providing that origin of food (geography, raw material, etc.) is guaranteed and specific characteristics such as flavor, taste and aroma are maintained (Kuşat, 2012).

Within this scope, R&D activities have been implemented in areas such as;

- Practices enhancing product safety
- Packaging to improve transportation and to increase the storage period
- Decreasing salt, sugar and fat content
- Ease of consumption.

The modifications made in traditional foods as a consequence of technological developments may negatively affect product safety as well as such sensorial characteristics of product as taste and flavor. In addition to the studies on chemical composition of each product, comprehensive studies are needed for the physical, chemical and biological hazards that are crucial for every product. It is considered that assessment of traditional products in terms of food safety will be effective in the production of these products as well as in the presence of these products into the global markets by allowing them to be recognized by larger masses (Demirbaş et al., 2006). For example, dried goose meat, which is produced by traditional methods in Kars and Ardahan provinces is possible to be known to larger masses if such parts of the goose as leg, breast, etc. are packaged with the appropriate packing material and by appropriate methods and then marketed, rather than marketing the whole dried goose. It is obvious that deoxidation will particularly make an important contribution to the preservation of the taste and flavor of this product in a better manner. Similarly, it is considered that the product quality for Erzurum Civil cheese can be preserved better by packaging in a modified atmosphere.

Traditional Foods-Food Safety

Food safety means that the food will not be harmful to the consumer when prepared and/or consumed in accordance with its intended use. Safe food is defined as foodstuff which is suitable for consumption in terms of its physical, chemical and microbiological properties and do not lose its nutritional value when prepared as intended. Information on food safety should be provided by an acknowledged expert and risks should be expressed explicitly and clearly. However, false statements devoid of scientific facts made by non-experts distract the consumer from actual risks. For example,

- Presenting some properties and thus effects of a food in an exaggerating manner,
- Presenting non-existing functions of a food as if they exist,
- Stating some properties as if they were specific to a certain food,
- Stating that a food is unhealthy or dangerous.

One of the most important determinants of demand for traditional foods and other food products is food safety. Traditional foods are usually perceived as healthy and reliable food by consumers. Although the demand for traditional foods is high, it is important to specify food safety criteria at all stages from production to consumption for these products and to keep them under control with relevant regulations.

As in other foods, traditional foods may also contain physical, chemical and microbiological hazards and may be risky in terms of food safety. Bacteria, viruses, molds and parasites are foodborne biological hazards. Foreign materials such as glass, metal, paper, plastic chips, stone, wood, etc. are included in the physical hazards group. In some cases, these foreign materials are accompanied by microbiological hazards. Pesticides, allergens, veterinary medicines, heavy metals such as cadmium and mercury, polychlorinated biphenyls, dioxins, nitrate/nitrite, hormones and similar growth and development regulators, biogenic amines, nitrosamines, polycyclic aromatic hydrocarbons, heterocyclic aromatic amines, components resulting from packaging material, many compounds such as legally-forbidden additives, are included in foodborne chemical hazards (Kaban and Kaya, 2009). For example, *Salmonella*, *Listeria monocytogenes*, *Staphylococcus aureus*, *Escherichia coli* O157H7 that may be present in the raw material used in the production of a traditional Turkish meat product, and other foodborne pathogens are also important biological hazards (Kaya and Kaban, 2016).

In addition, microbial load of the spices used and growth of pathogens during ripening are two other important biological hazards. While aflatoxin in the spice is included in chemical hazards group, metal contamination that may take place during the preparation and filling of the sausage mixture is included in the physical hazards group (Kaban and Kaya, 2009). Since fermentation takes place with spontaneous flora in traditional production, fermentation temperature is crucial for product safety. In cases where acidification is insufficient, high fermentation temperature may stimulate the growth of foodborne pathogens. On the other hand, usage of meat with high pH in these products may also stimulate the growth

of foodborne pathogens and adversely affect food safety. Therefore, sufficient knowledge and experience on the subject in traditional production have great importance (Kaya and Kaban, 2016). In addition, subjecting of sucuk, a kind of traditional dry fermented sausage, to frying process at high temperatures leads to nitrosamine formation and thus may endanger product safety.

Traditional foods are a part of cultural heritage and they have an economic importance. In order to pass down these products, which are considered as an important tool in rural development, to next generations and in order to reach to larger masses, further studies to preserve the specific properties of the product are needed to be conducted in the light of science and technology. In these studies, product safety should also be taken as a parameter and criteria specific to these products should be included in the relevant by-laws and regulations based on the results obtained.

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Evaluation of the Usability of Fly Ash as Raw and Filling Materials in Turkey

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Abstract: It is well known that increasing electric energy demand due to increases in population, improvements in human living standards, and industrial development, especially in developing countries, is met by the burning of fossil fuels such as natural gas, fuel oil and coal. Turkey has become one of the fastest-growing energy markets in the world with its rapidly growing economy. During lignite burning, huge amounts of fly ash, bottom ash and slag are produced as by-products, which also contain the natural radionuclides mentioned above. Depending on emission control systems such as cyclone and bag filters and electrostatic precipitators, a large proportion of the fly ash is collected, and is usually stored in piles or dumped on the land near the lignite-burning power plants. Therefore, the usability of fly ash, produced as by-products during lignite coal burning, in the construction sector and geotechnical applications is very important in view of economic and environmental protection. In this study, the activity concentrations of ^{226}Ra , ^{232}Th and ^{40}K in fly ash collected from the Kangal lignite-burning power plant with a power of 457 MWe were measured using gamma-ray spectroscopy with a high purity germanium detector HPGe detector.

Keywords: Coal, Fly Ash, Slag; Radioactivity, Activity Concentration Indices, Annual Effective dose

1. INTRODUCTION

As known, the increasing electric energy demand due to the increase in population, human living standards and industrial development especially in developing countries is met by the burning of fossil fuels such as natural gas, fuel oil and coal. Turkey has become one of the fastest growing energy markets in the world with a rapidly growing economy. In 2016, Turkey produced the gross electricity generation of 274.7 TWh and consumed the electricity of 278.3 TWh [1 [1,2,3]. As can be seen, Turkey is greatly dependent on fossil fuel to meet the electric power requirement [1]. The activity concentration of these radionuclides in slag and fly ash samples are found to be concentrated from 2 to 5 times that of the lignite samples.

In the study, the radiological characteristics (activity concentration, emanating power and mass exhalation rate of radon) of fly ash samples collected from Kangal LBPP were determined using gamma-ray spectrometer with an HPGe detector.

2. MATERIALS AND METHODS

Sample Collection and Preparation

In the scope of the study, 14 fly ash samples were collected from the Kangal lignite basin, the Kangal LBPP and the open ash deposit, respectively. The samples were brought to laboratory and coded. Each of coal and slag samples was pulverized using a grinder. Then the samples were dried in a temperature-controlled furnace at 110 °C for 24 h to remove moisture. The samples were transferred to plastic containers (5x6 cm), weighed and hermetically sealed to prevent escape of radon gas.

Measurement of the Activity Concentrations

The gamma-ray spectrometer is equipped with a coaxial p-type HPGe detector (GX5020) with a relative efficiency of 50%. The HPGe detector's energy resolution is 2.0 keV at 1332.5 keV. For gamma-ray shielding, a front opening split-top shield was used to reduce the background. Each sample was placed on the top of the detector and counted for 20,000-30,000[4,5,6].

Measurement of Major Oxides in the Fly Ash Samples

The major oxides concentrations in fly ash samples were determined using EDXRF spectrometer (Spectro Xepos, Ametek). This provides breakthrough advances in multi-elemental analysis of major, minor, and trace element concentrations. X-ray tube has thick binary Pd/Co alloy anode with air-cooling.

Assessment of Radiological Impacts of the Use of the Fly Ash

Activity concentration indexes I_{CM} is used only as a screening tool for identifying materials which might be of concern [1,3]. I_{CM} index is estimated for assessing of the radiological impacts from the use of the fly ash samples as covering material in road, street, embankments, pavement and related construction work using the formula.

$$I_{CM} = \frac{A_{Ra}}{700 \text{ Bq kg}^{-1}} + \frac{A_{Th}}{500 \text{ Bq kg}^{-1}} + \frac{A_K}{8000 \text{ Bq kg}^{-1}} \quad (1)$$

where A_{Ra} , A_{Th} and A_K are the activity concentrations of ^{226}Ra , ^{232}Th and ^{40}K (in terms of Bq kg^{-1}) in the fly ash samples, respectively in Bq kg^{-1} . The value of the I_{CM} must be less than unity for fly ash used as covering materials mentioned above applications. The values of I_{CM} estimated for the fly ash samples are given in the second column of the Table 1. The values of I_{CM} varied from 0.9 to 1.8 with an average value of 1.4.

Table 1. The activity concentrations of ^{226}Ra , ^{232}Th and ^{40}K in the fly ash

Sample code	Activity concentration (Bq kg^{-1})								
	^{226}Ra			^{232}Th			^{40}K		
FA1	901	±	34	37	±	2	225	±	18
FA2	1013	±	27	40	±	1	286	±	19
FA3	864	±	21	46	±	2	374	±	27
FA4	904	±	21	45	±	2	338	±	25
FA5	825	±	28	52	±	2	239	±	18
FA6	871	±	30	41	±	1	329	±	25
FA7	849	±	31	42	±	1	290	±	22
FA8	867	±	33	40	±	2	345	±	28
FA9	818	±	31	45	±	2	294	±	24
FA10	1013	±	42	48	±	2	350	±	29
FA11	940	±	38	45	±	2	312	±	26
FA12	947	±	41	43	±	2	321	±	28
FA13	928	±	41	39	±	2	301	±	26
FA14	890	±	35	22	±	1	123	±	11

3.RESULTS AND DISCUSSION

Measured activity concentrations of ^{226}Ra , ^{232}Th and ^{40}K together with the statistical uncertainty (1σ), average, standard error and minimum and maximum values in the lignite fly ash (FA) samples are given in Table 1. The activity concentration of ^{226}Ra , ^{232}Th and ^{40}K measured in the lignite samples varied from 107 ± 3 to 294 ± 9 Bq kg^{-1} with an average value of 187 ± 21 Bq kg^{-1} , 10 ± 2 to 21 ± 4 Bq kg^{-1} with an average value of 16 ± 1 Bq kg^{-1} and 43 ± 4 to 134 ± 11 Bq kg^{-1} with an average value of 99 ± 9 Bq kg^{-1} , respectively.

Radiological assessment of the usage of fly ash samples as raw material in construction sector. The average activity concentrations of ^{226}Ra , ^{232}Th and ^{40}K in fly ash samples were 937 ± 30 , 38 ± 2 and 272 ± 17 Bq/kg , respectively. Additionally, the total annual effective doses (the sum of the effective doses of external gamma radiation, inhalation). The highest average of the total annual effective dose is estimated at $153 \mu\text{Sv}$ for members of the public and $74 \mu\text{Sv}$ for workers, lower than the recommended annual limit of $1000 \mu\text{Sv}$. The Kangal LBPP produces 1.4 million tons of fly ash each year. The handling and storage of the fly ashes can cause environmental and radiological risks for the area.

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Heavy Metal Concentrations in Sepiolite Samples from Central Anatolia Region of Turkey

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Abstract: Heavy metal is naturally occurring chemical element that has a relatively high density compared to water. Heavy metals can be considered systemic toxicants that are known to induce multiple organ damage, even at lower levels of exposure when they can directly or indirectly interact with the human body. Recently there has been an increasing ecological and global public health concern associated with environmental contamination with heavy metals. Sepiolite have been widely used as additive raw material in pharmaceutical, cleaning-detergent, paper, paint, cosmetic agriculture, fertilizer, livestock, ceramics and cement industry due to its absorption (or adsorption), rheological and catalytic properties depending on physicochemical properties such as porosity, surface area, fibrous structure, crystal morphology and composition. In the present study, the concentrations of heavy metals (Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Rb, Sr, Zr, Cd, Hg and Pb) in sepiolite samples collected from Central Anatolia Region (Polatlı, Beylikova and Sivrihisar sepiolite quarries) were analyzed by using energy dispersive X-ray fluorescence (EDXRF) spectrometry.

Keywords: Heavy Metal, Sepiolite, EDXRF, Toxicants, Eskişehir, Ankara

1. INTRODUCTION

Sepiolite-palygorskite clay minerals are commonly associated with phosphatic sediments, salt deposits, sulphates, carbonates, zeolites, and siliceous rocks (Millot, G., 1970, Velde, B. 1985,

Jones, B. F., and E. Galan. 1988). Sepiolite is a naturally occurring clay mineral of sedimentary origin and belongs to the phyllosilicate group and is a magnesium hydrosilicate $\text{Si}_{12}\text{O}_{30}\text{Mg}_8(\text{OH})_4(\text{H}_2\text{O})_4 \cdot 8\text{H}_2\text{O}$. Sepiolite is natural occurring clay mineral of sedimentary origin and has wide range of industrial applications such as, animal feed bondants, decolorization, pesticide and herbicide carries, raw materials in pharmaceutical, cleaning, detergent, paper, paint, cosmetics, agriculture, fertilizer, livestock, rubber industries and production of ceramics, fiber and cement. X-ray fluorescence (XRF) spectrometer and X-ray diffractometer (XRD), respectively.

2. MATERIALS AND METHODS

In this study, chemical compositions of sepiolite samples investigated to determine from available sepiolite deposits collected in Turkey. Fifty samples from Ankara –Polatlı (AP), Eskişehir- Beylikova (EB) and Eskişehir –Sivrihisar (ES) are studied. The crystal structure of sepiolite is given in Table 1. In this work, their descriptions and their provenance and company that exploits the respective deposit. There are several types of sepiolites that have many different formation forms defined elsewhere in the world and in Turkey.

Table 1. Characteristics properties of studying zones

Properties	AP	ES	EB
N (North coordinate)	39° 13' 2.0064"	39° 11' 20.6016"	39° 35' 5800"
E (East coordinate)	32° 0' 9.118"	31° 33' 0684"	31° 12' 5056"
Average working zone (hectar)	40	40	50
Average total zone (hectar)	7500	3750	1000
sample number	50 (0-1000m)	20 (0-1000m)	20 (0-1000m)
Average gamma activity ($\mu\text{Sv/h}$)	21,8416	27,2144	32,3536
Average density (gr/cm^3)	2,56	2.43	2,27

3. RESULTS AND DISCUSSION

In this research, We used XRF analysis model Spectro Xepos, Ametek. It uses 50-watt end window x-ray tube to excite the samples. The mineralogical composition of the samples is similar: carbonates constitute the main impurities, dolomite appears in all samples studied in different proportions, and small amounts of calcite, quartz and palygorskite have been identified. There is a variation in almost all the reflections of sepiolite, the 101d-spacing ranges between 12.47 Å and 12.55 Å. Scanning electron microscopy images showed a good dispersion of Sepiolite in the samples, which is important for attaining better performance materials. SEM images of samples in 100x100 and 200x100 magnification are given in

the Figure-3. According to the SEM images, we can say that the grain size of samples taken from Beylikova (EB) is smaller than other samples. The sample is denser structure.

X-Ray Fluorescence (XRF)

The evaluation of the abundances of chemical elements in the Earth's crust is a pivotal geochemical problem. The major inorganic pollutants are toxic heavy metals such as Cr, Pb, Hg and Cd, which have become a serious problem in the aquatic environment due to their toxicity, bioaccumulation and persistence [1,2,3]. The water pollution caused by inorganic and organic pollutants represents an important ecological and health hazard and had gradually gained great scientific interest. Soil can be defined as a dynamic and complex system and plays both an important role in protecting the groundwater acting and contribute to the maintenance of all forms of life that occur in the terrestrial surface [4-7]. Heavy metal contamination refers to the excessive deposition of toxic heavy metals in the soil caused by human activities. Heavy metal contamination is colourless and odourless. It is difficult to be noticed and does not clearly damage the environment in a short period. When environmental conditions have changed or the heavy metal concentration exceeds the environmental tolerance. For Sepiolite minerals from three different regions (AP, EB and ES) are oxidized and at the Table-2 are showed. This table is given distribution of some elements are minor, major and trace oxides concentrations and earth's crust abundance [8-10].

Table 2. Oxides Elemental analysis results sepiolite samples and earths crus abundance

Sepiolite zones	MnO	SO ₃	FeO ₃	TiO ₂	CaO	K ₂ O	P ₂ O ₅	SiO ₂	Al ₂ O ₃	MgO	Na ₂ O
AP1	0.00382	0.06061	0.203 6	0.03626	4.283	0.0973	0.0219	61.935	0.5857	33.11	0.575
AP2	0.00411	0.09674	0.1279	0.02106	32.43	0.0012	0.03744	61.345	0.275	25.32	0.834
AP3	0.00524	0.09878	0.1825	0.02296	33.89	0.0012	0.0442	61.793	0.372	29.53	1.048
EB1	0.01424	0.00857	1.105	0.1284	2.372	0.3926	0.04101	60.396	2.631	43.79	1.091
EB2	0.01616	0.00825	1.484	0.1722	2.372	0.4974	0.03575	56.25	2.751	23.99	0.614
EB3	0.01766	0.00825	1.543	0.1744	2.233	0.5195	0.4221	61.69	2.851	29.23	0.587
ES1	0.00442	0.00845	0.1687	0.02564	26.98	0.0078	0.03432	60.239	0.3175	22.53	0.864
ES2	0.00237	0.00557	0.1259	0.02244	4.716	0.0545	0.02159	54.29	0.4852	41.91	1.243
ES3	0.00232	0.03291	0.3054	0.04483	2.177	0.1172	0.01246	27.73	0.5779	15.81	0.735

For AP₁ minor concentrations are (P₂O₅, TiO₂, K₂O and SO₂), major (SiO₂, Al₂O₃, MgO and FeO₃) and trace oxides (MnO). For EB₁ minor concentrations are (P₂O₅, MnO), major (SiO₂, Al₂O₃, MgO, FeO₂, K₂O, CaO, FeO₃ and TiO₂) and trace oxides (SO₃). For ES₁ minor concentrations are (P₂O₅, TiO₂ and SO₃), major SiO₂, Al₂O₃, MgO, FeO₂, K₂O, CaO, FeO₃ and trace oxides (MnO). When we examine the table, the abundance of some of the oxidized elements in the cephiolite mineral in this region is higher than the world average, while some values are below the world average. The average concentrations of Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Rb, Sr, Zr, Cd, Hg and Pb were found as 22.0, 59.3, 3566.8, 1.9, 23.3, 8.5, 16.1, 7.8, 13.8, 734.0, 8.8, 1.4, 0.5 and 1.5 µg/g, respectively. One of the most important reasons for this is the geological structure of the earth since its inception.

Tree type sepiolite samples mixed into molasses collected from AP, ES and EB county of inner province in Turkey has analyzed using EDXRF spectrometer. The average concentration results obtained for heavy metals were compared with the average of earth crust. The average concentration of Cr, Mn, Fe, Co, Ni, Cu, Zn, Rb, Zr and Pb is significantly lower than the average of earth crust of 83, 1000, 46500, 18, 58, 47, 83, 150, 170 and 16 µg/g, respectively while the average concentration of As, Sr, Zr, Cd and Hg is significantly higher than the average of earth crust of 1.7, 340, 170, 0.13 and 0.083 µg/g, respectively. The results revealed that the reason for the high As, Sr, Zr, Cd and Hg concentrations in the sepiolite samples should be investigated.

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Investigation of the Effects of Region Animal Husbandry and Economy of Neonatal Period Calf Diarrhea in Narman County of Erzurum Province

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Abstract: In this study, it was aimed to determine the damages caused by the neonatal period calf diarrhea in Narman County of Erzurum Province. The number of female cattle, pregnant cattle and calves that died in the first six month were used in research. These 2017 data were obtained from Narman Food, Agriculture and animal husbandry County Directorate. The calf which is a major problem in the cultivation of the neonatal period, diseases and death rates are highest in the period. The calf diarrhea can occur pathogenic and non-pathogenic causes. Diarrhea usually results in a high mortality rate in newborn calves. According the data obtained; the number of calves that died in the first month are 1487, unit price are 1950₺, financial damage are 2.899.650,00₺, the number of calves that died in the second month are 508, unit price are 2350₺, financial damage are 1.193.800,00₺, the number of calves that died in the third month are 342, unit price are 2850₺, financial damage are 974.700,00₺, the number of calves that died in the fourth month are 186, unit price are 3100₺, financial damage are 576.600,00₺, the number of calves that died in the fifth month are 93, unit price are 3250₺, financial damage are 302.2500,00₺, the number of calves that died in the sixth month are 51, unit price are 3450₺, financial damage are 175.950,00₺. In unhealthy state of the calf causes economic loss and medical expenses. Moreover, this losse does not change due to the death or the survival of the calf. Yield loss stake even in the life of the calf, is significantly damaging to animal husbandry in the region. Calf deaths as a result of the destiriction of the genetic material is a problem that cannot be ignored. As a result, the most critical issue in the region for animal husbandry in the solition of problems, which is unhealthy calves, walkthought identified with diarrhea, calf mortality can be reduced and the chance of treatment can be increased. Animal husbandry in the region can be recovered from the economic losses that ocur due to calf death and the loss of genetic material can also be prevented.

Keywords: Calf, diarrhea, Narman, Neonatal

1.INTRODUCTION

Neonatal calf diarrhea is an important problem in calf breeding. It is usually characterized by watery white or yellowish diarrhea and high mortality in 2-10 day old newborn calves [1;2]. Typically, diarrhea start in the calves for between 36 and 72 hours after birth and die within 2-3 days. The most critical period is the first few days following birth. Calf diarrhea can occur due to pathogenic and non-pathogenic causes [3]. Among the pathogenic agents, it was determined that the most common bacterial factors in calf diarrhea were E. coli, viral pathogens rota and coronaviruses, parasitic agents Cryptosporidium and Eimeria [4;5]. Non-pathogenic factors include colostrum failure, failure of colostral antibody absorption, malnutrition and environmental conditions. When the calf was born in the mother, the immune system did not form [6;7;8;9]. The first things about the calf immune system can be taken with the colostrum, which is fed to the calf within the first 24 hours following birth. Colostrum has become immunized against many pathogens because it will develop better the immune system [10;11].

Neonatal calf diathermy and deaths show which for cattle breeding is one of the major health problems and caused serious economic loss. It is also one of the biggest obstacles in the future of animal husbandry. In this research, it is aimed to show how large this economic loss is even at the district level.

2.MATERIALS AND METHODS

Number of calf deaths caused by calf work in Narman province of Erzurum province, 1457 livestock management belonging to registered animal, pregnant animal taken from Narman Food, Agriculture and Animal Husbandry district and number of calves dying in the first six months were given in the table below.

Table 1. The number of small calves died of six months of age and the approximate economic loss.

Province	ERZURUM	Number of Calves Died	Unit Price	Total Loss
County	NARMAN	Piece	(TL)	(TL)
Number of Calves Died one Month		1487	1950	2.899.650,00
Number of Calves Died Two Months		508	2350	1.193.800,00
Number of Calves Died Three Months		342	2850	974.700,00
Number of Calves Died Four Months		186	3100	576.600,00
Number of Calves Died Five Months		93	3250	302.250,00
Number of Calves Died Six Months		51	3450	175.950,00
Total Number of Pregnant Cows		13160	Narman County Total Damage of Calf Loss	6.122.950,00

It is seen how big the annual loss. Again as seen in the table, it is seen that the most death cases are shaped in the first one month period, and it has been determined that calf diarrhea is among the most common causes of deaths in this period.

3.RESULTS AND DISCUSSION

In many scientific studies, it has been shown that among the most common causes of neonatal period calf diarrhea are *E. coli* from bacteria [12], *corona* and *rota* viruses from viruses [13;14] , *Cryptosporidium* and *Eimeria* from parasites [15]. In addition, among non-pathogenic causes, care-feeding conditions, hygiene and colostrum are not given in time and adequately [2;8;9].

Especially, calves usually do not drink this colostrum, or the wrong amount and time are consumed. If this practice is done properly, the immune system will develop better. In this regard, many cases of death from diarrhea can be reduced even without medication. [16;17;18] . Neonatal period calf diarrhea, calf deaths, as the calf died and the genetic material caused by the disappearance. it has been shown that in the case of the life of the calves, the costs of treatment and inefficiency in the advanced life stage have caused considerable damage to the country's livestock and economy.

As a result, one of the biggest problems of regional animal breeding, calf diarrhea, needs to be studied and evaluated to determine the route to be followed. This will reduce the number of calf deaths. Thus, economic losses due to calf deaths of animal breeders in the region will be reduced.

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Probiotic and Humate Effects on Performance Parameters in Milk Suckling Period of Calves

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Abstract: In this study searched the effect on performance parameters that use of probiotic and humate as feed additives in the feeding in sucking period of calves. In the experiment, 24 -day-old Brown Swiss calves were used as part of the experiment, they were divide into 3 different groups as control (basal diet: full fat milk+alfalfa dry grass+calf stater concentrate feed), probiotic (basal diet+0,15% probiotic) and humate (basal diet+0.15% humate) which including 8 calves each with the average weight of 42,5 kg (± 2.5 kg). As feedstuff, full fat milk, alfalfa dry grass, humate and probiotic with additives concentrated feed were used. Performance parameters were determined by measurements throughout the experiment. The study continued for 12 weeks. While humate group decreased dry matter (DM) consumption of concentrate feed and alfalfa hay, it increased milk DM intake (0–56 days) ($p < 0.01$). Also probiotics group decreased DM consumptions of milk and concentrat feed ($p < 0.01$). Humate group significantly improved the feed efficiency compared with the control and probiotic groups. There were no effects of both humat and probiotic groups on live weight gains. As a result of this study, the effect of the humate group has found to be higher than the probiotic group on the performance parameters, however to say that humate performance parameters in calves have apositive effect, further work about it has necessary.

Keywords: calves, feed additive, humate. performance, probiotic.

1.INTRODUCTION

Antibiotic usage in animal feeds has increased animal health and grow reducing or eliminating certain pathogens [1]. But it leaves chemical residues in animal products in terms of food safety and it has also been shown that the pathogenic bacteria in humans develop risks for their health in terms of antibiotic-resistant development [2]. Because of this reason from all sub-therapeutic antibiotic growth promoters (AGP) have been banned in 1998 year European Union and January 2006 in Turkey [3]. By prohibiting antibiotics, the use of organic feed additives such as humate and probiotic has gained importance.

Probiotic defined that a live microbial feed supplement which beneficially affects the host animal by improving its intestinal microbial balance [4]. Probiotics provided that calves formed the microorganism balance in the gastrointestinal tract, had a positive effect on bowel health. It was also found that reduced pathogenic bacteria colonization, had positive effects on the digestion, lowered the pH, increased mucosal immunity and animal performance [5; 6]. Furthermore, the probiotics of conventional use has been reported that to reduce swelling, suppress diarrheal contagion, increase natural resistance to infectious diseases in the gastrointestinal tract [7], developed cellulite activity and methane production is reduced [8; 9].

Humates are defined as humic substances originating from the humic, fulvic, ulmic acid and hydrophobic compounds originating from humus, such as carbohydrates, amino acids and phenols, which are released by decomposition of organic matter in the soil over time [10; 11]. In addition humat compounds are complex substances that promote the development of beneficial microorganisms [12], decreases the secretion of hormones causing stress [13], developing the immune system, anti-inflammatory [14], anti-viral and antioxidant [13; 15]. Effect of humates found that livestock improved performance by increasing feed conversion ration, encourages growth, has positive effects on carcass increase, reduces mortality.

2.MATERIALS AND METHODS

For this research, Atatürk University Veterinary Faculty Animal Experiments Local Ethics Board was authorized with the letter dated 20 October 2009 and numbered 1166. In the experiment, 24 one-day-old Brown Swiss calves were used as part of the experiment, they were divided into 3 different groups as control group (basal diet), probiotic group (basal diet+0,15% probiotic) and humate group (basal diet+0.15% humate), including 8 calves (4 female, 4 male) and each calf has the average weight of 42.5 kg (± 2.5 kg). During the study, control group were fed dry clover grass+full-fat milk+calf starting feed (Basal diet). Probiotic group was fed basal diet+0,15% Nutri-Sacc. Humate group were fed basal diet+0.15% Bovifarm dryTM. Table 1 given levels of nutrition material and energy use experiment. The study continued for twelve weeks. During the study, the calves in the experiment groups were given milk in the amount of 10% of their live weight every week from the 1st day of the experiment on. Also they were fed with calf starting feed from the 7th day on, and dry

clover grass from the 28th day on. From the 3rd day of the experiment on, clean potable water was always available in front of the calves. SPSS 20 package program was used for statistical analysis of the data.

Table 1. Nutrient ratios of feeds (%)

Nutrients	Alfalfa hay (%)	Milk (%)	Calf starting feed (%)
Dry matter	91,70	12,15	91,40
Crude protein	7,98	4,66	19,01
Crude fat	3,85	4,10	4,67
Crude ash	8,61	0,76	8,00
Crude fiber	27,12	-	12,00
Energy	-	-	2900

3.RESULTS AND DISCUSSION

The highest milk dry matter consumption in the 0-7, 8-28 and 29-56 days periods of the study was in the humat group, it was lowest in the probiotic group whereas the value of the control group is similar to the values of both ($p<0.05$). In terms of milk dry matter consumption in the period of 57-84 days in the experiment was not significant difference in between the groups. The concentrated feed dry matter consumption Experiment 8-28, 29-56 and 57-84 days was the least in the humate group, whereas it was the most in the control group ($p<0.05$). While at least alfalfa dry matter consumption was 1645 g in the humate group, it was similarly 2510 g in the probiotic group and 2659 g in the control group ($p<0.01$). In terms of live weight gain occurred non-significant numerical differences between groups (Table 2).

Table 2. Calves belonging to performance values.

	Control group (K)	Humate group (H)	Probiyotic group (P)	SE	P
0-7 days					
Milk DMC (g)	3625 ^{ab}	3880 ^b	3370 ^a	174	*
LWG (g)	-450	-362	112	586	İV
8-28 days					
Milk DMC (g)	11312 ^{ab}	12290 ^b	10858 ^a	417	**
Concentrated feed DMC	2373 ^a	535 ^c	1800 ^b	137	**
LWG (g)	8362	9000	8812	567	İV
DLWG (g)	398	429	420	44	İV
FCR	1.637 ^b	1.425 ^a	1.436 ^a	89	**
29-56 days					
Milk DMC (g)	19391 ^{ab}	20678 ^b	18530 ^a	615	**
Concentrated feed DMC (g)	11501 ^a	6770 ^b	10111 ^a	786	**
Alfalfa DMC (g)	1020	1018	959	74	İV
LWG (g)	18275	16312	18825	1289	İV
DLWG (g)	653	585	672	46	İV
FCR	1.746 ^b	1.745 ^b	1.572 ^a	123	**
57-84 day					
Milk DMC (g)	26536	27482	26132	883	İV
Concentrated feed DMC (g)	17829 ^a	11874 ^b	17817 ^a	682	**
Alfalfa DMC (g)	2659 ^a	1645 ^b	2510 ^a	133	**
LWG (g)	26025	29125	25513	1326	İV
DLWG (g)	930	1040	911	47	İV
FCR	1.807 ^b	1.408 ^a	1.821 ^b	187	**
Total (1-84 days)					
Total DMC (g)	96247 ^a	86172 ^b	92087 ^{ab}	2489	**
Total LWG (g)	52212	54512	53150	2234	İV
DLWG (g)	621	649	632	29	İV
Average FCR	1.730 ^b	1.526 ^a	1.610 ^b	61	**

*: $p<0.05$, **: $p<0.01$, İnsignificant value: İV. a, b, c. The difference between the averages is important, indicated by different letters on the same line ($p<0.05$). Dry Matter Consumption: DMC, Feed Conversion Ration: FCR, Live Weight Gain: LWG, Daily Live Weight Gain: DLWG.

In this study, it was not found that both humate and probiotic preparations were used together as feed additives the milk suckling period of calves, humate and probiotic additives can be compared with the results of the studies done separately.

Humate group increased milk dry matter consumption in the 0-56 day period of the study whereas concentrated feed and alfalfa dry matter consumption were reduced. In the probiotic group, milk, concentrated feed and alfalfa dry matter consumption were much less than of humate group. Neither humate nor probiotic effect on live weight gain and total live weight gain. While the probiotic no effected on feed conversion ration, humate additive improved significantly feed conversion ration. Though reported, humatin reduces dry matter consumption in ruminants [16], improved daily live weight gain and feed conversion ration [16; 17; 18], in beef cattle [19] and lambs [17] in the studys has also been reported that the humate preparation (Bovifarm) participating in the rations no change daily live weight gain, feed consumption [19; 17], dry matter consumption and feed conversion ration [19]. Humat level and concentrate feed rate in ration were found to be effective in the occurrence of these results. Although probiotics support the finding that live weight gain and daily live weight gain do not change as they do not affect the amount of dry matter consumed and feed conversion ration [20; 21; 22; 23;24], there were studies reporting that the probiotic supplement increases the growth rate in ruminants, live weight, live weight gain, utilization from feed and dry matter consumption [25; 26]. Studies using probiotic additives have shown that the number of animals usually use has effect on the results. As a result, the effect of the humate group was found to be higher than the probiotic group on the performance parameters.

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An Overview on Meat Production of Livestock in the World and in Turkey

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Abstract: The purpose of this research was to evaluate the changes over the years the amount of meat produced by livestock in Turkey and in the world. Today, the demand for the meat of livestock is increasing day by day. Among the animal species dominant in the global dimension in world meat production are poultry, cattle-buffalo and pigs respectively while livestock such as sheep-goat are less common. When the continental meat production is taken into consideration, it is observed that the continent of Europe in 1986 (59.91 million tons) has taken over the leadership of meat production in Asia (74.81 million tons) since 1996. When the animals are examined as species, it is observed that the meat obtained from the poultry sector in total meat production in recent years has increased considerably. This increase in the poultry sector has tripled in 2016 compared to 1986, while pork production has been determined to be nearly twice as high as in the same years. Over 50% of the meat produced in the world is produced by China, America, Brazil, Germany and India respectively. The meat production in Turkey is about 1% of the world. The per capita meat production in the world was 44.55 kg in 2016 and, the same year, this rate has been identified as 43.21 kg in Turkey, 136.18 kg in America. In this results indicate that meat production has shown a certain increase in the world, but this rate is particularly high in Asia and less in Europe.

Keywords: Meat, production, world, Turkey

1. INTRODUCTION

Among the animal species that are dominant in the global dimension in world meat production, there are wings, cattle-buffalo and pigs in large proportions while farm animals such as sheep-goats are less common. However, the diversity of meat types obtained from around the world varies considerably from country to country. For example, horses in some countries and ducks in others have a significant share in total meat production (Ritchie and Roser, 2018).

Considering the livestock policies followed by the developed countries, it is seen that these countries have achieved a stable structure in the national production realized in the sectors and they are in an exporting position (Sakarya and Aydın, 2011).

Although technologically developed countries have 30-40% of world animal existence, they hold 75-80% of world animal production. However, Turkey's less including in developed and developing countries, although they retain the 60-70% of the presence of the animal world, and they realize 20-30% of animal products production (Grandin, 2000; Taylor, 1994). The main reason for the increase in meat prices in Turkey is a drop in consumption of red meat. (Akman, 2018). This results in factors such as the decline in animal existence according to the human population, the share of interrupted animals in total animal existence, and the carcass weights obtained.

Other reasons include; the increase in livestock fattening prices, price instability, the increase feed price, the lack of a basic right to animal husbandry, speculations created by some firms, inadequate organizations and mismanagement policies applied it is shown (Tan and Dellal, 2002). The crises experienced in the red meat sector led to difficulties in meat supply from the one hand and inadequacies in the consumption of red meat and meat products from the other side (Karakuş, 2011).

The most important factor affecting the production of a good is the demand for that good. The fact that the product to be produced is a basic commodity that meets the nutritional needs, also increases the interest in that business (Grandin, 2000; KKGM, 2010; Taylor, 1994). In this direction of this information, in this research aimed to assess the changes over time in the amount of meat produced by livestock in the Turkey and in the world.

2. RESULTS AND DISCUSSION

Global Meat Production

Global meat production has increased rapidly in recent years. When meat production is examined as continent in 2016; Asia 140.02, Europe 62.56, America 101.66, Africa 18.96 and Oceania 6.69 million tons total meat production was realized (FAO, 2018).

Meat Production as Species

When the animals are examined as species, it is observed that the meat obtained from the poultry sector in total meat production in recent years has increased considerably. When meat production is examined as a species in 2016; Poultry 120.30, pork 118.17, beef-buffalo 69.80, sheep-goat 14.93, camel 0.53, horse 0.74 and rabbit 1.43 million tons total meat production was realized (FAO, 2018).

Leading Countries in Meat Production and Export as Species

According to some animal species, the countries with the highest meat production and exports in 2016 (Table 1), (Trademap, 2018; FAO, 2018).

Table 1. Meat Production and Export as Species

Animal species	Meat Production	Export
Poultry	USA	Brazil
Pork	China	EU
Beef	USA	USA
Sheep and goat	China	Australia
Camel	Sudan	Sudan
Horse	China	Belgium
Rabbit	China	New Zealand
Duck, geese, turkeys, guinea fowl	USA	Brazil

Meat Production Quantity of Some Countries

Some countries, which have a large share in meat production in the world, and total meat production of Turkey is shown in Table 2 (FAO, 2018).

Table 2. Meat Production of Some Countries

	Meat Production (Million ton)			
	1986	1996	2006	2016
China	22.10	47.72	72.64	87.55
USA	26.28	34.26	40.12	44.62
Brazil	6.20	12.35	20.44	27.44
Germany	7.45	5.99	7.02	8.43
India	3.22	4.14	5.28	7.19
Turkey	1.17	1.10	1.60	3.35
World	159.16	207.22	266.14	329.89
% Share in World Meat Production				
5 Country*	40.99	50.41	54.67	53.12
Turkey	0.73	0.53	0.60	1.01

Meat Production, Price and Per Capita Income of Turkey

The meat production, price and per capita income in 1986 and 2017 years of Turkey are shown in Table 3. According to years; total meat production has increased about three times, while per capita income has increased by about eighteen times.

Table 3. Meat Production, Price and Per Capita Income of Turkey

Years	Per Capita Income (\$)	Meat Price (\$)	Total Meat Production (Million Tons)
1986	1.462	8.9	1.17
2017	25.780	10	3.35

The number of animals sheep, goat, cattle and buffalo slaughtered in Turkey, and the total amount of meat production derived from those are shown in Table 4. (TÜİK, 2018). In addition, poultry meat quantity was obtained about 2.2 million tons in 2017.

Table 4. Number of Slaughtered Animals and Meat Production according to animal species of Turkey (2017)

Animal Species	Number of Slaughtered Animals (head)	Quantity of Meat Production (tons)
Sheep	5.134.338	100.058
Goat	2.068.866	37.525
Cattle	3.602.115	987.482
Buffaloe	6.123	1.339
Total	10.811.442	1.126.404

Per Capita Meat Production According to Population Distribution of Some Countries

Per capita meat production according to population distribution, Table 5 is given. Among the countries surveyed, per capita meat production is the largest in the United States. The country which has made the greatest increase in per capita meat production in recent years is Brazil.

Table 5. Per Capita Meat Production According to Population Distribution (Rural- Urban)

	1986			2016		
	Total Population Distribution (%)		Meat Production	Total Population Distribution (%)		Meat Production
	Rural	Urban	Per Capita (kg)	Rural	Urban	Per Capita (kg)
China	75.43	24.57	19.96	42.65	57.35	60.79
USA	25.36	74.64	107.57	18.21	81.79	136.18
Brazil	29.30	70.70	44.58	14.07	85.93	133.71
Germany	27.38	72.62	94.18	24.49	75.51	102.18
India	75.41	24.59	4.03	66.86	33.14	5.54
Turkey	46.07	53.93	23.31	26.11	73.89	43.21
World	58.46	41.54	32.13	45.52	54.48	44.55

In this period, the success can be achieved to the extent that structural reforms that enhance competitiveness and productivity are achieved. In animal products, it is firstly necessary to aim at providing self-sufficiency. Policies aimed at increasing the red meat production by taking into account the consumption habits of the people should be made, but necessary applications should be made to prevent the drop in milk prices accordingly. Meat and milk production should be considered as interrelated. Although imports seem to be successful as a palliative (temporary) measure in keeping short-term prices stable, they should not be overlooked in the medium to long term.

The way to achieve price stability; to increase production. The way to achieve this is; it should not be forgotten that the livestock sector has effectively resolved its problems in state support and poverty. Units that will enable the breeder to market the product urgently, provide cheap and high quality concentrate feed, and protect and enrich feed resources should be established by the public. Considering the geographical conditions of the country, hybridization studies should be given importance to cattle and sheep breeding for fattening purposes.

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Evaluation of Learning Forms of Students Based on Data Mining: Bartın Vocational School Example

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Abstract: Education and training methods are constantly changing. Today, learning styles are personalized. For this reason, determining the appropriate learning style has become an important issue for the students. Information society comes to life with educated individuals. Data mining is concerned with obtaining meaningful information from many sources. The amount of data is increasing rapidly every day in the world. For this reason, data mining has become a major issue. Developed countries are investing heavily in data mining. In addition, data are used in all areas of the scientific world. The combined use of education and data mining is very limited. In this study, learning styles of students were evaluated with data mining. Demographic information (age, sex, country, department) and learning styles (visual, auditory, tactile) of the students in two different departments (material and material technology, marketing and advertising department) in Bartın Vocational School were asked in the study. A dataset was created on this count. Later, meaningful information was obtained from the data set by decision tree and association algorithms. As a result of the study, it was determined that the most important factor determining the predisposition to learning style was gender. It has been found that the student's age and country are important in the second degree. At the same time, it was discovered that women learned visually better by the association algorithm. It is known that data mining algorithms can be used in the field of education for more effective learning-teaching. More work is needed in this regard.

Keywords: Data mining, learning style, student, vocational school, algorithm

1.INTRODUCTION

The influence of knowledge on individuals and society has increased significantly in the 21st century. As a result, the investments made by developed countries in their academic work have increased. Learning constitutes a part of a process that begins at birth and continues for life as one of the most important skills of the individual (Can, 2011). Learning is expressed as the process by which the stimuli are taken to the brain and processed in the brain through sensory organs. The learning process begins with the perception of knowledge and is compiled and processed in the mind with the most perceptive perception of the quality of the stimulus. This process of behavior varies from individual to individual and at the same time shows that each individual has his or her own learning styles (Kavalcı and Unal, 2016).

The learning style reflects the person's approach and the general attitude towards the learning process (Cesur and Fer, 2009). At the same time learning styles are individual characteristics that show the individual's preferences for learning. The individual's approaches constitute his learning style and give hints about how he learns. The learning style differs according to the demographic characteristics of the person, the level of intelligence, the preferences for acquiring information, the psychological situation, the desires and expectations, and the characteristics of the environment in which the learning takes place (Kavalcı and Unal, 2016).

In this context, each individual's learning style is different from each other. The best learning for one person may not be enough for the other. For this reason, it is not possible to talk about a learning style which can be called as the single best. since learning styles are different, educational activities need to be organized to take into account individual differences (Varışoglu, 2018).

Providing training appropriate to individual differences between learners and learning styles as appropriate to their preferences will contribute to a more successful and effective learning outcomes of the students (Bozkurt and Aydogdu, 2009). In this way, with the correct learning style, students will be able to collect, organize, modify, translate, and use information effectively (Kavalcı and Unal, 2016). Therefore, determining the learning style of the student and teaching him / her appropriate teaching reduces the learning problems that the student will encounter (Mutlu, 2008).

Moreover, the realization of education and training in accordance with the differences in preferences of students' learning styles will naturally increase the necessary success in all areas of science. The important thing is to organize the appropriate teaching activities for each student in the most appropriate style (Ozgen et., 2011). For example, in a study conducted by Yazıcılar and Güven (2009), it has been determined that implementing teaching activities that take learning style characteristics into consideration is effective in increasing students' actual level of holding.

In this context, it is important to know the learning styles of the students. In the work done, learning styles were handled by data mining method. Data mining (Zhang et al., 2018) is one of the most important areas of computer science. Data mining is also known as discovery of information from databases. Obtaining meaningful information usually begins with raw data, continues with data preparation, feature extraction, machine learning, and ends with information evaluation. The aim of the study is to evaluate the learning styles of students with the use of data mining algorithms in the field of education. The decision tree algorithm was used for this purpose. In the present literature, the studies on this subject are very limited. With the study, it was aimed to complete a subtraction in this area.

2.MATERIALS AND METHODS

In this study, it is aimed to draw the rules of association with survey data and decision tree algorithm. It was tried to understand whether there was a change according to the demographic characteristics by determining which learning style (visual, auditory or tactile) the student uses on this page. Bartın University Vocational School Furniture and Decoration program students and Public Relations and Promotion program students were selected as the sampling area in the study. The survey used in the study is shown in Table 1. A total of 111 student data were collected. 42 percent of the students are female and 58 percent are male.

Table 1. Survey Used in The Study

Age	Gender	Area	Department	Learning Style
18-25	Female	Mediterranean	Public Relations and Publicity	Tactile
26-35	Male	Eastern Anatolia	Furniture and Decoration	Image
36-45		Aegean		Auditory
46 and over		Southeastern Anatolia Central Anatolia Black Sea Marmara		

The data from the questionnaire was used to train the decision tree algorithm. Decision tree is a machine learning algorithm and prediction can be used. A total of 111 students collected data. 70 percent of the data were used for training and 30 percent were used for testing. All of the operations were performed on the RapidMiner data platform. RapidMiner is a data mining platform (RapidMiner) with many features such as data upload and conversion, data preprocessing and visualization, modeling. Figure 1 shows the process formed by the Rapidminer operator.

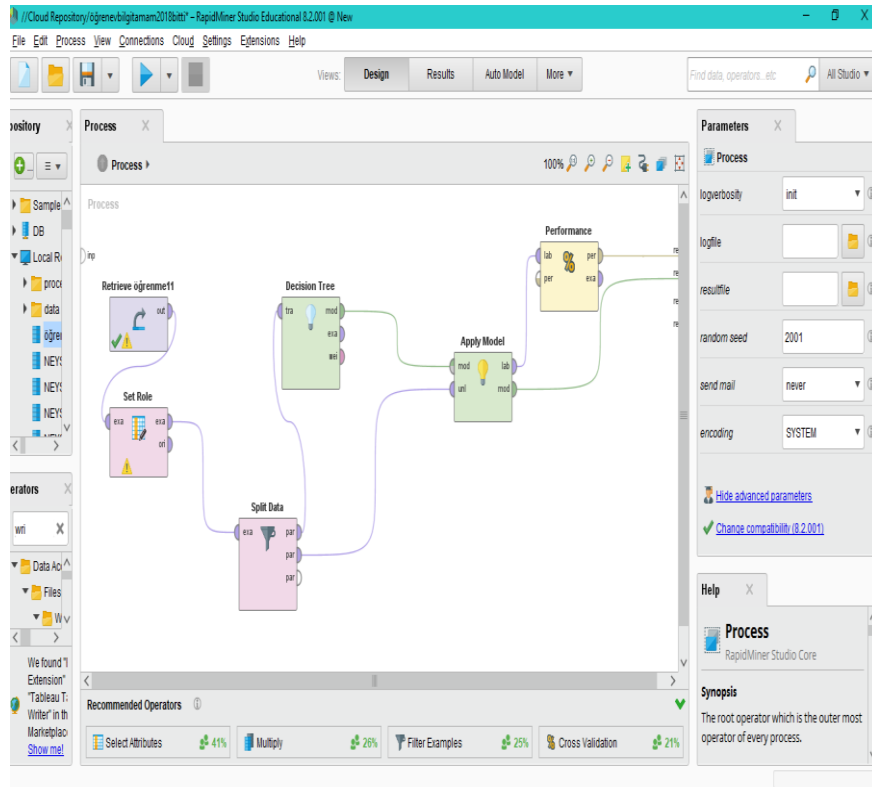


Figure 1. Rapidminer Created Process

3.RESULTS AND DISCUSSION

From the collected data, the decision tree algorithm revealed the hidden information. Figure 1 shows the decision tree generated by RapidMiner.

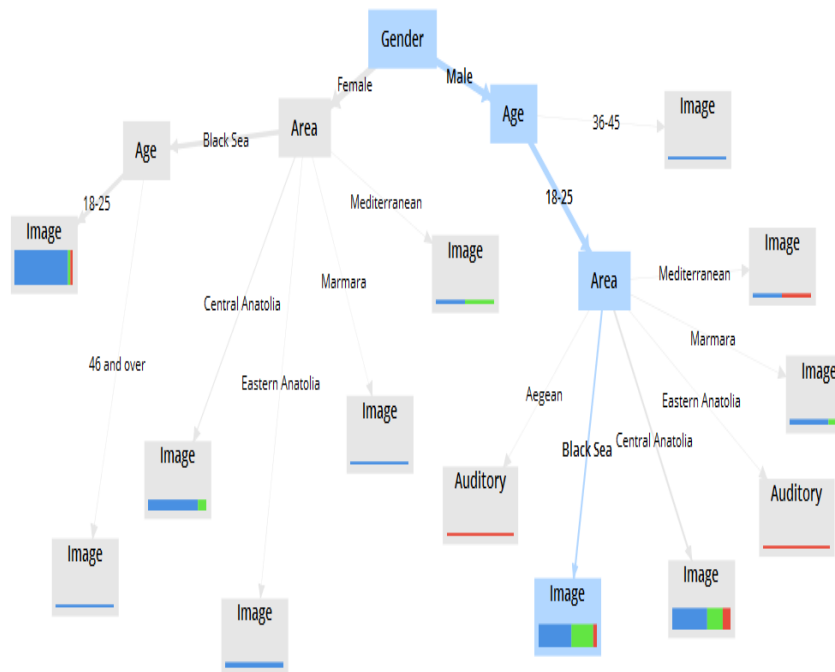


Figure 2. Decision Tree Created with Rapidminer Software

The most important factor in decision tree is determined as gender. At the same time, it is seen that women generally learn better visually. The accuracy of the model is 72.73 percent. The study has shown that data mining can be successfully applied in multiple areas.

Data mining is a field widely used today to reveal meaningful information. As a result of the study made with data mining algorithms, it was determined that the most important factor determining the learning style is gender. Other demographic factors such as age and country were found to be important in the second period. It is also seen that women have adopted more visual learning styles than men.

As a result, more effective learning and teaching can be realized by using data mining algorithms in the field of education, so more work needs to be done in this regard. The pilot study in this context is seen as a starting point and it is aimed to support the subject in detail with different data algorithms.

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Evaluation of Employee's Happiness by Data Mining and Statistical Methods in the Process of Internal Public Relations

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Abstract: In Institutional personnel are the first to be encountered in the presentation of services related to the institution. Institutional personnel are also good faith actors of an institution. It is an important tool in shaping the image and reputation of the institution. Therefore, if the happiness of the institutional staff is not achieved, it is very difficult to be successful in the services for the external target groups. Having a happy staff in this context constitutes the direct objective of the process of relations within the institution. The happiness level of Amasra Municipality staff in city of Bartın was investigated. The required data were collected on the basis of volunteerism and 40 staff members (42.5% female and 57.5% male) participated in the survey in the Amasra Municipality. The data obtained within the scope of the research were analyzed with the help of SPSS and Rapidminer programs and tried to determine the most decisive factors in happiness level and happiness of institution personnel. The Oxford Happiness Scale Turkish Form was used in the study, and this form is a 5 scale likert which is determined as the most unfavorable 1 and the most favorable 5 for all the variables was used in the scale. The happiness level of the personnel of Amasra Municipality was determined as 3.56 (71.2%) because of high happiness scores in the Oxford Happiness Scale. In addition, it is seen that the female staff (3,69) are happier than the male (3,47), the middle age group (26-35 and 35-45) in terms of age mean 3,65 happiness average and 18-25 year average happiness (3,47) than those who are 46 years and over (3,37), and finally the unmarried staff (3,58) are less happy than the married staff (3,55). However, no significant difference was found in the results of t test and one way analysis of variance with the help of SPSS program in terms of average of happiness. In this context, decision tree algorithm is used to determine happiness factors and it is determined that data mining is the most effective factor in happiness.

Keywords: In-house Public Relations, happiness, staff, data mining

1.INTRODUCTION

Data articulation refers to data mining, machine learning, statistics, data visualization, and various data analysis methods (Ashouri et al., 2018). This science is used in many areas. With data mining, meaningful information that is hidden in the data set can be revealed. Relations with the public in the institution, good understanding and application of relations within the organization, studies to establish an effective dialogue between personnel and management (Tortop and Ozer, 2013). Therefore, the happiness of employees within the scope of activities related to in-house people is very important. Because, in order for the institution to reach its direct targets in its activities for its external stakeholders, it is necessary first to ensure the happiness of its employees. In this context, the staff who work happily in the institution will play the main role in happiness that will be formed in the target groups of the institution.

Happiness is defined as a state with positive emotions. Positive emotions; life satisfaction, satisfaction, interest or pleasure. Positive happiness states that people are interested in their business, they are influential in acquiring new goals and pursuing them (Cohen, 2017). In this respect, it is important to know the happiness of the personnel in relation to the in-house people. The purpose of this study is to determine whether the employees of the institution are happy or not.

2.MATERIALS AND METHODS

In this study, which is done to measure the happiness of the personnel of the institution, volunteer-based data were gathered from the personnel of Bartın provinces Amasra Municipality as a research universal.

Participants were asked to determine the happiness level and the most decisive factors in happiness depending on their demographic characteristics such as gender, age, marital status. Survey data were obtained by using the face-to-face survey method. The obtained data were analyzed in SPSS 22.0 and Rapidminer package program. The decision tree (ID3) was used from the data mining algorithms in the study. For statistical analysis, the significance level was accepted as $p < 0.05$.

Survey questions that are appropriate for the purpose of the research are the Oxford Happiness Questionnaire (OHQ) developed by Hills and Argyle (2002) and the Oxford Happiness Inventory (OHI) made by Dogan and Sapsmaz (2012).

The survey form used in the research consists of two parts. In the first part, there are 3 questions about the demographic characteristics of the participants. In the second part, there are 29 one-dimensional questions to measure participants' happiness. For the scale, Likert with 5 options, which is the most negative 1 and the most positive 5, is used for all variables. It is also inversely coded from the queries on the scale (1, 6, 10, 13, 14, 19, 23, 24, 27, 28 and 29). In this context, the high averages obtained from the scale show the high level of happiness. Therefore, the interpretation of happiness was evaluated as 1.00-1.80: Very Low, 1.81-2.60: Low, 2.61-3.40: Medium, 3.41-4.20: High, 4.21-5.00: Very High.

The Cronbach's alpha coefficient was taken into account to determine whether the questions were perceived and their reliability. The Cronbach Alpha value is considered to be reliable when the value is 0.70 or greater (Durmus et al., 2013). In this context, Cronbach Alpha value was found to be 0.873 as a result of the reliability analysis conducted for the Oxford Happiness Scale used in the research.

3.RESULTS AND DISCUSSION

42% of the total 40 personnel participating in the research are women and 57.5% are men. When their distribution according to their ages is examined, it is seen that 35% are in the age range of 26-35 and 3% are in the 18-25 age range. In terms of marital status, 65% were married and 35% were single. In this context, the detailed demographic characteristics of the respondents are given in Table 1.

Table 1. Findings Related to Participants Demographic Characteristics

Variable	Frequency (f)	Percent (%)	Variable	Frequency (f)	Percent (%)
Gender			Marital Status		
Woman	17	42,5	Married	26	65,0
Male	23	57,5	Single	14	35,0
Age					
Between 18 - 25	3	7,5			
Between 26 - 35	14	35,0			
Between 36 - 45 years	13	32,5			
Age 46 and over	10	25,0			

When the average results of the survey participants on the Oxford Happiness scale were examined, it was found that the general happiness was higher with an average of 3,56 (Table 2).

Table 2. Average of Oxford Happiness Scale

	Arithmetic Mean	Standard Deviation
General Happiness	3,56	0,539

The perceived significance levels of the happiness scale of the participants in the survey were tested by t test and variance analysis to see whether they differed according to their demographic characteristics. In this context, the t test results for gender variable are shown in Table 3 and the difference between the participants' averages was not statistically significant.

Table 3. Investigation of Variables for Gender

	Gender	Available	Arithmetic Mean	Standard Deviation	t Value	Significance Value (p)
General Happiness	Woman	17	3,69	0,39		
	Male	23	3,47	0,61	1,303	0,20

The results of the one-way ANOVA using Post Hoc multiple comparison criteria to determine whether there is a difference in the happiness according to the age groups of the participants in the survey are shown in Table 4 and the difference between the participants' averages was not statistically significant.

Table 4. Investigating Variables for Age Groups

	Age	Available (N)	Arithmetic Mean	Levene Value (p)	Welch Value (p)	F Value	Significance Value (p)
General Happiness	18-25	3	3,47	0,38	-	0,815	0,49
	26-35	14	3,65				
	36-45	13	3,65				
	46+	10	3,34				

The results of the t-test to see whether there is a difference between the marital status of the participants and the happiness of the participants are shown in Table 5 and the difference between the participants' averages was not statistically significant.

Table 5. Investigation of Variables for Marital Status

	Gender	Available	Arithmetic Mean	Standard deviation	t Value	Significance Value (p)
General Happiness	Married	26	3,55	0,55	-0,155	0,87
	Single	14	3,58	0,52		

In addition to the above results obtained with the help of the SPSS program, the decision tree algorithm of the participants was analyzed.

Decision Trees are among the data mining classification algorithms. These algorithms are not parametric. Decision Trees help to make the best decision in stages by dividing the lot in the amount. Gender, age, marital status and general happiness factors were chosen as model inputs in the study. Figure 1 shows the decision tree model obtained as an end result.

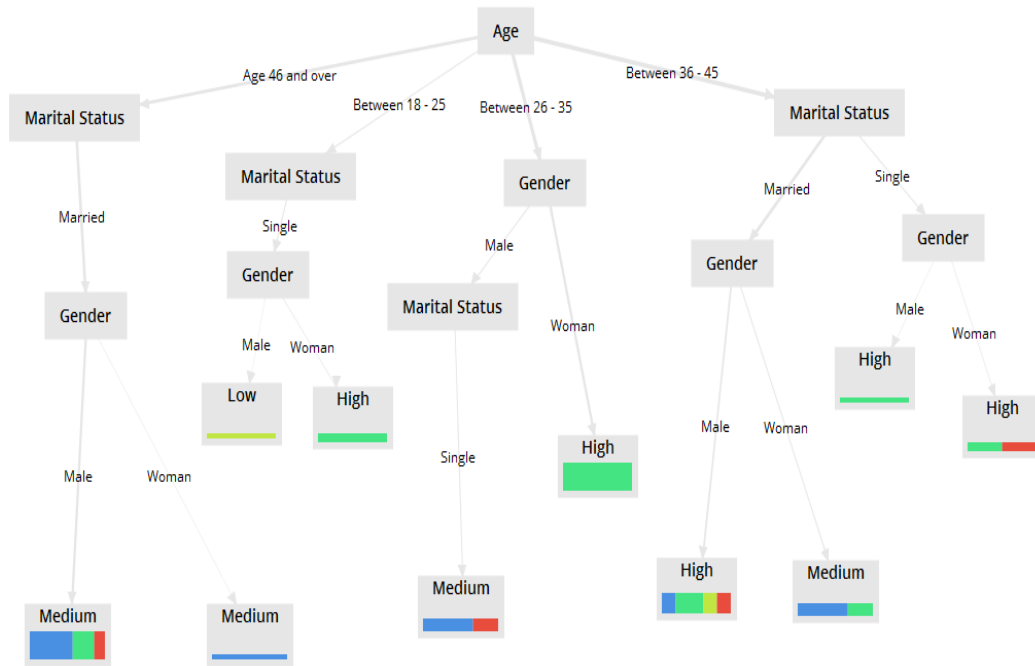


Figure 1. Decision Tree Model

When the decision tree model is examined, it is seen that the most important factor in determining happiness is age. This can be explained by the fact that young people are healthier.

This study was carried out to measure the happiness of Bartın Province Amasra Municipality staff and the data of 40 volunteer participants were taken into consideration. In this context, the employee happiness, which is important in relation to the in-house people, is investigated as demographic data.

It has been determined that Amasra Municipality staff is happy in the date range of the data gathered by the evaluation made within the thresholds determined for happiness as a result of the research done. Although there was no significant difference in terms of gender, age and marital status, which were demographic characteristics, SPSS was found to be the most effective factor in happiness over data mining program Rapidminer.

In this context, a significant difference can be reached with the Rapidminer program, which has the depth of reviewing capacity, and this leads to the necessity of further studies. Because, when the literature is examined, it is understood that the studies in which SPSS and Rapidminer programs are equivalent are very limited. Therefore, the study is seen as a beginning and it is aimed to support the subject with more comprehensive studies.

The limit of the work is only for the personnel of an institution. Moreover, the happiness of the employees is a matter that needs to be repeated regularly as it gives a snapshot when measured.

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Awareness of Ecological Corridor Notion at Landscape Architecture Undergraduate Level: Case of Kastamonu University - Bartın University

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Abstract: The landscape ecology, which is defined as the science field that studies the relationship between living and nonliving entities, investigates the structure, function and change of landscape. When the landscapes are examined within the scope of landscape ecology working on ecological processes at different scales it is concluded that landscapes are dynamic structures that are constantly changing. These changes occur in patch - corridor and matrices that make up the structure of the landscape. The discipline of Landscape Architecture covers these issues as a discipline with ecological base. One of the corridor types is the ecological corridors. Ecological corridors affect the quality of life of every living creature in the landscape. The impact rate of ecological corridors for every living and non-living entity on Earth changes depending on the status of the ecological corridor. The conversion of ecological corridors over time directly and / or indirectly affects all ecosystems. Therefore, the functions of ecological corridors should be well known. In addition, to protect and improve the ecological corridors that can be described as communication networks on the earth, the necessary operations should be done sensitively. In the context of all these data, a survey was conducted to measure the ecological corridor perception of landscape architecture students of the undergraduate level. In this research, undergraduate students of Landscape Architecture department from Kastamonu University and Bartın University were selected as sample. As a result of statistical evaluations of the questionnaires, knowledge level differences between grades of landscape architecture undergraduates are provided. In the general scope; the recognition level of the ecological corridor concept by undergraduate students of landscape architecture was evaluated. Thus, the awareness status of the students that are expected to have ecological corridor sensitivity from the beginning which is required by the landscape architecture discipline has been put forward.

Keywords: Landscape Architecture, Landscape Ecology, Ecological Corridor, Awareness, Kastamonu, Bartın

1. INTRODUCTION

According to the intended use of ecological corridors; there are many effects such as providing transportation, creating transition zone, increasing species diversity, creating microclimatic effect, visual effect etc.

Turkey due to its geographical location and landforms; is a very rich region in terms of water surface such as rivers, creek that are including ecological corridor features (Şahin et al. 2014). In this sense, there are many example areas that can be examined in the context of the ecological corridor.

Landscaping architecture occupational discipline comprise these subjects as an ecological based studies (Koçan, 2013). Ecological corridors are an important and sensitive issue for landscape architecture profession discipline. Because, the change of ecological corridors over time is directly and / or indirectly affecting all ecosystems (Cengiz, 2007). In order to protect and improve the corridors that can be described as communication networks on the earth, the necessary actions must be done sensitively.

Landscape ecology is a science that examines the relationship between living and non-living things that make up the landscape. Structure, function, change components of the landscape are examined by landscape ecology. According to McGarigal and Marks (1994) (Uzun, 2003); landscape structure; the arrangement of spatial patterns or landscaping elements. Landscape function is energy within the structure, material, wind, water, plant, animal flow and movements.

Landscape exchange is the function and structure of ecological mosaic over time. Change is dynamic. The changes that take place in the landscapes take place in the structure of the landscape. The structure of the landscape is formed by stain, corridor, matrix.

This research was conducted to measure the ecological corridor perception of landscape architecture undergraduates in the context of landscape ecology and ecological corridors which are indispensable work areas of the landscape architecture professional discipline.

2. MATERIALS AND METHODS

In the work carried out in Kastamonu University and Bartın University Landscape Architecture Departments; undergraduate education is categorized as undergraduate 1 (39), undergraduate 2 (30), undergraduate 3 (15), undergraduate 4 (29).

For this study; two separate groups were obtained by merging the undergraduate1 and undergraduate2 classes which received an ecology-based single course (landscape ecology) as the level 1; and undergraduate3 and undergraduate4 classes after taking the ecology-based courses intensively as the level 2.

Total of 307 students from the Bartın University Department of Landscape Architecture including 144 students and from the Kastamonu University Landscape Architecture Department including 163 students have form the subject material. According to Özdamar (2003) (p.116-118), in the sample of 307 people, a sample size of 10% error margin and 99% confidence level so 108 questionnaires were needed.

A questionnaire was conducted with 113 participants and the first part of the questionnaire was subjected to SPSS 'square analysis. Among these participants, a questionnaire was conducted with 60 female and 53 male students to try to achieve gender equality. In chi-square analysis, the components forming the concept of ecological corridor according to educational status, the formations that come to mind in the name of ecological corridor, the functions of ecological corridors were questioned. In addition, the scientist expert on ecologic corridors have been come to recognize by students according to the educational status.

In the second phase of the study, participants were asked to make an assessment of the Likert scale of 6 with an expected 28 question. In this question; I need to score between 0 and 5 points as I do not know - I do not agree absolutely - I do not agree - I do not understand - I agree - I agree absolutely. In order to evaluate this part of the questionnaire, a correlation analysis was conducted in SPSS in order to establish the situation between level 1 and level 2.

3. RESULTS AND DISCUSSION

In the question of the constituents of ecological corridors, the concept of homogeneity came to the forefront by receiving negative responses from 92 people. There were 80 participants for the linearity, 79 participants for boundary / barrier, 23 participants for habitat, 82 participants for visuality, 84 participants for recreational benefit, 77 participants for microclimatic region, 56 participants for type transition have responded negatively.

In the question of ecological corridor samples, the highway option came to the forefront by receiving negative response from 94 participants. There were 17 participants for the river, 98 participants for the railway, 32 participants for the greenery, 32 participants for the stream, 86 participants for the settlement area, 102 participants for the street, 59 participants for the bush-tree fence, 52 participants for the mountain line, 95 participants for artificial wind speed responded negatively.

In the question of the functions of ecological corridors, the infrastructure function responded negatively came to the forefront by 104 participants. There were 79 participants for transportation, 79 participants for recreation, 37 participants for increasing species diversity and richness, 25 participants for inter-habitat transition, 85 participants for asylum and hunting areas, 71 participants for visual benefit and 72 participants for climatic benefit.

In the question of the recognition rate of scientists specializing in ecological corridors; Richard Forman was recognized by 30 participants, Kevin McGarigal by 24 participants, Edvard A. Cook by 20 participants, Reed F. Noss by 8 participants, Michel Godron by 33 participants.

When the educational level (level 1 and level 2) and level of knowledge of the ecological corridor components were measured in the context of the analyzes made, only a significant difference was found between the "border / barrier" feature and the "visual" feature (table 1).

Table 1. Ecological Corridor Components

Components	Education
Homogeneity	0.115
Linearity	0.625
Border / Barrier	0.045
Living Environment / Habitat	0.647
Visuals	0.009
Recreational benefit	0.311
Microclimatic region	0.412
Type pass	0.486

76.8% of students in Level 1 (Bachelor1 and Bachelor 2) answered no response and 59.1% of students in Level 2 (Bachelor 3 and 4) responded with no response, indicating that ecological corridors are not border / barrier characteristics.

When analyzed the relationship between visual composition of ecological corridors and educational status is; 63.8% of students in level 1 (undergraduate1-2) and 86.4% of students in level2 (undergraduate3-4) responded as not visual components.

In the question of ecological corridor samples, there was a significant difference between level 1 and level 2 only in the concept of street (table 2).

Table 2. Ecological Corridor Types

Which is the Ecological Corridor?	Gender	Education
River	0.989	0.837
Highway	0.422	0.837
Railway	0.275	0.928
Greenway	0.678	0.292
Stream, Tea	0.673	0.056
Settlement	0.055	0.494
Street	0.593	0.033
Bushes & Wooden Fences	0.209	0.12
Mountain orders	0.599	0.066
Artificial windy strip	0.457	0.113

85.5% of the students in level 1 and 97.7% of students in level 2 gave no answer as to whether the street option was ecological corridor.

In the question of the functioning of ecological corridors, it was determined that ecological corridors have a meaningful difference in the option of "visual benefit" depending on education level (table3).

Table 3. Ecological Corridor Functions

Functions	Education
Transportation	0.92
Recreation	0.075
Infrastructure	0.724
To increase species diversity and richness	0.563
Crossing habitats	0.083
Creating asylum and hunting areas	0.395
Visual Benefit	0.033
Climatic Benefit	0.105

In terms of the functions of ecological corridors, visual benefit was received as a no response by 55.1% of the students in the level 1 while receiving a response of 75% of the level 2 students.

While expected to show differences linked the level of education to recognition of known scientists study on ecological corridors there are no significant difference has arisen (table 4).

Table 4. The Status of Recognition of Related Scientists

Recognition of Scientific People	Education
Richard Forman	0.147
Kevin McGarigal	0.053
Edvard A. Cook	0.54
Reed F. Noss	0.39
Michel Godron	0.433

Significant correlation was found in correlation analysis ($p < 0.001$).

According to Kendall's tau-b value; the correlation between level 1 and level 2 participants is moderate to severe correlation with $r = 0,545$ coefficient value. Participants seem to be informed about ecological corridors after taking a single ecologically based course but this information appears to be made more clearly by students at level 3 and level 4 who make up level 2.

In the next step it is revealed that the propositions which done likert scale assessment come class to which likert scale on average. In Table 5, there is no idea that participants were segregated because they were not point values and the averages of the participants' opinions were taken.

Table 5. Evaluation of ecological corridor proposals

		Opinions Non	Person Number	Total Point	About Average
1	The concept of ecological corridor is important for landscape architecture.	1	112	498	4.4
2	The concept of an ecological corridor applies only to natural areas.	16	97	258	2.7
3	Ecological corridors can be found in areas of human intervention.	10	103	357	3.5
4	Ecological corridors are only found in natural areas.	7	106	282	2.7
5	Ecological corridors are important for wildlife.	5	108	463	4.3
6	When the says the ecological corridor it comes to mind in terms of highways.	10	103	252	2.4
7	When the says the ecological corridor it comes to mind in terms of river.	9	104	400	3.8
8	The ecological corridor is important for the environment.	2	111	462	4.2
9	I have enough knowledge about ecological corridors.	10	103	291	2.8
10	Ecological corridors are important for birds.	11	102	392	3.8
11	Ecological corridors are important for scientific studies.	6	107	415	3.9
12	Ecological corridors have microclimatic effects.	18	95	368	3.9
13	Ecological corridors carry visual value.	1	112	430	3.8
14	Ecological corridors carry recreational values.	12	101	375	3.7
15	Ecological corridors make people happy.	8	105	374	3.6
16	Ecological corridors pay attention enough important.	13	100	246	2.5
17	Ecological corridors are nature's transportation lines.	11	102	391	3.8
18	Information on ecological corridors is given enough in the lessons.	12	101	320	3.2
19	Ecological corridors host some animals and mammals.	10	103	388	3.8
20	I cannot connect the ecological corridor and landscape architecture.	10	103	224	2.2
21	Ecological corridors should be left naturally.	9	104	353	3.4
22	Ecological corridors should be intervened.	16	97	224	2.3
23	Ecological corridors host some animals and mammals.	10	103	373	3.6
24	There should be wildlife protection areas around ecological corridors.	13	100	359	3.6
25	Ecological corridors are related to matrices and stains.	24	89	314	3.5
26	Ecological corridors increase species diversity.	12	101	382	3.8
27	Ecological corridors create hunting-hiding areas for animals.	15	98	350	3.6
28	Ecological corridors provide transportation.	17	96	326	3.4

As a result of the evaluations of the participants according to Table 5, having an average value between 4 (agree) and 5 (strongly agree);

- The concept of ecological corridor is important for landscape architecture.
- Ecological corridors are important for wildlife.
- The ecological corridor is important for the environment.

The proposals are in the foreground with a high average.

Having an average value between 2 (disagree) and 3 (unstable);

- The concept of an ecological corridor applies only to natural areas.
- Ecological corridors are only found in natural areas.
- When the says the ecological corridor it comes to mind in terms of highways.
- I have enough knowledge about ecological corridors.
- Ecological corridors pay attention enough important.
- I cannot connect the ecological corridor and landscape architecture.
- Ecological corridors should be intervened.

The proposals from the students in the Landscape Architecture vocational discipline came to the forefront in parallel with the low average.

As a final stage, the respondents in Table 6 grouped according to Level 1 (License 1 and License 2) and Level 2 (License 3 and License 4) and the percentages of the likert scale answers given to the proposals were given.

Table 6. Proportion Percentages of Ecological Corridors

	level1 (%)						level2 (%)					
	no idea	strongly disagree	disagree	unstable	agree	strongly agree	no idea	strongly disagree	disagree	unstable	agree	strongly agree
1	1.4	5.8	1.4	0.0	37.7	53.6	0.0	2.3	0.0	0.0	29.5	68.2
2	21.7	8.7	31.9	17.4	17.4	2.9	2.3	15.9	34.1	20.5	20.5	6.8
3	11.6	4.3	13.0	14.5	50.7	5.8	4.5	0.0	20.5	27.3	29.5	18.2
4	10.1	13.0	37.7	17.4	17.4	4.3	0.0	9.1	38.6	25.0	20.5	6.8
5	7.2	7.2	1.4	4.3	34.8	44.9	0.0	2.3	2.3	2.3	34.1	59.1
6	13.0	20.3	31.9	14.5	15.9	4.3	2.3	29.5	27.3	15.9	18.2	6.8
7	13.0	4.3	7.2	7.2	40.6	27.5	0.0	4.5	9.1	18.2	43.2	25.0
8	2.9	5.8	2.9	5.8	36.2	46.4	0.0	9.1	4.5	2.3	31.8	52.3
9	14.5	13.0	26.1	29.0	10.1	7.2	0.0	6.8	15.9	52.3	18.2	6.8
10	14.5	5.8	5.8	13.0	37.7	23.2	2.3	6.8	0.0	18.2	40.9	31.8
11	8.7	8.7	5.8	11.6	40.6	24.6	0.0	2.3	0.0	20.5	40.9	36.4
12	26.1	4.3	2.9	11.6	36.2	18.8	0.0	2.3	2.3	18.2	56.8	20.5
13	1.4	5.8	4.3	8.7	52.2	27.5	0.0	4.5	11.4	18.2	40.9	25.0
14	15.9	2.9	4.3	14.5	42.0	20.3	2.3	9.1	11.4	20.5	34.1	22.7
15	10.1	4.3	7.2	15.9	49.3	13.0	2.3	11.4	6.8	31.8	25.0	22.7
16	18.8	17.4	37.7	10.1	7.2	8.7	0.0	22.7	27.3	31.8	11.4	6.8
17	15.9	7.2	4.3	8.7	42.0	21.7	0.0	2.3	9.1	18.2	38.6	31.8
18	17.4	8.7	18.8	17.4	23.2	14.5	0.0	9.1	18.2	38.6	18.2	15.9
19	14.5	5.8	4.3	7.2	44.9	23.2	0.0	6.8	6.8	20.5	50.0	15.9
20	14.5	29.0	33.3	5.8	13.0	4.3	0.0	38.6	29.5	15.9	9.1	6.8
21	11.6	23.2	33.3	20.3	5.8	5.8	2.3	13.6	25.0	15.9	38.6	4.5
22	18.8	29.0	23.2	11.6	15.9	1.4	6.8	18.2	34.1	25.0	15.9	0.0
23	14.5	20.3	47.8	7.2	5.8	4.3	0.0	2.3	25.0	25.0	36.4	11.4
24	18.8	4.3	5.8	10.1	43.5	17.4	0.0	6.8	15.9	27.3	36.4	13.6
25	31.9	2.9	14.5	13.0	26.1	11.6	4.5	2.3	20.5	13.6	31.8	27.3
26	15.9	2.9	4.3	14.5	43.5	18.8	2.3	4.5	2.3	25.0	52.3	13.6
27	17.4	8.7	10.1	13.0	33.3	17.4	6.8	0.0	13.6	13.6	54.5	11.4
28	24.6	5.8	4.3	15.9	33.3	15.9	0.0	6.8	22.7	34.1	27.3	9.1

When the percentage results are considered;

The response of "I think highways come to mind in terms of ecological corridor." while it had an average at level 2. The response of "Ecological corridors make people happy" had a high tendency at level 1 as I agree while it had an undecided at level 2. While "Ecological corridors are important enough" did not agree with participants at level 1, participants tended to respond to instability at level 2. The response of "Information on ecological corridors is given enough in the lessons" had a high tendency at level 1 as I agree while it had a high tendency as undecided at level 2. The response of "I cannot connect the ecological corridor to the landscape architecture" had a high tendency at level 1 as I don't agree while it had a high tendency as I don't agree highly at level 2.

"Ecological corridors should be left naturally" by making a significant difference in proposals level 1 and level 2 and I do not participate at level 1 and I participate at level 2 as highly. The main reason for this is that the level 2 students

change intensively through taking ecological-based lessons. The recommendation of "should intervene in ecological corridors" has received high response strongly as disagree with at level 1 and I do not agree at level 2.

The recommendation of "Ecological corridors host some animals and mammals" has received high response strongly as disagree with at level 1 while it had response I agree with at level 2. The recommendation of "Ecological corridors are relevant to matrices and stains" the most prominent suggestion among all propositions. I do not agree with highly as the rate of 31.9% at level 1; and the rate of 31.8% at level 2.

This result also shows that; participants do not know the concepts of stain, corridor and matrix before they take the ecological-based lessons intensively. The recommendation of "Ecological corridors provide transportation" has received high response strongly as agree with at level 1 while it had response undecided at level 2.

The question was asked about the nature of ecological corridors it has come to an end as border / barrier. The expected result is an increase in the level of knowledge about the components of the ecological corridors as the level of education increases. In this sense, it has been revealed that ecological corridors are boundary / barrier composition, as the ecology-based courses are considered as density in support of anticipation.

In the question of the visual effects of ecological corridors, participants have shown that their visuals are not frontal. The reason for this is; based education for vocational discipline in ecology-based courses, and in this context, it is thought that the students are leading the functional meaning components ahead of the visual based components.

Parallel to the expected result of the questionnaire about the ecological corridor samples, it was determined that the students did not show any significant difference in terms of gender. The answers to the question of the street concept have been shown; students know that this concept is not an example of an ecological corridor and have reinforced this knowledge with the training they have received.

Parallel to the question of the ecological corridor components and the choice of visibility to be meaningful, in this question visual efficacy was expected to give this result. The reason for this end result is that ecological corridors are taken into account by the multifunctional effect of the visual effect, after the nature-based education of the students.

In the question that scientists are questioned;

As a consequence of the fact that students do not know these important scientists, it can be concluded that these subjects are not mentioned enough in the lessons.

Correlation analysis showed the results;

Landscape Architecture students who receive a nature-based education have more and more qualified knowledge about the importance and functions of ecological corridors, along with the lessons they have learned.

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Importance of Hadron Colliders in High Energy Physics

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Abstract: The universe is made of twelve particles of matter and four forces of nature. The particles are divided into two subatomic sets: quarks and leptons. To reach these subatomic particles of hadrons and understand the forces between the particles, hadron colliders are used during last decades. The colliders already performed groundbreaking work, which were awarded with Nobel prizes in the past. Therefore, hadron colliders have played crucial role to understand our universe in details such as their contribution to the discovery of Higgs boson (God particle). Some of the well-known hadron colliders are Tevatron, Large Hadron Collider (LHC) and Future Circular Collider, which are giant and amazing engineering structures. Tevatron already completed its mission and was shut down. LHC is still colliding protons and collecting data, and Future Circular Collider is planned to be built for post-LHC era, which will have about 10 times bigger center-of-mass energy than LHC. In the talk, predictions and experimental results of these hadron colliders and their contributions to science will be presented and discussed. Main focus will be stressed on the structure of the colliders and their single boson measurements.

Keywords: Hadron Colliders, High Energy Physics, Particle Physics, Leptons, Boson

1.INTRODUCTION

A hadron collider is a giant particle accelerator that is useful to test the particle physics theories in nuclear physics, high-energy physics, or particle physics by colliding hadrons (Denisov, 2013). A hadron collider uses underground tunnels to accelerate, store, and collide two particle beams. A hadron is any particle that is made from quarks, anti-quarks. The standard model (SM) is the name given in the 1970s to a theory of fundamental particles and how they interact. The universe is made of twelve particles of matter and four forces of nature. The particles are divided into two subatomic sets: quarks and leptons. Figure 1 presents the SM of elementary particles.

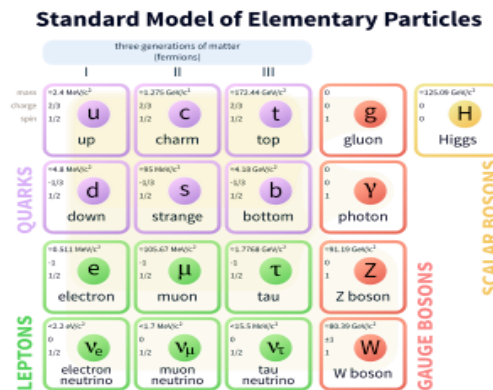


Figure 1. Elementary particles

Hadron colliders aim to probe the limitation of SM and internal structure of the proton as well as detecting new physics signatures at high luminosities. All particle detectors built up to date (Shiltsev, 2012) is given in Figure 2. Here, the Tevatron and LHC are the hadron colliders. The remaining is example of the lepton colliders.

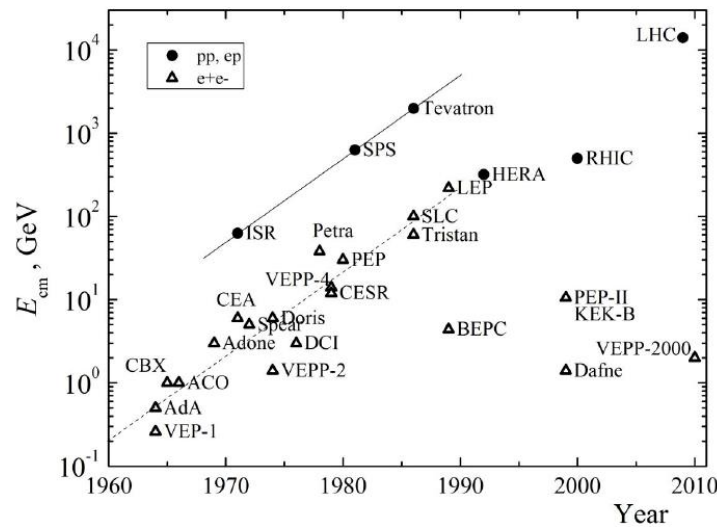


Figure 2. Collision energies of colliders built in the past as a function of the first run date.

The structure of hadron colliders must be radiation hard, which means the parts of the collider could survive extremely high radiation. The increase in energy at particle physics experiments increases the radiation amount. Besides, the hadron colliders requires to constructed with sensitive and fast scintillating materials. The LHC is the best example of this. On the LHC, there are different groups with different detectors. Two of these are ATLAS and CMS detectors. The CMS detector is designed like onion with many layers. On the other hand, the ATLAS design looks like a bookshelf. Different designs bring different advantages and disadvantages.

Importance of Hadron Colliders

The most famous hadron is proton, which consists of two up quarks (u) and one down (d) quark. Normally, the mass of u quark is $0.5 \text{ MeV}/c^2$ while d quark mass is $0.3 \text{ MeV}/c^2$. Once we sum two u quark mass ($2 \times 0.5 \text{ MeV}/c^2$) and one d quark mass ($0.3 \text{ MeV}/c^2$), we could have $1.3 \text{ MeV}/c^2$, expected proton mass. However, the proton mass is experimentally and theoretically found as $938.27204 \text{ MeV}/c$. That means the mass of a proton is much larger than the mass of the quarks that make up the proton. At this point hadron colliders take role to explain this feature. Therefore, hadron colliders are necessary to understand the structure of matter and what they are made of.

Accelerators contributed many particle discoveries but the most popular and newest one is Higgs boson (God particle). All matter and force-carrier particles expected in the SM have now been discovered, a majority of them in experiments at particle accelerators and colliders, and the predictions of the SM confirmed with remarkable precision in hundreds of measurements. While the properties of the Higgs boson, so far, seem consistent with those expected of a SM Higgs boson, its measured mass of $\sim 125 \text{ GeV}$ is also consistent with it being the harbinger of new physics beyond the SM (BSM). Therefore, the discovery has reignited strong interest in the world-wide high energy physics community in future energy-frontier colliders beyond the LHC to study the properties of the Higgs boson with great precision and to access BSM physics.

Hadron colliders also help to reveal the mystery of antimatter. So far, with hadron colliders, we found that the universe is made only of matter although antimatter is expected to be in the same amount of matter during the Bing Bang. To discover new particles, the colliders are required to reach very high energies. This is only possible with the collision of hadrons. Therefore, existence of hadron colliders is crucial for the future of particle, nuclear and high-energy physics.

2.RESULTS AND DISCUSSION

Peter Higgs explicitly predicted the Higgs boson in 1964. Observation of this boson took many years. The Large Electron-Positron (LEP) Collider worked five years to search the Higgs boson with a mass of around 80 GeV . However, they reported that there is no sign of the Higgs boson at the end of their studies (Samuel, 2001).

Then, Large Hadron Collider (LHC), a proton-proton collider, has started to play a crucial role for high energy and particle physics in 2011. The LHC is capable of colliding particles at higher energies than any previous accelerator, so experiments pointing to a lighter Higgs increased the Tevatron's chances of discovery. In 2011, the LHC's ATLAS and CMS experiments both show hints of the Higgs at around 125 GeV , the first signal at nearly the same mass. In February 2012, the collision energy of the LHC was boosted from 7 to 8 teraelectronvolts (TeV), which resulted in increasing its Higgs

sensitivity by 30 to 40 per cent. In March 2012, data from the Tevatron's last gasp places the Higgs between 115 and 152 GeV. Figure 3 presents the results from Tevatron (Tuchming, 2013), ATLAS (ATLAS, 2012) and CMS (Bernardi, 2014).

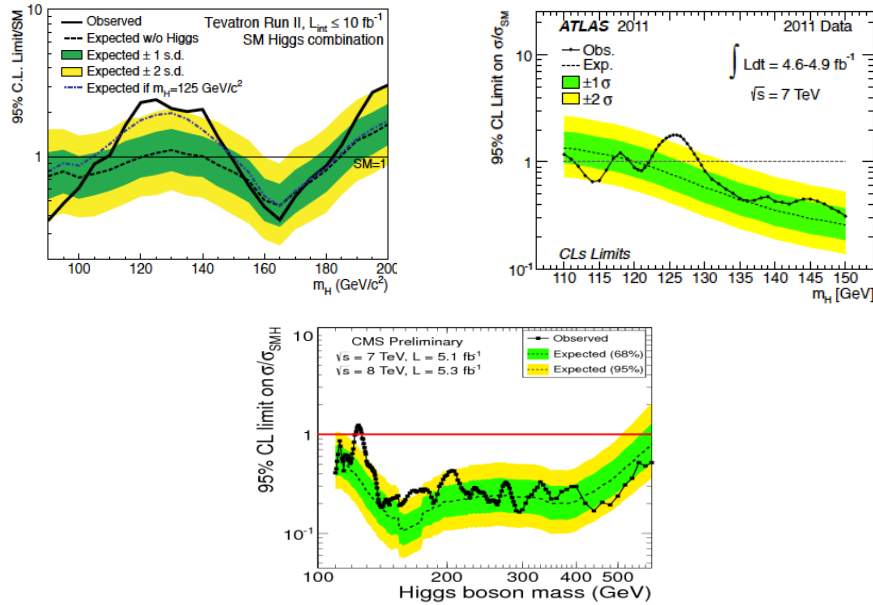


Figure 3. The Higgs boson mass distributions from Tevatron ($\sqrt{s} = 1.96$ TeV), ATLAS ($\sqrt{s} = 7$ TeV) and CMS ($\sqrt{s} = 7$ and 8 TeV).

Determination of Higgs boson mass is crucial, this can be achieved only with hadron colliders. The impact of the Higgs boson mass on top quark can be given as follows. The top quark mass was measured as 172.44 ± 0.13 (stat) ± 0.47 (syst) GeV/ c^2 . If we assume the Higgs boson mass is fixed at 64 GeV, we calculate top quark mass as 160.8 GeV. Then we went one more step and fixed the Higgs boson mass at 68 GeV, then, we obtained the top quark mass 162 GeV. As can be seen, the correct determination of the Higgs boson mass plays crucial role for other particles as well.

According to the results, hadron colliders are important tool to understand internal the structure of proton and improve the theoretical models. On the other hand, LEP Collider, lepton collider, was not capable to observe the Higgs boson; however, the boson was experimentally observed when we moved to hadron collider due to the increase of the collision energy. Hadron colliders are also necessary to obtain real characteristics of particles. In our study, example of the top quark is given. For different, the Higgs boson mass values we obtained top quark masses. To the best of our knowledge, all force-carrier particles predicted by the SM have been discovered. The accelerators and colliders have contributed to observation of them in experiments. Now, we have to perform studies for beyond the SM region. To perform these studies, we have to increase the collision energy of our existing hadron collider or we need to build new one, which is capable to collide hadrons higher energies than the current ones. Some could think that all these discoveries and searches are pointless; however, it is good to remind that majority of the people thought the electron as useless in 1897 when it is discovered. Today, we have a whole world running on electronics.

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Theoretical Evaluation of W Boson Differential Cross Section at 8 TeV Center of Mass Energy

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Abstract: Large hadron collider (LHC), which collides protons at 7, 8, and 13 TeV, offer researchers great opportunities to study existing particles as well as searching new ones. The experiment groups of high-energy physics community perform physics measurements of particles using LHC data to confirm the standard model predictions. In this regard, measurement of differential cross section for any particle is one of the crucial studies for validating standard model; therefore, we present QCD predictions as a function of muon pseudorapidity at 8 TeV center of mass energy for $W \rightarrow \mu\nu$ events. These predictions are computed at next-to-next-to leading order QCD using publicly available Monte Carlo simulation tools FEWZ 3.1 and DNNLO 1.5. Here, the tools are interfaced with latest parton distribution models such as CT10, NNPDF 3.0, MMHT 2014, and HERAPDF 1.5. After providing predictions at next-to-next-to leading order QCD, we also show the next-to leading order QCD predictions to identify the differences between different orders of quantum chromodynamics. Another topic covered in the presentation is the comparison of theoretical predictions with experimental results so that we could provide the reliability of the publicly available Monte Carlo simulation tools.

Keywords: W Boson, Standard Model, Differential Cross Section, Muon, QCD

1.INTRODUCTION

W boson is an elementary particle, which was observed on experiments in 1983. The existence of the particle is explained by Standard Model and very well-known example of electroweak theory. Many precision measurements of W boson were performed up to date. The nature of the particle and its observable quantities are well explained in the thesis (Ogul, 2016). There are two W bosons with different charges, the normal W^+ , and its antiparticle, W^- boson. These charged bosons may occur after the collision of two hadrons. In our case, the theoretical evaluations are performed for proton-proton (pp) collisions. The main mechanism of charged W bosons are presented in Figure 1. Here, the cartoon shows that one up (u) and one anti-down (\bar{d}) quark makes W^+ boson while W^- boson comes from one anti-up (\bar{u}) and one down (d) quark. Proton, the most famous hadron, consists of two up quarks and one down quark. This leads to fact that the number of u quarks existing in the medium will be greater than the number of d quarks once two protons collide. Therefore, occurrence of W^+ is more often than negatively charged W boson. In other words, even though the masses of W^+ and W^- are the same, the probability of their decay will be different. This motivate us to study their cross sections especially as a function of any chosen variable to see if there is any detector effect on the decay rates.

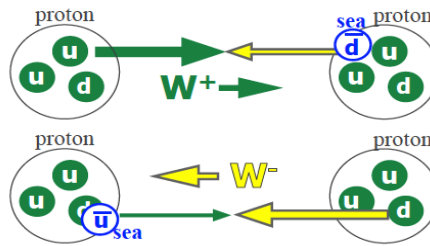


Figure 1: The cartoon of W^+ and W^- boson production.

The definition of the cross section is simply the probability of an interaction. In other words, it tells physicists how likely particles are to interact in a given way. The theoretical predictions of $W^{+/-}$ bosons were already evaluated before. In this paper, we present theoretical evaluation of W boson differential cross section at 8 TeV center-of-mass energy.

2.MATERIALS AND METHODS

To calculate the differential cross sections, we used publicly available Monte Carlo simulation tool, FEWZ 3.1 (Li and Petriello, 2012). The theoretical calculations were performed using CT10, HERAPDF1.5, NNPDF3.0 and MMHT2014 parton distribution functions (PDF) at next-to-leading order (NLO) and next-to-next-to-leading order (NNLO) quantum chromodynamics (QCD). The necessity of NNLO predictions was highlighted with comparison studies. Initially, different PDF models provide similar predictions but they might be distinguished with their ways of parameterizing PDFs, values of heavy quark masses, treatments of heavy quarks, and input data. The cross section values were predicted differentially for different pseudorapidity (η) bins: [0,0.2], [0.2,0.4], [0.4,0.6], [0.6,0.8], [0.8,1.0], [1.0,1.2], [1.2,1.4], [1.4,1.6],

[1.6,1.85], [1.85,2.1], and [2.1,2.4]. The bins were selected such that the migration effects due to the finite η resolution are negligible.

3.RESULTS AND DISCUSSION

The differential cross section of W boson was calculated for positively and negatively charged W bosons. Here different PDF models are used to examine whether any different outcome for each other was observed or not. The chosen PDFs are CT10 (Gao J. et al., 2014), NNPDF3.0 (Ball R. D. et al., 2015), HERAPDF 1.5 (Radescu V., 2010), and MMHT2014 (Harland-Lang L. A. et al., 2015). Theoretical evaluations were made at NLO and NNLO. Table 1 and 2 provide the numerical values of calculations. The numbers are stated in the unit of Pico barn, and it is observed that all PDF models provide the numbers close to each other maximum deviation is about 2-3 percentages. This number is fairly good at this level.

Table 1. Theoretical cross section prediction of W^+ at 8 TeV center of mass energy.

η Bin	CT10	NNPDF3.0	MMHT2014	HERAPDF1.5
0-0.2	729	711	720	752
0.2-0.4	730	709	726	752
0.4-0.6	737	720	729	759
0.6-0.8	735	713	728	757
0.8-1.0	744	719	734	765
1.0-1.2	751	726	743	769
1.2-1.4	754	728	742	770
1.4-1.6	765	739	759	779
1.6-1.85	759	726	745	769
1.85-2.1	757	735	756	765
2.1-2.4	725	697	717	733

Table 2. Theoretical cross section prediction of W^- at 8 TeV center of mass energy.

η Bin	CT10	NNPDF3.0	MMHT2014	HERAPDF1.5
0-0.2	554	542	558	571
0.2-0.4	554	543	555	571
0.4-0.6	548	532	546	565
0.6-0.8	540	528	545	558
0.8-1.0	530	517	533	548
1.0-1.2	519	509	524	537
1.2-1.4	505	483	509	525
1.4-1.6	493	485	500	513
1.6-1.85	471	463	475	491
1.85-2.1	454	438	457	475
2.1-2.4	420	413	425	440

According to the calculated theoretical cross sections, the cross section numbers of W boson are dependent on pseudorapidity. The W^+ values first increase by the increase of the pseudorapidity until the last bin. Once it reaches the last bin, it drops significantly. On the other hand, the cross section of W^- decreases by the increase of the pseudorapidity. All these calculated numbers could be used to validate experimental result since different PDF models are agree with each other.

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The Effect of Transglutaminase Enzyme on Physico-Chemical, Microbiological, Sensory and Textural Properties of Pastırma

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Abstract: In the study, the effects of using different levels (%0, 0,25, %0,50 or %1) of transglutaminase enzyme on physico-chemical, microbiological, sensory and textural properties of pastırma were investigated. *M.Longissimus thoracis et lumborum* muscles obtained from two different carcasses were used in production. The muscles obtained from the right and left sides of each carcass were divided in two and a total of four pieces muscles were obtained. After the first drying stage, these pieces were treated with different ratios of transglutaminase enzyme. 5% NaCl and 150 ppm sodium nitrite were used in the pastırma production. Pastırma production was carried out under controlled conditions. According to the results of analyses, it was determined that the pH value was affected by the enzyme application at a significant level ($P<0,05$). Enzyme application showed an effect at $P<0,01$ level on lactic acid bacteria count. On the other hand, it was detected that transglutaminase application had no significant effect on a_w value, *Micrococcus/Staphylococcus* and yeast-mold counts ($P>0,05$). *Micrococcus/Staphylococcus* formed the dominant flora in pastırma, and the number of Enterobacteriaceae was found under the detectable limit. Enzyme application factor had a significant effect ($P<0,05$) on texture and had no significant effect on other investigated sensory properties (color, odor, taste and general acceptability) ($P>0,05$). Enzyme application significantly affected cohesiveness and springiness of samples at $P<0,01$ level. Firmness, adhesiveness, gumminess and chewiness were not affected by application of different level transglutaminase ($P>0,05$). On the other hand, max. shear force ($P<0,05$) and max. force ($P<0,01$) were also affected.

Keywords: Pastırma, Transglutaminase, Texture, Sensory, *Micrococcus/Staphylococcus*

1.INTRODUCTION

Pastırma, a traditional Turkish dry-cured meat product, is made from whole muscle obtained from certain parts of beef and water buffalo carcasses. This traditional meat product is also classified as an intermediate-moisture meat product. Pastırma is quite different from other dry-cured meat products in terms of process time and conditions of raw material. Production time is approximately one month (Tekinşen and Doğruer 2000; Gökalp *et al.* 2012; Kaban 2013). Proteolysis is important for the texture and characteristic flavour in dry-cured meat product such as pastırma, ham and lacon (Toldrá and Flores 1998; Kaban 2013). Endogenous muscle enzymes are mainly responsible for degradation of proteins in such products (Deniz *et al.* 2016 Food research international). During the manufacturing, non-protein nitrogen content increases and contributes to the unique characteristics of the product (Kaban 2009; Hazar *et al.* 2017; Akköse *et al.* 2017).

Meat with high lysine and glutamine content is a good substrate for transglutaminase (MTgase), which catalyzes the cross-linking of glutamine and lysine residues in proteins. It is reported that the usage of transglutaminase has an important effect on the functional properties of meat proteins and on the textural properties of the products (Li *et al.* 2013). In addition, these cross-linking between lysine and glutamine residues enhances textural properties of the product and contributes to the biological value (Motoki and Seguro 1998; Serdaroğlu ve Turp 2003; Kurt ve Zorba 2004; Yüksel ve Erdem 2007). In many studies, it was reported that many food proteins, such as milk and whey proteins, soy globulins, myofibrillar proteins and albumin, are substrates for the MTGase enzyme. In meat industry, this enzyme is used for restructured meat products. Transglutaminase increases the stability, reduces cooking losses, improves the textural properties of the product and gives a homogenous appearance by cross-linking (Gaspar and Góes-Favoni 2015). On the other hand, there is only one research about the usage of transglutaminase in dry-cured meat products (Bergamin Filho *et al.* 2010).

In this study, the effects of usage of different transglutaminase levels (0%, 0,25%, 0,50% and 1%) on physico-chemical, microbiological, sensory and textural properties of pastırma were investigated.

2.MATERIALS AND METHOD

Pastırma Production

M.Longissimus thoracis et lumborum muscles obtained from two different carcasses were used in production. The muscles obtained from the right and left sides of each carcass were divided in two and a total of four pieces of muscle were obtained. Pastırma production was carried out under controlled conditions. After the first drying stage, these pieces were treated with different ratios of transglutaminase enzyme (0%-control, 0,25%, 0,50% and 1%). 5% NaCl and 150 ppm sodium nitrite were used in the pastırma production.

Microbiological Analysis

For the enumeration of lactic acid bacteria and Enterobacteriaceae, De Man, Rogosa Sharpe (MRS Merck) agar and Violet Red Bile agar (VRBD Merck) were used respectively. Incubation was carried out at 30°C for 48h under anaerobic conditions. For *Micrococcus/Staphylococcus*, Mannitol Salt Red (MSA Oxoid) agar was used and plates were incubated at 30°C for 48h. Yeast-molds were detected on Rose-Bengal Chloramphenicol (RBC Merck) agar at 25°C and 5 days.

Physical and Chemical Analysis

To detect pH value, 10-gram samples were homogenized with ultra-turrax for 1 min by adding 100 mL distilled water. pH value was measured with pH meter (MARKA). Water activity (a_w) was detected by using an a_w device (Novasina AG CH-8853, Switzerland) at 25°C.

Pastırma samples were subjected to texture profile analysis by using the Texture Analyzer (TA.XT Plus Stable Micro Systems Ltd., Surrey, England).

Sensory Analysis

The sensory analysis was performed using a hedonic-type scale.

Statistical Analysis

Data were analyzed according to randomized complete block design with two replicates by using SPSS software (SPSS 20.0). Differences among means of results were tested for significance ($P < 0,05$) by Duncan's multiple range test.

3.RESULTS AND DISCUSSION

The effect of different enzyme levels on pH and a_w values of pastırma samples are showed in Table 1. According to these results, the a_w value was not affected by enzyme levels. The a_w value found to be below 0,90 in all pastırma samples treated with transglutaminase. In contrast, enzyme levels had a very significant effect on the pH value. The highest average of pH value was observed in the group with 0,25% transglutaminase. However, there are no significant differences between groups with 0,25% and 1% transglutaminase levels. According to the Turkish Food Codex Meat and Meat Products Communique, the pH value in pastırma must be at most 6. The pH value determined in the study were found to be lower than this value in all pastırma groups. On the other hand, the pH value did not fall below 5,5, in all groups as in other studies on pastırma (Kaban 2009; Hazar et al. 2017; Akköse et al. 2017).

Table 1. The effect of different enzyme levels on the pH and a_w values of pastırma samples (mean \pm SD)

Enzyme Ratio	a_w	pH
Control	0,867 \pm 0,021a	5,89 \pm 0,04bc
0,25%	0,846 \pm 0,010a	5,95 \pm 0,03a
0,50%	0,850 \pm 0,005a	5,87 \pm 0,02c
1%	0,860 \pm 0,023a	5,93 \pm 0,02ab

a-c: any two means on the same colon having to the same letters are not significantly different ($P > 0,05$)

The effect of different enzyme levels on the microbiological properties of pastırma samples are showed in Table 2. The use of transglutaminase in pastırma processing had no significant effect on *Micrococcus/Staphylococcus* and yeast-mold counts. On the other hand, the highest average mean of lactic acid bacteria number was observed in 0,25% transglutaminase-treated pastırma groups.

Table 2. The effect of different enzyme levels on the lactic acid bacteria, *Micrococcus/Staphylococcus* and yeast-mold counts of pastırma samples (mean \pm SD)

Enzyme level	Lactic Acid Bacteria (log kob/g)	<i>Micrococcus/ Staphylococcus</i> (log kob/g)	Yeast-Mold (log kob/g)
Control	3,88 \pm 0,83b	7,76 \pm 0,40a	5,56 \pm 0,07a
0,25%	4,94 \pm 0,31a	7,80 \pm 0,08a	4,92 \pm 0,09a
0,50%	2,52 \pm 0,30c	7,21 \pm 0,76a	5,27 \pm 1,36a
1%	3,21 \pm 0,64bc	7,66 \pm 0,06a	5,15 \pm 0,57a

a-c: any to means on the same colon having to the same letters are not significantly different ($P > 0,05$)

Color is an important quality criterion in meat products. The effect of different enzyme levels on sensory properties of pastırma samples are showed in Table 3. The use of transglutaminase had no statistically significant effect on color. Similarly, there are no significant differences between pastırma samples with or without transglutaminase in terms of odor, taste and general acceptability. However, texture was affected by different enzyme levels. The highest average

texture value was found in pastırma samples with 1% transglutaminase and this average was not statistically different from that of pastırma samples with 0,50% transglutaminase (Table 3).

Table 3. The effect of different enzyme levels on sensory properties of pastırma samples (mean \pm SD)

Sensory Properties	Control	0,25%	0,50%	1%
Color	6,73 \pm 1,49a	7,14 \pm 1,36a	7,18 \pm 1,05a	7,32 \pm 1,36a
Odor	6,41 \pm 1,68a	6,68 \pm 1,59a	6,50 \pm 1,65a	7,00 \pm 1,83a
Texture	6,36 \pm 1,18b	6,14 \pm 1,36b	6,91 \pm 1,38ab	7,32 \pm 1,36a
Taste	6,50 \pm 1,63a	6,23 \pm 1,80a	6,36 \pm 2,06a	6,82 \pm 2,06a
General Acceptability	6,27 \pm 1,08a	6,18 \pm 1,18a	6,77 \pm 1,54a	7,05 \pm 1,50a

a-b: any two means on the same column having the same letters are not significantly different ($P>0,05$)

The texture analysis results are given in Table 4. Enzyme application had a significant effect on cohesiveness and springiness of samples at $P<0,01$ level. Firmness, adhesiveness, gumminess and chewiness were not affected by application of different levels of transglutaminase ($P>0,05$). The lowest average cohesiveness value was determined in pastırma samples with 0,50% enzyme. On the other hand, the highest springiness value was found in pastırma group with 1% transglutaminase. However, the use of transglutaminase did not have a significant effect on firmness, adhesiveness, gumminess and chewiness (Table 4). Moreover, max. shear force ($P<0,05$) (Table 5) and max. relaxation force ($P<0,01$) were also affected by transglutaminase (Table 6).

Table 4. The effect of different enzyme levels on firmness, adhesiveness, cohesiveness, springiness, gumminess and chewiness values of pastırma samples (mean \pm SD)

Textural Properties	Control	0,25%	0,50%	1%
Firmness	74,51 \pm 35,40a	72,92 \pm 17,12a	70,53 \pm 20,93a	72,21 \pm 41,62a
Adhesiveness	1,82 \pm 1,15a	2,12 \pm 0,89a	2,10 \pm 1,36a	3,45 \pm 4,26a
Cohesiveness	0,64 \pm 0,07a	0,63 \pm 0,05ab	0,60 \pm 0,04b	0,67 \pm 0,03a
Springiness	0,71 \pm 0,07b	0,65 \pm 0,07c	0,67 \pm 0,04bc	0,76 \pm 0,02a
Gumminess	49,90 \pm 27,19a	48,25 \pm 15,35a	42,85 \pm 14,70a	48,06 \pm 28,65a
Chewiness	36,38 \pm 24,50a	35,22 \pm 16,01a	28,94 \pm 11,56a	36,25 \pm 22,40a

a-c: any two means on the same column having the same letters are not significantly different ($P>0,05$)

Table 5. The effect of different enzyme levels on shear test value of pastırma samples (mean \pm SD)

Enzyme Ratio	Shear Test (Max Force)
Control	18,71 \pm 2,31b
0,25%	22,91 \pm 1,09a
0,50%	22,20 \pm 2,23a
1%	24,61 \pm 4,35a

a-b: any two means on the same column having the same letters are significantly different ($P<0,05$)

Table 6. The effect of different enzyme levels on max.force, relaxation time and min. force values of pastırma samples (mean \pm SD)

Enzyme Ratio	Max. Force (N)	Relaxation Time(min.)	Min. Force (N)
Control	82,25 \pm 29,25c	80,42 \pm 26,10a	25,54 \pm 10,01a
0,25%	100,74 \pm 37,79b	80,65 \pm 10,13a	33,73 \pm 10,61a
0,50%	132,02 \pm 36,83a	109,79 \pm 20,90a	37,76 \pm 9,24a
1%	118,04 \pm 48,46a	85,47 \pm 21,76a	34,45 \pm 14,01a

a-c: any two means on the same column having the same letters are not significantly different ($P>0,05$)

As a result, using transglutaminase affected the cohesiveness, springiness, shear test and max. relaxation force. However, this enzyme had no significant effect on odor, color, taste and general acceptability.

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Zn: Fe₂O₃, Mg: Fe₂O₃ and Fe₂O₃ Thin Films Grown by Spray Pyrolysis and Gas Sensor Application

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Abstract: Iron oxide semiconductor gas sensors are used in a variety of different applications. They are relatively cheap compared to other sensing technologies and benefit from high material sensitivity, reliable and quick response times. Spray pyrolysis (SP) is one of the solution based coating technique to grow thin or thick films. The technique of SP without the requirement of vacuum is a method that can be preferred in the industry, in order to allow the production of large size films in both cheap and fast. When we get the gas sensor measure we see that Mg:Fe₂O₃ is the p type semiconductors and Zn:Fe₂O₃, Fe₂O₃ are n type semiconductor. For Fe₂O₃ thin film, because of the electrons that emerge as a result of the reaction increase the carrier concentration. Thus resistance is reduced. For Mg:Fe₂O₃ thin films, because of the electrons that vanish as a result of the reaction decrease the carrier concentration. Thus resistance is increased. X-Ray Diffraction (XRD) measurements of the obtained films were taken. As a result of Atomic Force Microscope (AFM) measurements, was obtained information about surface morphology. Optical properties were measured by Double-Diffracted UV-VIS photoelectron spectroscopy. I-V (Van der Pauw) technique has been used for response of gas sensor.

Keywords: Zinc Ferrite, Gas sensors, Iron oxide.

1. INTRODUCTION

The emission of toxic and flammable gas pollutants (NO_x, SO_x, etc.) derived from factories, vehicles and industrialization imposes great threat to the environment and human health due to the formation of ozone and acid rain as well as lung disease [Hu et al 2017].

In terms of gas sensor, α-Fe₂O₃-based sensors is widely applicable for the detection of various gases such as H₂, CO etc. However, several obstacles have to be overcome for its future application. For example, the working temperatures are still high, and the recovery time is too long. These shortcomings can be partly avoided or improved by depositing noble metals, by composing with other semiconductors, and, most importantly, by introducing newly developed nanostructured α-Fe₂O₃ to the sensors. The synthesis and functionalism of low dimensional nanostructured ferric oxide (α-Fe₂O₃) has fascinated the researchers due to their significant potential applications [Mukherjee and Pal, 2003]. Various chemical pollutants have been released in high quantities into the atmosphere as a result of human activities. In order to monitor air pollution on a large scale, inexpensive, reliable and easy to use gas sensors are needed. [Sonker and Yadav 2014; Sonker et al. 2015]. Ferric oxide is considered to be the most promising highly sensing materials of sensors due to the temperature dependent surface morphology and photocatalytic activity [Chaudhari 2008]. For gas sensing applications, the materials having lower density and higher active surface area are challenging for the fabrication of sensors.

2. MATERIALS AND METHODS

The technique of SP without the requirement of vacuum is a method that can be preferred in the industry, in order to allow the production of large size films in both cheap. Many parameters such as substrate temperature, the salts, solvent type, molarity and deposition time have carefully been chosen to obtain the best growth condition in this technique. The salts given in Table 1 were prepared as 0.1 molar solution in deionized water. The substrate was sprayed with argon gas onto a substrate heated to 320 °C at a distance of 30 cm.

Table 1. Experimental details of the Fe₂O₃, Mg:Fe₂O₃ and Zn:Fe₂O₃ thin films grown by Chemical Spray Pyrolysis technique

Film	Used Chemical Salt	Solution Molar Ratio
Zn:Fe ₂ O ₃	FeCl ₃ .6H ₂ O+FeCl ₂ .4H ₂ O+NaOH+Zn(NO ₃) ₂ .6H ₂ O	1:2:0.25:0.1
Mg:Fe ₂ O ₃	FeCl ₃ .6H ₂ O+FeCl ₂ .4H ₂ O+NaOH+Mg(NO ₃) ₂ .6H ₂ O	1:2:0.25:0.1
Fe ₂ O ₃	FeCl ₃ .6H ₂ O+FeCl ₂ .4H ₂ O+NaOH+	1:2:0.25

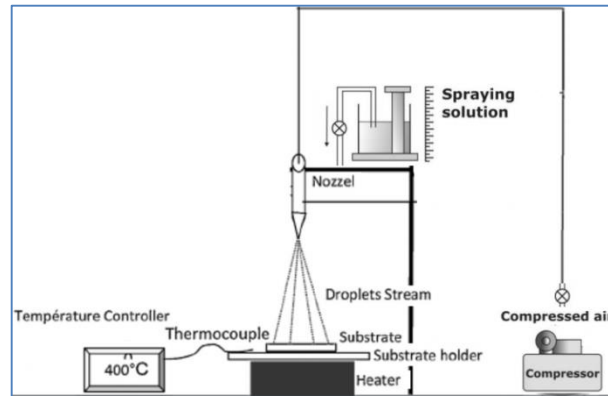


Figure 1. Schematic diagram of homemade spray pyrolysis system for the preparation of nanostructured Zn:Fe₂O₃, Mg:Fe₂O₃ and Fe₂O₃ thin films.

3.RESULTS AND DISCUSSION

The structural, especially; morphological optical structure (particle size, pore size, *etc.*), electrical properties of Zn:Fe₂O₃, Mg:Fe₂O₃ and Fe₂O₃ thin films have been extensively and carefully investigated. XRD and AFM techniques have been used for structural analysis; I-V (Van der Pauw) technique has been used for responses of gas sensor. According to XRD measurements, the crystal structure of the materials have changed.

As seen in Fig. 2a), to calculate the energy band gap of Fe₂O₃ and Zn:Fe₂O₃ structure, $(\alpha h\nu)^2$ vs. $h\nu$ graph have been plotted. The band gap energy of Fe₂O₃ and Zn:Fe₂O₃ structure were determined as 2.167 eV and 2.14 eV respectively by the extrapolation of the linear region on the energy axis ($h\nu$) as shown in Fig.2a. Also as seen in Fig. 2b), to calculate the energy band gap of Mg:Fe₂O₃ structure, $(\alpha h\nu)^2$ vs. $h\nu$ graph has been plotted. The band gap energy of Mg:Fe₂O₃ structure was determined as 2.25 eV by the extrapolation of the linear region on the energy axis ($h\nu$) as shown in Fig.2b.

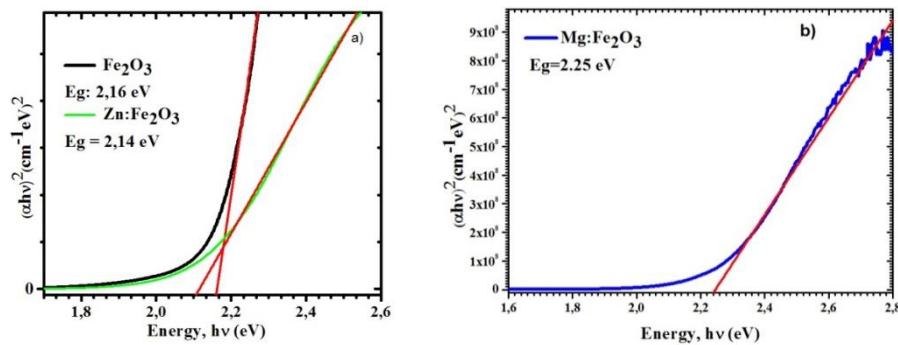


Figure 2. a) Plots of $(\alpha h\nu)^2$ versus $h\nu$ and variation of Fe₂O₃ and Zn:Fe₂O₃ thin films and b) Zn:Fe₂O₃ structure on the glass substrate.

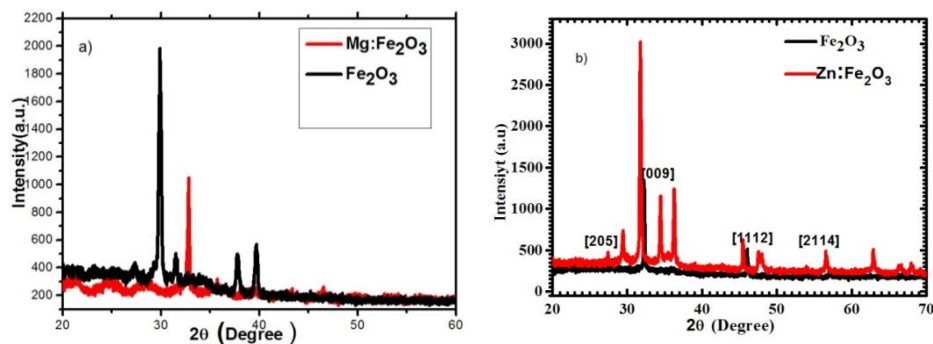


Figure 3. a) XRD patterns of Fe₂O₃ and Mg:Fe₂O₃ b) Fe₂O₃ and Zn:Fe₂O₃ thin films

Fig.3a) shows the XRD patterns of the Fe_2O_3 and $\text{Mg:Fe}_2\text{O}_3$, Fig.3b) shows the XRD patterns of the Fe_2O_3 and $\text{Mg:Fe}_2\text{O}_3$ thin film samples. Fe_2O_3 thin film sample has tetragonal crystal structure [Reference Code 00-015 0615] and also a polycrystalline structure. $\text{Zn:Fe}_2\text{O}_3$ thin film sample has cubic crystal structure, $\text{FeZn}_{6,67}$ and Fe_2O_3 hexagonal crystal structure [Reference Code 01-076-1821; 01-073-1963; 00-045-1186 respectively].

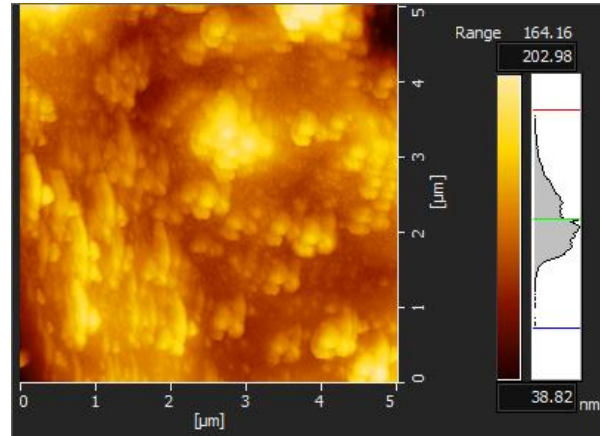


Figure 4. Two-dimensional AFM images of the $\text{Mg:Fe}_2\text{O}_3$ thin film. The $\text{Mg:Fe}_2\text{O}_3$ films line roughness value is about 13,8 nm.

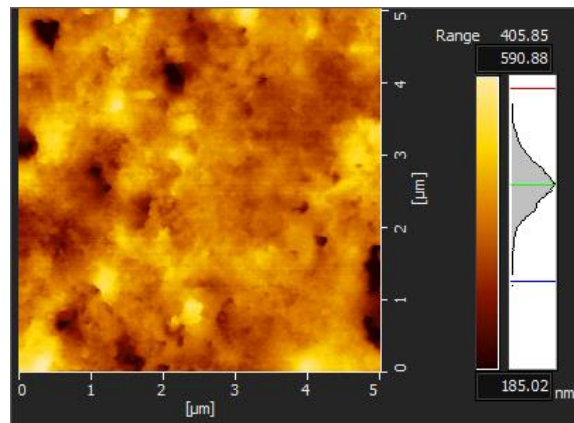


Figure 5. Two-dimensional and three-dimensional AFM images of the Fe_2O_3 thin film. The Fe_2O_3 films line roughness value is about 34,2 nm.

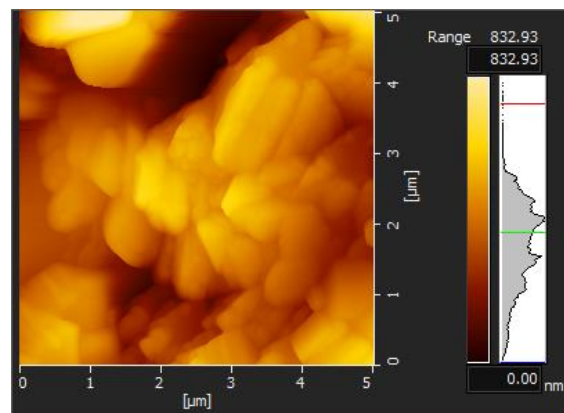


Figure 6. Two-dimensional AFM images of the Zn:Fe₂O₃ thin film. The Zn:Fe₂O₃ films line roughness value is about 89,8 nm.

In Fig. 6. the two-dimensional AFM images obtained for the Zn:Fe₂O₃ film showed that the particles in the structure showed a more sharp image. There are pits and hills almost everywhere resembling craters.

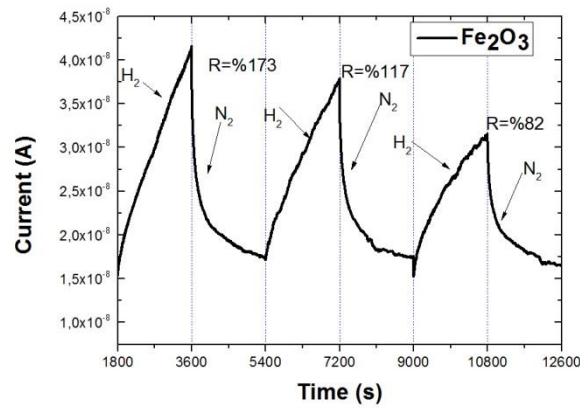


Figure 7. Sensor Response of Fe₂O₃ thin film [Saritas et al. 2018]

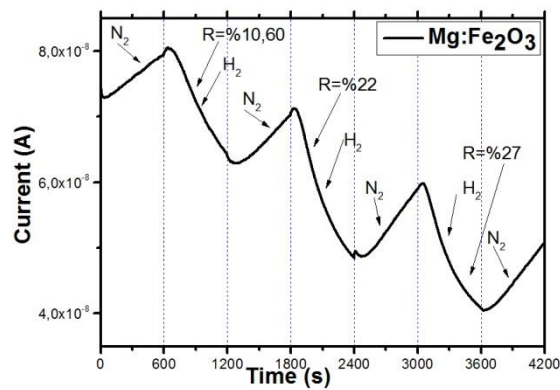


Figure 8. Sensor Response of Mg:Fe₂O₃ thin film

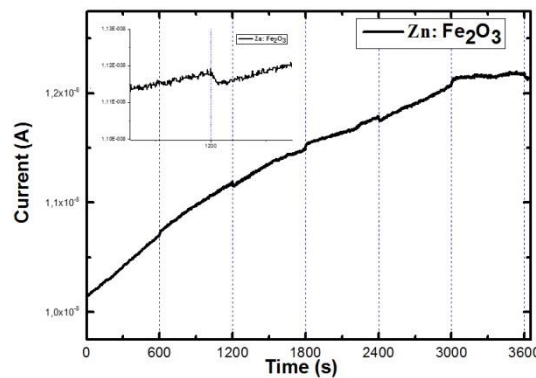


Figure9. Sensor Response of Zn:Fe₂O₃ thin film

$\%R = \frac{I_0 - I}{I_0} \cdot 100$; R sensors respons, I_0 ; first current, I ; finally current. According to calculations made, Table 2. gives the respons of the gas sensors.

Table 2. The respons of the gas sensors

Time	1800.s (100 ppm)	1800.s (500 ppm)	1800.s (1000 ppm)
Fe ₂ O ₃	%R=173	% R=117	% R=82
Time	600.s (100 ppm)	600.s (500 ppm)	600.s(1000 ppm)
Mg: Fe ₂ O ₃	% R=10,60	% R=22	% R=27
Zn: Fe ₂ O ₃	% R=0.10	% R=0.17	% R=0.20

This measurement (In Fig.7) was made to evaluate the response of the thin film to hydrogen gas, and the reaction of the film to hydrogen gas found to be very high relatively but more slowly respons (1800 s) than others.

The measurement (In Fig.8) was made to evaluate the response of the thin film to hydrogen gas, and the reaction of the film to hydrogen gas wasn't found to be very high relatively but faster respons than others. During the measurement periodically 600 s nitrogen and 600 s hydrogen gas were supplied to the system at 200 °C temperature. Nitrogen was used as the sweeping gas. In the first 600 s 500 ppm nitrogen swept system, 100 ppm hydrogen gas was then supplied and the amount of current drawn by the system increased. When the nitrogen is swept in again, the current drawn is reduced, but not receded to the previous level. This means that some of the hydrogen remains in the structure. 500 ppm for 600 s in the second cycle, 1000 ppm for 600 s in the third cycle and the current value increased with the hydrogen value. The measurement (In Fig.9) was made to evaluate the response of the thin film to hydrogen gas, and the respons of the film wasn't found to be high due to its high conductivity property. This material is a promising material for gas sensor application as well as promising hydrogen storage applications.

When we get the gas sensor measure we see that Zn:Fe₂O₃, Fe₂O₃ are the n type semiconductors and Mg:Fe₂O₃ is p type semiconductor. For Zn:Fe₂O₃, Fe₂O₃ thin films, because of the electrons that emerge as a result of the reaction increase or decrease the carrier concentration.

As seen in the AFM images, the grain of Mg: Fe₂O₃ structure is bigger. The surface area required for the gas sensor can not be provided. Due to the this, the sensor response is low.

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Investigation of Electrical Properties of Gase Single Crystal Depending on Temperature

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Abstract: In this paper, the p-type GaSe crystal used in this study was obtained by the Bridgman-Stockbarger method. Ohmic contacts for the Hall and magnetoresistance measurements were made by in evaporation in a vacuum of 10^{-5} Torr. Indium shots located on the evaporated indium dots in contacts were annealed in nitrogen medium at 305 °C for 3 min. The thermal conditions must be well controlled to grow high quality single crystals. The Hall effect measurements were made by using the four-point probe technique forward current at different temperatures to obtain the effects of temperature on the concentration and mobility of carriers. The current was made to flow in the surface planes and a magnetic field (2.3 T) was applied perpendicular to these planes. The temperature dependencies of the Hall mobility of holes, the carrier concentration, the electrical conductivity, Hall voltage, resistivity and the transverse magnetoresistance effect has been investigated in p-GaSe in the sample temperature range 10–340 K. The carrier concentration increases with increasing temperature according to the properties of semiconductors.

Keywords: Bridgman-Stockbarger, Hall effect, Magnetoresistance

1.INTRODUCTION

GaSe is a semiconductor with layered structure. It consists of thin tightly bound layers, where each individual layer consists of four sheets of atoms in the sequence Se-Ga- Ga-Se. The bonding between two sheets within an individual layer is thought to be covalent in nature with some ionic contribution, while the bonding between two fourfold layers occurs through the van der Waals force [Huang et al. 2015; Ferneliu1994; Rybkoyskiy et al. 2011; Therhell 1983]. Gallium selenide (GaSe) crystallizes in a laminar structure characterized by a strong covalent interaction within the layers and a weak van der Waals binding between them as occurs in many other III-VI compounds. The GaSe-type structure can be described as a stacking of hexagonal layers and there are four possible stacking arrangements leading to the four polytypes: β -, ϵ -, γ -, and δ -GaSe. With such a unique structural anisotropy, GaSe has long been an interesting material for both experimental and theoretical physics studies. GaSe and related III-VI compounds have received considerable attention for their potential applications in various device structures [Choi et al. 2009; Andreev et al. 2006; Eytodiev et al. 2009]. GaSe is a native p-type semiconductor, while the electrical and optical characteristics of GaSe crystal material when doped with elements in groups I, II, IV, and VII had been reported. Gallium selenide has a relatively large band gap energy of 2.0 eV, so it has potential applications to photoelectric devices that operate in the visible region [Huang et al. 2006]. In addition to knowing the properties of GaSe semiconductors, it is also important to grow this semiconductor. Different methods are used to grow GaSe. Molecular Beam Epitaxy, Bridgman Method, Vacuum Evaporation Method and Mechanical Alloying Methods. One of the best ways to grow this semi-conductor in a relatively homogeneous way is the modified Bridgman-Stockbarger method. Modified Bridgman-Stockbarger method provides better control of thermal conditions to grow high quality single crystals. Some other methods have limited success in terms of control [Abdullah et al. 2010].

2.MATERIALS AND METHODS

Magnetoresistance is a change in the electrical resistance of the material when an external magnetic field is applied. The most common form of magnetic resistance (MR) is the magnetic field effect of electrons on the orbits (Lorentz force). Magnetoresistance gives information about the constant energy surfaces of the semiconductor and the unknown magnetic field. In the transverse magneto resistant, the direction of the magnetic field and the direction of the current are perpendicular to each other, and in the longitudinal magnetoresistance, the direction of the current and magnetic field is the same. It has been demonstrated that this effect can be assigned to a variation of the properties of Zeeman (spin) states of triplet excitons in a magnetic field, which initiates a change in the optical activity of these states in circularly and linearly polarized light. For the transition to become possible, the model requires that the electronic system of the crystal supports spin-orbit coupling. The approach employed permits the adequate description of experimental data, as well as calculation of the evolution of the effect during the bound-exciton lifetime. Hall measurements are needed to find the important parameters of a semiconductor, resistivity measurements, the type of semiconductors (n or p-type electrical conductivity), carrier density and mobility.

In this work, GaSe single crystals grown by the modified Bridgman– Stockbarger method at our crystal growth laboratory were used. Ohmic contacts for the Hall and magnetoresistance measurements were made by In evaporation in a vacuum of 10^{-5} Torr. Indium shots located on the evaporated indium dots in contacts were annealed in nitrogen medium at 305 °C for 3 min. Ohmic contacts were obtained using special masks and indium metal to determine the electrical properties of the crystals. In making ohmic contacts, the contacts must be very small and symmetrical on the sample surface, we can minimize faults by making the contacts in the smallest possible size. The magnetic field is applied perpendicular to the sample surface. The temperature dependent electrical resistivity and Hall effect measurements by using the conventional four-point direct current method were carried out between 10 and 340 K under vacuum in a closed cycle cryogenics helium cryostat using a Lake-shore 331 temperature controller. Four points technique was used for measuring the Hall and magnetoresistance of the sample. This technique requires four contacts symmetrically on the four corners of the sample surface. Four measurements (two resistances and two Hall voltage measurements) are sufficient to monitor the current voltage change. The current is applied through a pair of opposed contacts and the voltage from the other crossing pair is read. The current and voltage measurements were made via a current and a digital multimeter .The current was applied between the point contacts A and B, and voltage was measured between the two point contacts C and D for both the Hall and magnetoresistance effects (Figure 1).

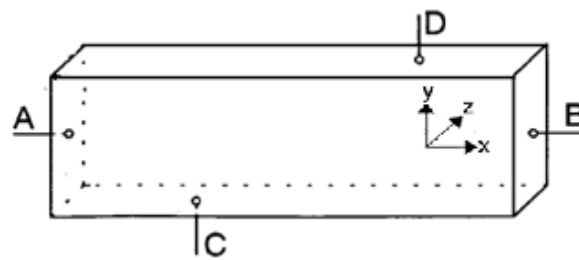


Figure 1. An illustration of Hall geometry.

3.RESULTS AND DISCUSSION

The values of transverse magnetoresistance coefficient, carrier concentration, Hall coefficient, Hall mobility and electrical resistivity were calculated by means of electrical measurements and the variations of these quantities according to temperature were examined. The $n=I.B/\tau.q.V_H$ equation is used to determine the carrier density. In order to calculate the mobility, the current is calculated by holding constant to 0.02 mA. The values in Table 1 is used in these calculations.

Table 1. The data that we used in Hall measurement.

Parameters	GaSe
Magnetic field (B)	2,5 Tesla
Current (I)	0,02 mA
The Sample thickness	0,0025 m
Scattering Coefficient	1
Distance between contacts	0,004 m
Sample width	0,0041 m
Electron charge	$1,6 \times 10^{-19}C$

In Figure 2-7, the Hall effect of the samples of GaSe is given due to the temperature. Figure 2 shows a plot of $\Delta\rho/\rho$ vs I (current) at a sample temperature of 50 K. As seen from Figure 2, the plot is not linear; hence, linear regression is not applicable to calculate a mean value of the magnetoresistance coefficients. Therefore, transverse magnetoresistance coefficient is calculated at a fixed magnetic field of 0.5 T.

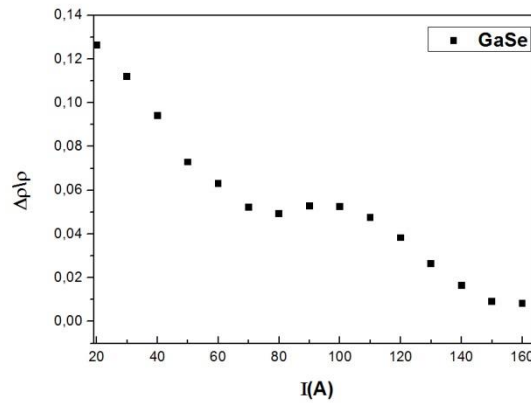


Figure 2.

vs current(I) measured for GaSe.

Magnetoresistance effects

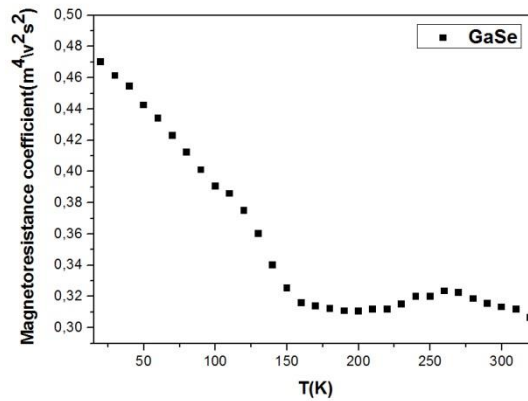


Figure 3. Temperature dependence of magnetoresistance coefficient(m⁴v²s⁻²) for GaSe crystal.

The variation of the transverse magnetoresistance coefficient of GaSe crystal is given in Figure 3. With increasing temperature in GaSe crystal, the transverse magnetoresistance (according to temperature power law $T^{-\beta}$) has decreased. This may be due to the different scattering of the existing defects in the crystals and may also depend on the anisotropic band structure of the sample [Camassel 1978]. At low temperatures, the variation of the transverse magnetoresistance in the GaSe samples with temperature is due to the scattering of holes by the impurities and defects in the crystals [Blood and Orton 1992].

The change in Hall mobility in the GaSe crystal is shown in Figure 4. In the GaSe crystal, the dependence of the Hall mobility on the magnetic field was not significantly decreased between 10 and 150 K, but the decrease of the temperature difference between 210 and 340 was explained as the increase of the scattering. The decrease in the low temperature zone is due to ionized impurities. Because, as they move towards lower temperatures, they are scattered from ionized impurity, mobility increases with decreasing temperature due to neutral impurity and phonon scattering. Due to the increase in mobility value, we may be responsible for acceptor scattering of electrons. Impurity at high temperatures is in effective, at higher temperatures, the carriers move faster and remain in the vicinity of the impurity atom for very little time and are scattered ineffectively.

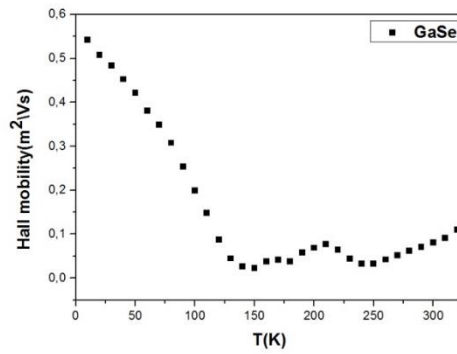


Figure 4. Temperature dependence of Hall effect for GaSe crystal.

Changes in electrical conductivity and temperature in GaSe crystal is given in Figure 5. The conductivity decreases between 100 and 150 K due to the variation in Hall mobility and concentration of the dopant in GaSe crystal.

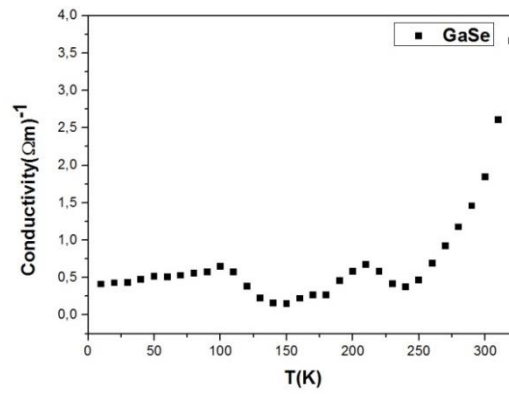


Figure 5. Temperature dependence of conductivity for GaSe crystal.

Temperature variations of carrier density in GaSe crystal (10-340 K) is given in Figure 6 respectively. The carrier concentration increases as the temperature increases in accordance with the properties of the semiconductors. In GaSe semiconductor, the carrier density values increase with increasing temperature. Carrier density values in GaSe crystal is in the range of 10^{19} - 10^{20} m^{-3} . Some researchers have reported the electrical and optical characteristics of GaSe doped with elements in groups I, II, IV, and VII. Hole concentrations of the order of 10^{15} - 10^{17} cm^{-3} at room temperature have been obtained by doping with Cd, Zn, Cu, Er and Ag [Hsu et al. 2004].

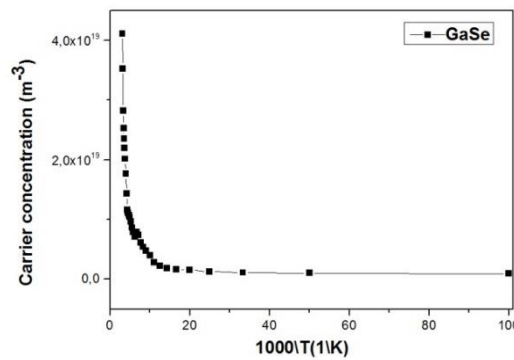


Figure 6. Temperature dependence of carrier concentration for GaSe crystal.

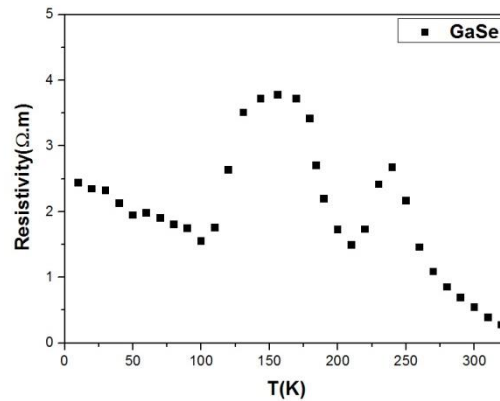


Figure 7. Temperature dependence of resistivity for GaSe crystal.

The variation of the resistivity with temperature in the GaSe crystal is given in Figure 7. The temperature gradient in the GaSe sample decreases ($T < 100$ K), then increases by 100 -150 K due to the carrier concentration and the change in conductivity, while $T > 150$ K decreases. Increasing the carrier density as the temperature increases will cause the resistivity to decrease.

With increasing temperature in GaSe crystal, the transverse magnetoresistance (according to temperature power law $T^{-\beta}$) has decreased. This may be due to the different scattering of the existing defects in the crystals and may also depend on the anisotropic band structure of the sample [Camassel 1978]. In the GaSe crystal, the dependence of the Hall mobility on the magnetic field was not significantly decreased between 10 and 150 K, but the decrease of the temperature difference between 210 and 340 was explained as the increase of the scattering. In GaSe semiconductor, the carrier density values increase with increasing temperature. Carrier density values in GaSe crystal is in the range of 10^{19} - 10^{20} m^{-3} .

Hall voltage (V_H), Hall mobility (μ), carrier concentration (n) and resistivity (ρ) were found as a result of Hall effect measurements of the samples. The positive signs of the Hall voltage indicate that the semiconductor samples have p-type conductivity.

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Investigation of Antioxidant Properties of Ethanol, Methanol and Ethyl Acetate Extracts of Different Parts of Endemic *Achillea teretifolia* (Civan Perçemi) from Gümüşhane

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Abstract: In these study antioxidant properties of ethanol, methanol and ethyl acetate extracts of endemic *Achillea teretifolia*'s different parts (stem and flowers) has been investigated. After collection and dried, plants have been extracted with mentioned solvents. Firstly, total extraction yields have been calculated. Total phenolic and flavonoid contents have been measured by spectrally as gallic acid and quercetin equivalents, respectively. Antioxidant activity of extracts have been determined by 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) di-ammonium salt (ABTS) and 1,1-diphenyl-2-picrylhydrazyl (DPPH) methods by spectrally and calculated as trolox equivalent. The results showed that methanol extracts of stem parts have exhibited the highest phenolic and flavonoid contents as 171.3 mg GAE/g extract and 86.8 mg QUE/extracts, respectively. Similarly, methanol extracts of stem parts have had the highest level of DPPH (573.3 µg/ml TEAC) and ABTS (404.5 µg/ml TEAC) activities. On the other hand, ethanol extracts of flower parts have exhibited the highest phenolic and flavonoid contents as 75.3 mg GAE/g extract and 42.4 mg QUE/extracts, respectively. This extracts also have showed the highest level of DPPH (543.2 µg/ml TEAC) and 381.9 µg/ml TEAC), if compared to others. In conclusion, endemic *Achillea teretifolia* plants have partly antioxidant properties and these plant's different parts with various extracts might be suggested new natural agents in some industries.

Keywords: Antioxidant, Ethanol, Methanol, Ethyl acetate, *Achillea teretifolia*

1. INTRODUCTION

The *Achillea* genus has 49 species (58 taxa) occurring in five sections and 24 of them are endemic in Turkey (Güner et al, 2012). Not only in Turkey but also around world *Achillea* species is an important biological resource in folk medicine against most of health problems. According to literature, some *Achillea* extracts exhibit rich pharmacologic activities such as anti-oxidant, anticancer (Bali et al, 2015), antimicrobial (Karaalp et al, 2009), wound healing (Akkol et al, 2011), antidiabetic (Conforti et al, 2005), anti-inflammatory (Küpeli et al, 2007), antihypertensive, and antihyperlipidemic properties (Asgary et al, 2000).

There are some reports about this plant that it has also antioxidant properties. But as we know that plants can accommodate their land by using more and different kind of seconder metabolites like phenolic and flavonoids, they have a big role on radical scavenger systems. And plants can store these kinds of metabolites in stems or flowers. Because of that, we investigated *Achillea teretifolia* (endemic) plants which using by rural people as a folk medicine. This plants collected from Gümüşhane, has extreme climate conditions and difficult habitat, during flowering time (July).

2. MATERIALS AND METHODS

This research was carried out in Gümüşhane University, Department of Genetic and Bioengineering Research Lab. Plant samples were collected from Gümüşhane Artabel Natural Park, Beşgöller around, 2800-3000 m. The plant aerial parts were chopped, dried and powdered. The plant materials (20 g) were extracted with 400 ml each solvent at 37 °C 125 rpm during 24 h. The extracts were filtered using Whatman filter paper (No: 1) and then concentrated under vacuum at 40 °C using a Rotary evaporator. The residues obtained were stored in a freezer at -20 °C until further tests.

The amount of total phenolic content in the extract was determined according to Folin-Ciocalteu method with minor modifications (Slinkard and Singleton 1977) 31.25 µl of sample solution (1 mg/ml) were introduced into well containing 125 µl of Folin-Ciocalteu's reagent and 93.75 µl of 7.5% Na₂CO₃. After 2 h incubation at room temperature, the absorbance was measured at 750 nm with micro plate absorbance reader (iMark™ 1681135, Bio- Rad). The total phenolic content was calculated as Gallic acid equivalents (GAE) in milligram per gram of extract (mg GAE/g extract).

Total flavonoid content of the extract was determined according to AlCl₃ colorimetric method with some minor modification (Moreno et al., (2000). Briefly, 20 µl of sample solutions (1 mg/ml) was mixed with 172 µl methanol, 4 µl 10% AlCl₃, and 54 µl 1 M potassium acetate and waited 40 minutes. After incubation mixture was measured at 415 nm. The total flavonoid content was calculated in milligrams of rutin equivalents (RE) per gram of extract.

The effect of the plant extracts on 1, 1-diphenyl-2-picrylhydrazyl (DPPH) radical was estimated according to Kirby and Schmidt (1997) the with minor modification. 125 µl of the plant extract was added to 125 µl 0.1 mM DPPH. The mixture

was waited 45 minutes and measured at 490 nm. The antioxidant capacity of each extract was calculated as trolox equivalents (TE) (mg TE/g extract).

ABTS (The 2, 2-azinobis-3- ethylbenzothiazoline-6-sulfonic acid) free radical caption scavenging activity was determined using a spectrophotometric method according to Re et al., (1999), with minor modifications. 80 µl sample and 160 µl ABTS solution mixed and waited at 6 minutes. The mixture was measured at 750 nm and the antioxidant capacity of each extract was calculated as trolox equivalents (TE) (mg TE/g extract).

All the analyses were carried out in triplicate. The data was recorded as mean±standard deviation and analysed by SPSS (version 11.5 for Windows 2000, SPSS Inc.). Oneway analysis of variance was performed by ANOVA procedures. $P < 0.05$ was accepted as significant.

3.RESULTS AND DISCUSSION

Diffrent parts of (endemic) *Achillea teretifolia* plant has been evaluated in terms of antioxidant properties in this study. Extraction yields, total phenolic and flavonoid contents of the three different extracts were shown in Table 1. The highest yield of extract was methanol flower (15.3%) and the lowest was stem EtoAc (2.4%). The total phenolic and flavanoid content of extracts, as determined ranged from 75.3±0.3 to 171.3±0.4 mg GAE/g extract and 42.4±0.5 to 86.8±0.2 mg QUE/g extracts, respectively (Table 1).

Table 1. Total phenolic and flavonoid contents of *Achillea teretifolia* extracts

Plant Parts	Extracts	% Yield	Fenolic Content (mg GAE/g Extract)	Flavanoid Content (mg QUE/g Extracts)
STEM	EtOH	6.2	89.23 ^b ±0.1	45.9 ^b ±0.1
	MetOH	10.6	171.3^a ±0.4	86.8^a ±0.2
	EtoAc	2.4	14.8 ^c ±0.5	10.9 ^c ±0.4
FLOWER	EtOH	10.9	75.3^a ±0.3	42.4^a ±0.5
	MetOH	15.3	66.7 ^b ±0.4	30.6 ^b ±0.8
	EtoAc	5.9	20.0 ^c ±0.5	12.6 ^c ±0.6

Values are expressed means ± S.D. of three independent measurements, different letters in the same column indicate a significant difference ($P < 0.05$), GAE: Gallic acid equivalents, QUE: Quercetin equivalents.

Antioxidant activities were determined by two methods which are DPPH and ABTS. Results were given as Trolox Equivalent (TAEC) at Table 2. Methanol extract of stem exhibited the highest level of antioxidant activity and the lowest one was EtoAc extract of flower.

Table 2. Antioxidant activity of *Achillea teretifolia* extracts (DPPH; ABTS⁺)

Plant Parts	Extracts	DPPH· (TAEC value µg/ml)	ABTS ⁺ (TAEC value µg/ml)
STEM	EtOH	530.5 ^b ±0.1	359.6 ^b ±0.2
	MetOH	573.3^a ±0.3	404.5^a ±0.3
	EtoAc	509.8 ^c ±0.2	252.9 ^c ±0.4
FLOWER	EtOH	543.2^a ±0.2	381.9^a ±0.5
	MetOH	525.7 ^b ±0.3	240.0 ^c ±0.6
	EtoAc	414.6 ^c ±0.5	288.4 ^b ±0.3

Values are expressed as means ± S.D. of three independent measurements, different letters in the same column indicate a significant difference ($P < 0.05$). TAEC: Trolox equivalents.

The *Achillea* species are the most important native economic plants of Anatolia. Especially, in Gümüşhane, it is so valuable in folk medicine. Because of their bioactive compounds, it is possible that they might have some pharmacological properties. As we know, most of diseases caused by reactive oxygen species and it is very important to remove them from

living cells by antioxidant agents. In recent studies, researchers have focused on natural products such as plants to scavenging of ROS. Because of this, in this study the aim was to investigate anti-oxidant effects of *Achillea teretifolia* plant's different parts and solvent extracts. The results showed that methanol extracts of stem exhibited a remarkable phenolic, flavonoid content and also DPPH and ABTS scavenging activity. Ethanol extract of flower followed these results. There were positive correlations between total phenolic, flavonoid contents and their antioxidant activities. These antioxidant properties might be caused by phenolic and flavonoid contents. In addition to them, ethanol flower and methanol stem extracts could be good and powerful antioxidant sources if compare to other extract of solvents.

This is the first report demonstrating the potential anti-oxidant effect of *Achillea teretifolia* plants which collected from Gümüşhane, Artabel area. According to the results methanol extracts of stem parts exhibited the highest level of phenolic and flavonoid contents and antioxidant activities. On the other hand, ethanol extracts of flower parts exhibited the second highest level of antioxidant properties. The results of this study revealed that different parts of plants with various extracts might be used as a natural antioxidant agent. Even if, this study gives us some idea about antioxidant properties of this plant, further studies should be carried out in vivo conditions to understanding of the best uses.

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Investigation on Antibacterial Activity of a *Dianthus* Species

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Abstract: The plants have been used by people for a long time for different purposes. While some are consuming as nutrients, many plants are used for medical purposes. According to the researches made, many people apply to medical plants as the first resort when they have health problems. For this reason, humans have done a lot of research on the biological activity of plants and this activity screening work is still going on. In this study, antibacterial activity of *Dianthus orientalis* obtained from Gumushane was investigated. First, the plants were collected and dried. Plant material was extracted with each solvent (ethanol, methanol and ethyl acetate). Disc diffusion method was used to determine antimicrobial activity. Fourteen microorganisms have been tested to determine activity. As a result, the extracts exhibited antimicrobial activity against at least one test organism. The extracts showed antimicrobial activity against both gram-positive and gram-negative organisms. Ethyl acetate extract showed strong antimicrobial activity on *Candida albicans* with 13 mM inhibition zone. As a result, it is estimated that *Dianthus orientalis* has potency to be used as a natural antimicrobial agent.

Keywords: Antimicrobial Activity, *Dianthus*, Disc Diffusion, Gram-negative Organisms, Gram-positive Organisms

1. INTRODUCTION

Dianthus species, the second largest plant species in Turkey is a member of the Caryophyllaceae family (Hamzaoglu et al., 2015a). *Dianthus* genus is represented in our country with 76 species, 2 subspecies, 12 varieties. 45% of *Dianthus* genus members in our country are endemic (Reeve, 1967; Davis et al., 1988; Menemen and Hamzaoglu, 2000). *Dianthus* species are medical plants belonging to Caryophyllaceae family have been reported to be used as diuretics, anti-inflammatory, immunostimulatory and expectorant agents. Due to their beneficial biological effects, traditional treatments are used in the treatment of urinary infections, boils, menopause, gonorrhea, cough and cancer. (Hsieh et al., 2004; Lamula and Ashafa, 2014). In this study, the antimicrobial activity of extracts of *Dianthus orientalis* plant collected from Gumushane using different solvents was investigated. *Dianthus orientalis* is not endemic to our country but this research is the first report based antimicrobial activity for plants collected from Turkey.

2. MATERIALS AND METHODS

Plant materials were picked up from Beşgöller around at 2800-2900 m in Artabel Natural Park, Gumushane. Plants were dried without exposure to direct sunlight. The air-dried and finally ground plant samples were extracted by using three solvent (ethanol, methanol and ethyl acetate). 10 g plant material with 200 ml solvent were mixed and shaken at 125 rpm 37 °C for 24h. Extracts were filtered by using filter paper and solvent evaporated under vacuum (Ozcan and Acet, 2018).

The extracts were tested for antimicrobial activity against to twelve randomly selected bacterial strains and one yeast. Test organisms were *Enterococcus faecalis* ATCC 29212, *Staphylococcus epidermidis* ATCC 12228, *Staphylococcus aureus* ATCC6538, *Enterococcus faecium* DSMZ 13590, MRSA ATCC 43300, *Enterococcus hirae* ATCC 10541, *Klebsiella pneumoniae* ATCC 13883, *Pseudomonas aeruginosa* ATCC 27853, *Escherichia coli* ATCC 29998, *Yersinia enterocolitica* ATCC 27729, *Vibrio parahaemolyticus* ATCC 17802, *Salmonella typhimurium* CCM 5445 and *Candida albicans* DSMZ 5817.

Disc diffusion method was used to determine antimicrobial activity. A stock solution having a concentration of 10 mg/ml of plant extracts was first prepared using DMSO. In the second step, petri dishes prepared using Mueller-Hinton agar were inoculated with fresh culture test organisms (0.5 McFarland). Then sterile 6 mm discs were placed on the organism-applied petri dish and 20 µL of stock solutions per disc were put and the petri dishes were left for 2 hours at 4 °C for diffusion of the media extracts. After this process, petri dishes were incubated at 37 °C and 25 °C, respectively, for bacteria and yeast. After 2 days of incubation, the inhibition zone around the discs was measured in millimeters (Bauer et al., 1966, Ozcan et al., 2013). As a positive control, chloramphenicol and nystatin were used in equal concentrations with the samples.

3. RESULTS AND DISCUSSION

In this study, antimicrobial activity of *Dianthus orientalis* plant extracts was screened by disk diffusion method. 6 Gram (+) and 6 Gram (-) bacteria were used. Activity against 3 of the Gram (+) organisms was detected, and in particular, the ethylacetate extract showed antimicrobial activity on *E. faecium* equal to chloramphenicol (Table 1). For Gram (-) bacteria, all extracts showed activity against at least one test organism except *P. aeruginosa* (Table 2). Only *C. albicans*

was used as yeast in the experiment and ethyl acetate extract showed significant activity against *C. albicans* compared to nystatin (Table 3). Ethanol extract did not exhibit any activity on *Gram (+)* organisms while showing no methanol extract activity on *Gram (-)* organisms. As a result, activity on 3 *Gram (+)* and 5 *Gram (-)* microorganisms was detected.

Table 1. Antibacterial activity on *Gram (+)* bacteria

Antibacterial activity on <i>Gram (+)</i> bacteria (*mm zone diameter)						
Plant extracts	<i>E. faecalis</i>	<i>S. epidermidis</i>	<i>S. aureus</i>	<i>E. faecium</i>	MRSA	<i>E. hirae</i>
Methanol extract	-	-	8	8	8	-
Ethanol extract	-	-	-	-	-	-
Ethyl acetate extract	-	-	7	10	-	-
Chloramphenicol	15	17	10	10	15	17

Table 2. Antibacterial activity on *Gram (-)* bacteria

Antibacterial activity on <i>Gram (-)</i> bacteria (*mm zone diameter)						
Plant extract	<i>E. coli</i>	<i>Y. enterocolitica</i>	<i>V. parahaemolyticus</i>	<i>S. typhimurium</i>	<i>K. pneumoniae</i>	<i>P. aeruginosa</i>
Methanol extract	-	-	-	-	-	-
Ethanol extract	10	9	9	-	9	-
Ethyl acetate extract	13	10	8	8	11	-
Chloramphenicol	16	12	10	15	12	16

Table 3. Antimicrobial activity on *Candida albicans*

Plant extracts	Antimicrobial activity on <i>Candida albicans</i> (*mm zone diameter)
Methanol extract	-
Ethanol extract	9
Ethyl acetate extract	13
Nystatin	12

Antimicrobial activity was also found in previous studies with different *dianthus* species. Bonjar (2004) was investigated *Dianthus caryophyllus* against to *Bacillus cereus*, *Bacillus pumilus*, *Bordetella bronchiseptica*, *Escherichia coli*, *Klebsiella pneumoniae*, *Micrococcus luteus*, *Pseudomonas aeruginosa*, *Pseudomonas fluorescens*, *Serratia marcescens*, *Staphylococcus aureus* and *Staphylococcus epidermidis*. In the study, the scientist identified antibacterial activity in all the extracts of *Dianthus caryophyllus* against *Staphylococcus epidermidis*, *Klentiella pneumonia*, *Bordetella bronchiseptica*. In other study, Benli et al., (2008) investigated the activity against 14 microorganisms using the methanol extract of the above-ground parts of *Dianthus balansae* and could not detect activity against any test organism. In our study, *Dianthus orientalis* extracts were found to be effective on 3 *Gram (+)* and 5 *Gram (-)* organisms.

According to the results of *Dianthus orientalis* disc diffusion, the extracts have significant activity on both *Gram (+)* and *Gram (-)* organisms. For this reason the plant extracts might be use for as any natural antimicrobial agent. It is believed that plant extracts have a potency to be used as an effective agent especially in the fight against *K. pneumoniae*, *E. faecium* and *C. albicans*.

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Plant Cell Wall proteins: Arabinogalactans

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Abstract: The presence of a cell wall confers many of the gross morphological characteristics of plants and is one of the features that distinguish them from animals. The cell wall is a complex composite of cellulose, high molecular weight polysaccharides, proteins, and aromatic substances that undergoes dynamic changes. In addition to providing structural support and a passive barrier against invading pathogens and pests, the cell wall controls cell expansion and is involved in the exchange of water and substances throughout plant development. It also constitutes a reservoir of antimicrobial compounds and is a source of signalling molecules. Arabinogalactan proteins (AGPs) are a class of Hyp-rich glycoproteins that are highly glycosylated and are abundant in the plant cell wall and plasma Membrane. In Arabidopsis, the glycosylphosphatidylinositol (GPI)-anchored AGPs can be divided into four subclasses, the classical AGPs, those with Lys-rich domains, and AG peptides with short protein backbones. The fasciclin-like AGPs (FLAs) constitute a fourth distinct subclass of AGPs. AGPs have some significant roles such as pattern formation, cell expansion, salt tolerance, disease response, and plant - microbe interactions and programmed cell death (PCD). However, plasma membrane AGPs in cell wall integrity control still speculative and should research with details. Especially, there is few knowledge about how it works under salt stress and how connects with plant growth regulators. If we can enlighten these pathways, it might be important to protect plants and these kinds of studies are so valuable for industry related to cellulose, hemicellulose and pectin. On the other hand, if we can understand genes that have role on plant cell wall, it will help to develop plant biotechnological studies.

Keywords: Plant, cell wall, stress, arabinogalactan proteins

1.INTRODUCTION

The plant cell wall is a dynamic matrix composed of cellulose, hemicelluloses, pectins, enzymes, and structural proteins, including hydroxyproline-rich glycoproteins (HRGPs) (Tan et al., 2018). HRGPs can be classified into three subfamilies, including the highly glycosylated arabinogalactan-proteins (AGPs), the moderately glycosylated extensins, and the least glycosylated proline rich proteins (PRPs) (Kieliszewski et al., 2010). AGPs are found in intercellular and the apoplastic spaces and cell walls, on plasma membranes, and in cytoplasmic vesicles, suggesting multiple roles for AGPs in various processes associated with cell growth and plant development (Majewska-Sawka and Nothnagel, 2000; Ellis et al., 2010).

Arabinogalactan-proteins (AGPs) are undoubtedly one of the most complex families of macromolecules found in plants, perhaps matched only by the polyphenolics (lignins/cutins/suberins) and pectins. Their complexity arises from the incredible diversity of the glycans decorating the protein backbone, the array of peripheral sugars decorating the large arabinogalactan (AG) chains, the micro heterogeneity of protein backbone glycosylation and the diversity of protein backbones containing AG glycomodules (Ellis et al., 2010) (Figure 1).

A sub-group of AGPs have been termed fasciclin-like AGPs or FLAs (Johnson et al., 2003). Shi et al., 2003 has identified a mutant in FLA4 that is *sos5* (salt overly sensitive). According to their results, the root of *At-fla4* shows a drastic reduction of elongation growth combined with radial swelling of the elongation zone (Figure 2). Cell walls appear abnormally thin in *At-fla4*, apparently lacking the middle lamella (Shi et al., 2003).

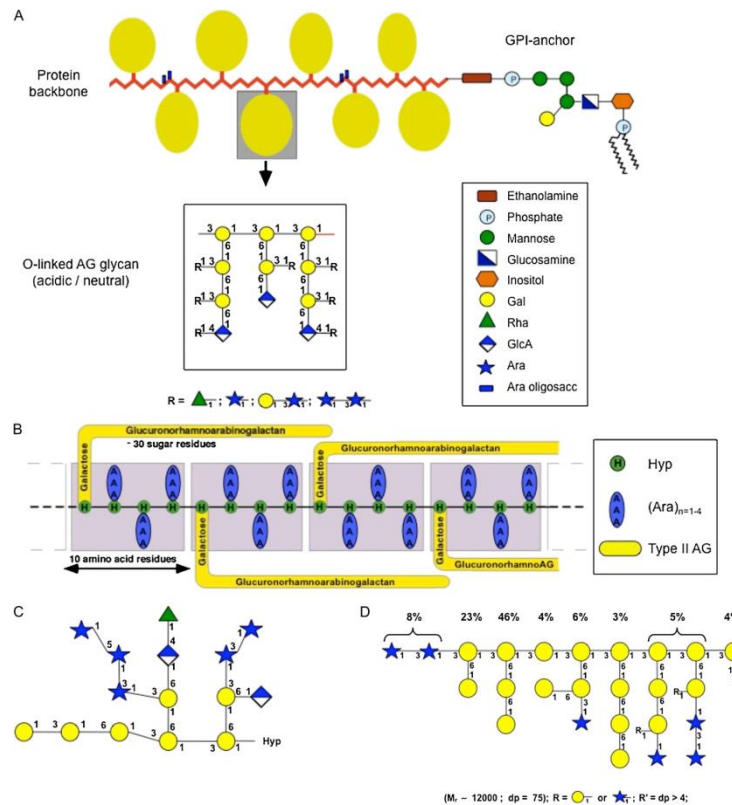


Figure 1. A, The wattle blossom model of the structure of AGPs with a GPI membrane anchor attached.

In this model, there are approximately 25 Hyp residues. Most Hyp residues are noncontiguous and are predicted to bear an AG chain. Each AG chain may contain 15 or more repeats of a b-(1-3)-linked Gal oligosaccharide. There may be a few contiguous Hyp residues bearing short arabino-oligosaccharides. The molecule as a whole is spheroidal. The structure of the GPI anchor shows an ethanolamine-phosphate (P) between the anchor and the C terminus of the protein backbone, which is common to all GPI anchors. The core oligosaccharide of the GPI shown is based on PcAGP1 from pear (*Pyrus communis*; Oxley and Bacic, 1999), which comprises 2- and 6-linked Manp residues, a 4-linked GlcNH₂ residue, and a monosubstituted inositol with a partial Galp residue substitution to C(O)4 of the 6-linked Manp residue. The lipid moiety is a ceramide composed primarily of a phytosphingosine base and tetracosanoic acid. This model is modified from Fincher et al. (1983). B, The twisted hairy rope model of the structure of the GAGP. A hypothetical block size of 7 kD contains 10 amino acid residues (1 kD), 30 sugar residues (Ellis et al., 2010).

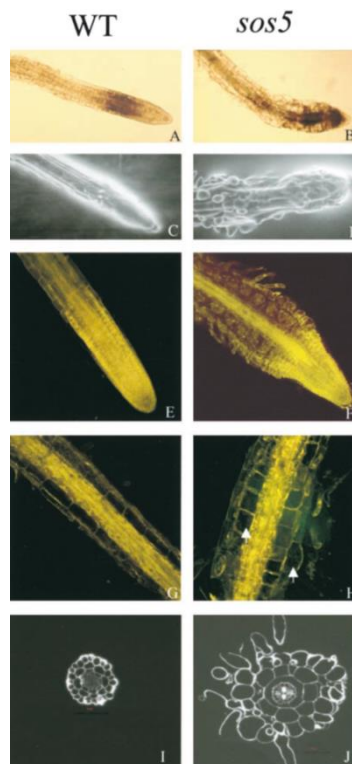


Figure 2. Root Tip Swelling in the *sos5* Mutant (Shi et al., 2003).

((A), (C), (E), (G), and (I) Wild-type (WT) roots as controls. (B), (D), (F), (H), and (J) *sos5* mutant roots. (A) and (B) Light microscopy images of root tips 3 days after transfer from MS agar medium to MS agar medium supplemented with 100 mM NaCl. (C) and (D) Scanning electron microscopy images of root tips treated for 5 days with 100 mM NaCl. (E) to (H) Confocal images of root tips and mature primary roots grown on the surface of MS agar (0.8%) medium for 3 weeks. Arrows point to cells with abnormal expansion. (I) and (J) Thin cross-sections at 0.5 cm away from the apex of roots grown on the surface of MS agar (0.8%) medium for 3 weeks).

2.RESULTS AND DISCUSSION

The plant cell wall has a crucial role in any aspect of a plant's life cycle and, as a result, cell wall research touches all aspects of plant biology and it is a dynamic composite structure, consisting of distinct but interdependent networks that change during cellular development and in response to biotic or abiotic stresses (Keegstra, 2010; Wolf et al., 2011).

AGPs that involved in cell wall proteins have some significant roles in plants such as pattern formation, cell expansion, salt tolerance, disease response, plant-microbe interactions and programmed cell death (PCD) (Somerville et al., 2004). However, plasma membrane AGPs in cell wall integrity control still speculative and should research with details. Especially, we should better understand how it works under salt stress and the other abiotic/biotic stresses. On the other hand, how connects with plant growth regulators should be explained. For instance, Seifert et al., (2014) showed that the predicted lipid-anchored glycoprotein *At-FLA4* positively regulates cell wall biosynthesis and root growth by modulating ABA (a stress related plant growth hormone) signalling. If we can enlighten these kinds of pathways, it might be important to protect plants and such studies are so important for industry related to cellulose, hemicellulose and pectin. Addition to them, if we can understand genes that have role on plant cell wall, it will help to develop plant biotechnological studies. In conclusion, researchers should work to establish a detailed understanding of cell wall architecture, stress interactions, signalling networks etc.

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Essential Oils Compounds of Seed of Palm (*Phoneix dactylifera*) Grown in Libya

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Abstract: The aim of the study, investigation of the essential oil of seed of palm (*Phoneix dactylifera*) grown in from Libya. Palm seed were collected from Libya. The essential oil was obtained from crushed seed by hydro-distillation. The gas chromatography–mass spectrophotometry (GC–MS) analysis of the obtained essential oil was conducted. Essential analyses of the palm seed results show that, 50 compounds were found both aroma and fatty methyl esters (FAMES) analyses. 21 of these 50 compounds at the FAMES analysis, and also 18 of 50 compounds at the aroma analysis could not be determined with data library. The highest amount of compounds was found methyl stearate (48.70%) in the FAMES analysis. The highest amount of compounds was found β -citronellol (31.70%) in the aroma analysis. According to the study results, essential oil of the palm seed can be used in both cosmetic industry and pest control.

Keywords: *Phoneix dactylifera*, palm seed, essential oil, methyl stearate, citronellol

1.INTRODUCTION

The use of antibiotics is restricted and/or prohibited, especially for the resistance of pathogens, the effects of environmental microflora, ecological balance and human health. Researchers are started the search for natural products, such as; non-specific immune system stimulating and/or supporting products, enzymes, organic acids, probiotics-prebiotics and plant extracts, instead of chemicals. Essential oils are on the GRAS list of foods published by US FDA (Gültepe et al., 2015). Essential oils obtained from many medical and aromatic sources; antifungal, antifungal, antiviral, antioxidant, antidiabetic, anti-inflammatory, anticancer activity, as well as treatment of many other conditions related to treatment fires, insect bites and skin (Holetz et al., 2002; Prabuseenivasan et al., 2006; Alvino & Alvino 2009; Kazemi et al., 2012; Mekonnen et al., 2016).

Approximately 6,268,954 metric ton dates are produced per year in world. According to FAO (2018), ranking of the Libya is 12th with 161,000 metric ton dates production, concurrently the Turkey is ranked 16th with 26,277 metric ton production.

Table 1. Ranking of Dates Production of Country

Rank	Country	Amount (mt)
1	Egypt	1,084,529
2	Iran	947,809
3	Saudi Arabia	836,983
4	Iraq	675,440
5	Pakistan	556,608
6	UA Emirates	533,701
7	Algeria	485,415
8	Sudan	435,668
9	South Sudan	432,100
10	Oman	239,397

Weight of date seed changes between 5.16-14.2% of date. There is 0.2-0.5% fat in date and 7.7-9.7% fat in seed. Date seed included linoleic, myristic (tetradecanoic), palmitic, stearic, oleic, and linolenic fatty acids. The largest being oleic acid with approximately 39% and palmitic acid with approximately 24% (Ergönül 2005, Süleymani 2012).

The purpose of the with this information, investigation of the essential oil of seed of palm (*Phoneix dactylifera*) grown in from Libya.

2.MATERIALS AND METHODS

The date seed used in this study was obtained from Libya. The essential oil was obtained from seed by hydro-distillation, using a Clevenger system with 150 g grinded seed and 1500 mL water. The gas chromatography–mass spectrophotometry (GC–MS) analysis of the obtained essential oil was conducted at the Kastamonu University Center Research Laboratory Application and Research Center by using a Shimadzu GCMS QP 2010 ULTRA (Bufrag et al., 2017; Gültepe 2018).

3.RESULTS AND DISCUSSION

Essential analyses of the palm seed results show that, 50 compounds were found both aroma and fatty methyl esters (FAMES) analyses. 21 of these 50 compounds at the FAMES analysis, and also 18 of 50 compounds at the aroma analysis could not be determined with data library. According to the FAMES analyses results, 10.68% of the compounds of the date seed were not identified with GCMS library. The maximum amount of compounds was methyl stearate with 48.70% (Figure 1).

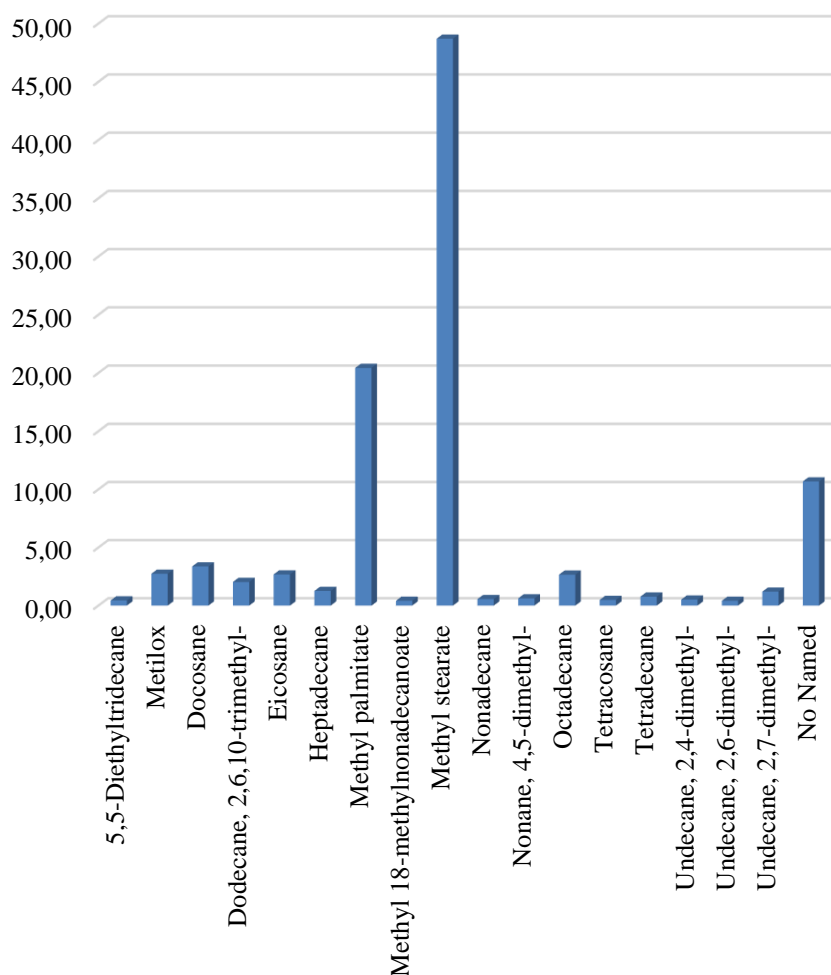


Figure 1. FAMES Analyses Results of Palm Seed

According to the aroma analyses results, 3.59% of the compounds of the date seed were not identified with GCMS library. The maximum amount of compounds was β -citronellol with 31.70% (Figure 2).

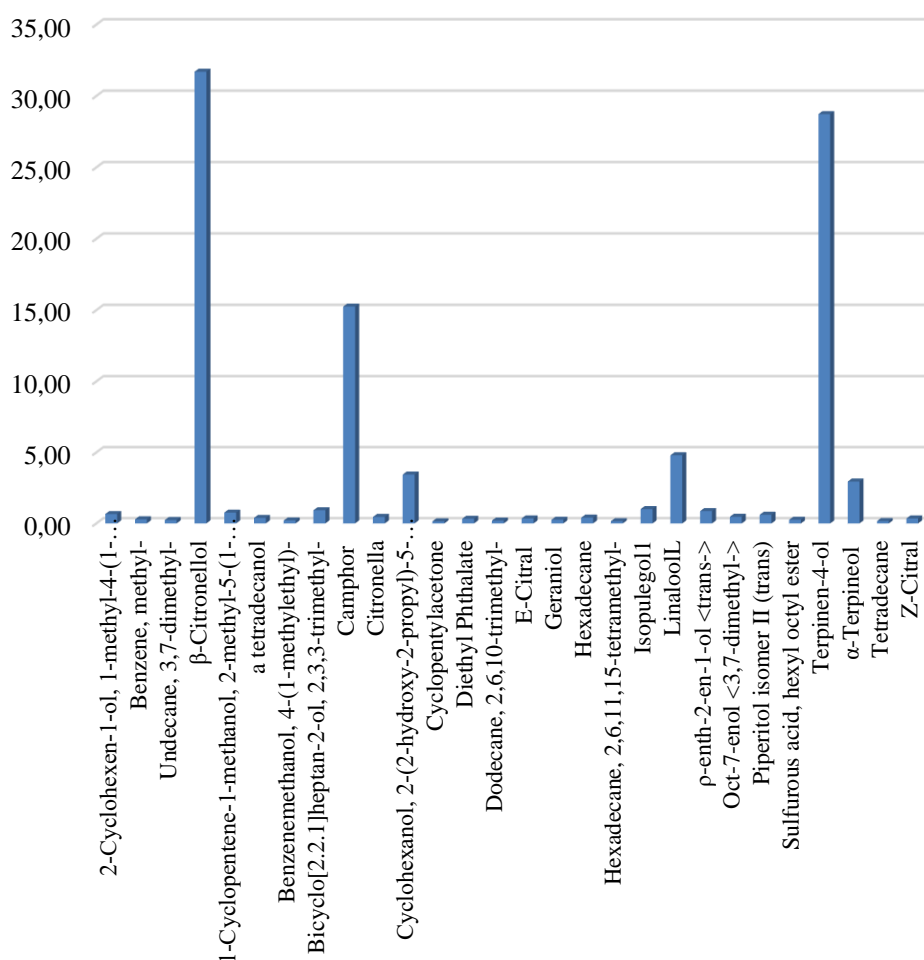


Figure 2. Aroma Analyses Results of Palm Seed

Palm seed have approximately 32% β -citronellol. β -citronellol has a lot of benefits, for these reason this compound is currently used in many areas. At the beginning of these;

- reduces the blood pressure by vascular smooth muscle leading to vasodilatation,
- as effective as an analgesic in various pain,
- insect repellents,
- used on food crops and ornamentals to attract mites, which are an important agricultural pest (Zuang et al., 2009; Brito et al., 2015; Reis et al., 2016).

This study results shows that palm seed essential oil included important chemical aromatic compound, which is using a lot of commercial business line. For this reason, palm seed essential oil is a new and inexpensive source to β -citronellol for using different commercial sectors.

The highest amount of essential oil compounds of palm seed was found methyl stearate (48.70%) in the FAMEs analysis. The highest amount of essential oil compounds of palm seed was found β -citronellol (31.70%) in the aroma analysis. According to the study results, essential oil of the palm seed can be used in both cosmetic industry and pest control.

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Determination of the Secondary Metabolite Production Potential of Marine-Derived Actinomycetes by Molecular Techniques

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Abstract: Actinomycetes are gram positive bacteria with high G + C content and are known for their capacity to produce new compounds with significant biological activity. Many actinomycetes, especially Streptomycetes, are active secondary metabolite producers. Marine ecosystems are among the richest habitats in the world and are expected to be excellent sampling points due to microbial diversity in seawater and sediments. Studies have shown that marine actinomycetes are physiologically and phylogenetically distinct from terrestrial relatives and are a rich source of new chemically versatile bioactive secondary metabolites with potential applications in antimicrobial and anticancer therapy. Surveys of natural products from marine actinomycetes have proven to be tremendous potential for sea strains as biologically active secondary metabolite producers even at early stages compared to terrestrial inbreds. Several natural products belong to the chemical family of polyketides and non-ribosomal peptides. Polypeptide synthases (PKS) and non-ribosomal peptide synthetases (NRPS) are megacentetases consisting of subunits that are involved in the biosynthesis of a large group of different microbial natural products known as polyketides and non-ribosomal peptides. The method of screening the PKS and NRPS gene region on the genome is a technique that can be used to identify bioactive secondary compounds. Marine-derived actinomycetes also have PKS and NRPS pathways for the production of secondary metabolites. As a result, it is possible to determine the secondary metabolite production capacities of marine-derived actinomycetes using molecular techniques with appropriate primers targeting the PKS and NRPS gene regions.

Keywords: Actinomycetes, NRPS, PKS, Secondary Metabolite, Screening

1. INTRODUCTION

Actinomycetes are Gram (+) filamentous bacteria with high G + C content. They are found abundance in soil. Capacities for producing secondary metabolites are much higher than for many organisms. Actinomycetes, especially Streptomycetes, are in the first place in the production of antibiotics and these properties make them commercially valuable (Waksman, 1989). Also, streptomycetes the potential to produce a multitude of bioactive secondary metabolites, including, but not limited to, antibiotics, immunosuppressants, antifungals and anti-cancer compounds (Demain & Sanchez, 2009). In fact, from the 1940s to the early 1950s, 70-80% of the newly identified natural antibiotics were isolated from Streptomycetes species in the so-called "golden age" of antibiotic exploration (Berdy, 2005).

Most of the recent isolates from the soil result in the elimination of known secondary metabolites. For this reason, studies have focused on actinomycetes and their secondary metabolites in ecosystems with different stress conditions and environmental conditions in recent years. It is stated that organisms in extreme conditions such as deserts, hot and cold water sources, caves, sea and oceans may be different. (Fenical et al., 2006; Bull & Stach, 2007).

Microbial diversity in the seas has been neglected for many years (MacLeod, 1968). The microbial diversity of marine systems that offer a combination of low nutrients, high pressures, high salt rates and many extreme conditions has not been investigated for many years. However, since the terrestrial specimens have greatly reduced the amount of new active compound and the isolation of the same materials repeatedly, marine environments have also begun to be investigated due to extreme conditions and different conditions. Studies have found that marine environments have as rich a microbial variety as amazon forests as contemplated (Haefner, 2003). When it is thought that ¾ of the world is covered with seas, a treasure with high biological diversity is still waiting to be discovered.

Secondary Metabolite Production Capacity of Marine-Derived Actinomycetes

Marine-derived actinomycetes, like terrestrial relatives, produce much in the production of secondary metabolites. These organisms can produce the same or similar active compounds in the literature, while others can produce completely different molecules (Ward & Goodfellow, 2004).

Secondary metabolite screening are traditionally carried out on fermentation liquids of cultural organisms. But as molecular techniques and information on genomic information increase, genetic material can be used for screening. For this reason, gene maps of organisms are being sought out. In this context, *Streptomyces coelicolor* and *Streptomyces avermitilis* the first all-genome sequencing antibiotic producing organisms (Bentley et al., 2002; Ikeda et al., 2003). Both organisms have a very high secondary metabolite production capacity. However, most of these metabolites are not produced under standard cultivation conditions. The environmental conditions within the organism cause different

metabolites to be produced. That is why genomic capacity is not expressed in all conditions. PKS-1 (polyketide synthase) is one of the important targets widely used in genome-based active metabolite screening. The ketosynthase (KS) domain in the PKS-1 gene is important in phylogenetic diagnosis. A prediction can be made about the structure of the secondary metabolite produced in the complex biosynthetic pathways through the KS sequences (Gontang et al., 2010).

Studies on the Production of New Secondary Metabolites by Molecular Methods

PKS and NRPS scans can be used as an adjunctive strategy in the discovery of bacterial natural product variety (Pathom-Aree et al., 2006). Because the diversity of natural products reflects bacterial genetic diversity. PCR screening of these genes is not functional. However, pre-screening with PCR primers targeting genes with potential for encoding bioactive molecule biosynthesis is an effective approach to screening new and useful secondary metabolites (Ketela et al., 2002). Libraries created from recombinant environmental samples offer the opportunity to use microbial diversity for drug discovery from natural sources (Liu et al., 2003).

With the aid of Ecopia BioSciences Program, high-throughput genomic screening can detect secondary cluster of metabolites genes. The predicted structure of the material is then determined might using the PKS and NRPS sequences. In further stages, fermentation can be performed in various media and it can be determined whether or not substance is produced (Zazopoulos et al., 2003). In this method, new antibiotics were produced from *Streptomyces aizunensis* and new antifungal *Amycolatopsis orientalis* (McAlpine, 2005; Banskota et al., 2006). The gene may be cloned into the cosmid and BAC vectors and expressed in fast growing, easily manipulated heterologous expression systems ((Baltz et al., 2006; Berner et al., 2006)

2.RESULTS AND DISCUSSION

Whole genome analysis completed organisms can be screened for secondary metabolites Donadio (2007) conducted a screening of potential secondary metabolites in the presence of PKS and NRPS genes of bacteria with genomes 1-9 MB. In this study conducted in 2007, it was determined that PKS and NRPS genes are rarely found or rarely found in organisms with a <3 Mb genome (Donadio et al., 2007).

There is a linear link between genome size and coding capacity. As the size of the genome increases, the coding capacity of PKS and NRPS genes is also increasing, which is 1.9% for actinomycetes. Low levels of PKS and NRPS coding percentages of other organisms cause re-concentration of actinomycetes (Liyny et al., 2007; Udway et al., 2007).

Secondary metabolite diversity is generated by horizontal gene transfer, point mutations, gene duplications, gene deletions and substitutions, homologous recombination. In addition, functional gene clusters can be diversified by intermingling or intermingling with glycosyltransferase and other gene clusters (Baltz et al., 2008). The PKS and NRPS gene clusters are suitable for this process. For example, the avermectin biosynthetic pathway was rediscovered by gene duplication and alterations of two different PKS domains present in *Streptomyces avermitilis* (Jenke and Kodama, 2006).

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Terahertz Intersubband Photodetectors based on GaN/AlGaIn Materials

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Abstract: We report the development of terahertz quantum well photodetectors based on intersubband transitions in GaN/AlGaIn heterostructures, covering the frequency range that is fundamentally inaccessible to existing Arsenide-based devices due to Reststrahlen absorption. In this work, two different approaches have been implemented to reduce the deleterious effects on the intrinsic polarization fields of nitride-based materials. The first approach is to employ a suitable double step quantum wells on a c-plane GaN materials, which is more convenient from the materials perspective. The second approach is to grow GaN/AlGaIn heterostructures on a semi-polar GaN substrate as a host material to reduce the internal polarization fields effectively, which is more convenient from the design perspective. We have experimentally confirmed that based on these two approaches the total internal polarization fields that complicate the device design and growth, can be reduced or eliminated effectively in nitride-based devices. Electrical characteristics of the associated devices indicate a significant decrease in dark current with decreasing temperature especially the device grown on semi-polar substrate. The symmetric behavior in current-voltage characteristics have suggested that the quantum wells are nearly in a rectangular shape which confirms the absence of internal electrical fields. The photocurrent spectra of the two devices overlap with the reststrahlen band of GaAs and also the device grown on semi-polar substrate indicates narrower bandwidth than the device grown on c-plane (polar plane), which is due to reduced scattering at the interfacial layers. Promising results are obtained with both approaches, which could be extended to other device applications as a way to utilize the intrinsic advantages of nitride semiconductors for THz intersubband optoelectronics. The same materials platform is also promising for the development of THz quantum cascade emitter with possibility of room temperature operation.

1. INTRODUCTION

Recently, THz spectral region has been attracting many attentions due to potential applications in biomedical sensing, security screening, quality control, and spectroscopic study of drug detection. III-Nitride materials including GaN, AlN, InN, and their alloys enable high performance light emitting diodes and laser diodes for solid-state lighting and display applications. Due to their excellent material properties such as large band offset and LO-phonon energy (90 meV), III-Nitride materials are great interest for the development of intersubband (ISB) devices compared to conventional GaAs-based materials.^{1,2} The LO-phonon frequencies of III-nitride is over 22 THz in GaN whereas 9 THz in GaAs. As a result, III-nitride devices could operate at THz frequencies within the forbidden reststrahlen band of arsenide semiconductors², which is a lack in the full spectral coverage of optoelectronics.³ In addition, GaN materials could potentially be utilized for the development of quantum cascade lasers at room-temperature operation,^{4,5} since GaN is not intrinsically limited to cryogenic temperatures due to thermally activated LO-phonon emission unlike current devices. There have been couple studies on THz ISB transitions in GaN with different combinations of GaN/AlGaIn QW structures.⁶⁻⁹ First THz ISB photodetection¹⁰ and electroluminescence¹¹ have demonstrated based on GaN/AlGaIn QWs.

Besides these promising advancements, one needs to consider the potential materials- and design-challenges to fully utilize the GaN THz ISB devices. Material challenges are mainly due to large density of threading dislocation that is intrinsically available in GaN substrate. These dislocations create deleterious effect in devices operation that vertical transport is the main operation mechanism. Thankfully, commercially available high-quality free-standing GaN substrate helps to eliminate this problem. From the design perspective, the existence of strong internal electric fields that are due to spontaneous and piezoelectric polarizations in QWs grown along the polar crystallographic c axis precludes the flat potential energy profile in QWs. As a result of these fields conduction- and valence-band lineup are formed in a trapezoidal shape that tends to blue-shift the ISB transition energies, and therefore can significantly complicate the development of long wavelength ISB devices. In many QWs designed for THz-range ISB transitions, the first excited states fall within the triangular portion of the well, and therefore the carrier extraction from these subbands into that continuum where the carriers contribute to photocurrent (as needed for ISB photodetection) becomes extremely difficult. In addition, the design of the quantum cascade laser operation is problematic in the same level due to interwell tunneling transport at longer wavelength.

Recently, step QW structures,^{6,8} where two or more layers of different (Al)GaN compositions are used in each well to create a more rectangular potential energy profile to overcome the problems that just addressed. Sudradjat et al.¹³ has reported a QW infrared photodetector (QWIP) operating near 13 THz with this approach, where two different AlGaIn

layers are also used in each barrier to allow for an optimal bound-to-quasi-bound QWIP design (with the first-excited subbands nearly resonant to the top of the barriers). However, the problem with this design is the interface roughness scattering, which all bound states have to face at each QW hetero-interfaces. This scattering mechanism has been shown to be particularly strong in III-nitride QWs,¹⁴ leading to extremely fast ISB decay lifetimes and proportionally large spectral broadening. For example, in the far-infrared QWIP demonstration of ref. 13, a rather broad responsivity spectrum with full width at half maximum (FWHM) of over 9 THz was measured. Another way to overcome the same design challenge is the use of QWs grown along semi-polar (or nonpolar) crystallographic directions, where the undesirable internal electric fields are significantly reduced (or completely eliminated). Recently, the growth of III-nitride semiconductors along the semi- and non-polar directions for the measurement of THz ISB absorption^{7,9} have been reported as well as investigation of mid-infrared ISB transitions.¹⁵⁻¹⁸

2.RESULTS AND DISCUSSION

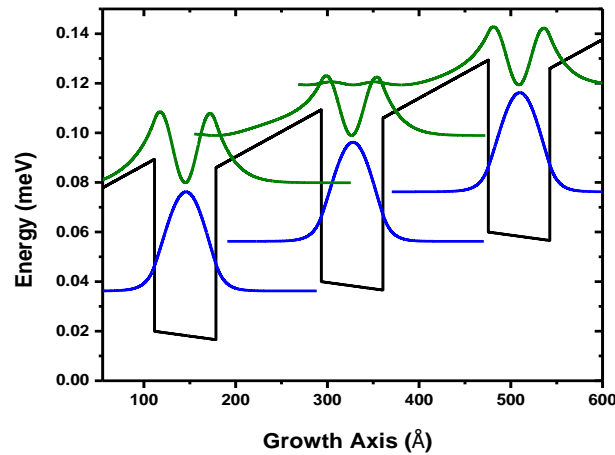


Fig. 1: Conduction-band lineup of the semi-polar GaN/AlGaIn QWIP developed in this work, under an externally applied voltage bias of about 20 mV/period. The squared envelope functions of the bound-state subbands of each well are also shown, referenced to their respective energy levels.

In the present work, we demonstrate a III-nitride THz QWIP grown on a semi-polar ($20\bar{2}1$) GaN substrate. Compared to nonpolar surfaces, this substrate can be expected to feature smaller anisotropy in the adatom kinetics,¹⁹ which should simplify the epitaxial growth. The active material of this device consists of 30 GaN/ $\text{Al}_{0.06}\text{Ga}_{0.94}\text{N}$ QWs capped with a 200-nm-thick $\text{Al}_{0.04}\text{Ga}_{0.96}\text{N}$ contact layer. The well and barrier thicknesses are obtained from X-ray diffraction data analysis as 67 and 115 Å, respectively. The cap and well layers are *n*-doped with Si to a nominal level of $1 \times 10^{18} \text{ cm}^{-3}$. The conduction-band diagram of the QWIP (as shown in Figure 1) active material under bias is computed with a Schrodinger-equation solver that includes spontaneous and piezoelectric polarization effects in semi-polar QWs following ref. 20. The internal electric fields produced by the interface polarization charges are found to be approximately 16 and 9 kV/cm in the wells and barriers, respectively, i.e., an order of magnitude smaller than in identical QWs grown along the *c* direction. In Fig.1 the calculated ISB transition energy between ground- and 1st excited state is obtained as 42.8 meV, corresponding to a frequency of 10.3 THz and a wavelength of 29.0 μm. All energy states are well confined in the rectangular QWs for maintaining a large oscillator strength of the absorbing transitions, while at the same time 1st excited state being in resonance with top of the barrier for efficient photo-electron escape out of the QWs.

Thirty repetitions of this QW structure (beginning and ending with the 50-ML-thick $\text{Al}_{0.06}\text{Ga}_{0.94}\text{N}$ barrier layer) were grown on a single side polished $5 \times 8 \text{ mm}^2$ ($20\bar{2}1$) GaN substrate, using a Veeco GEN-II system with a UNI-Bulb RF plasma source for active nitrogen. Due to its non-standard size the wafer was soldered to a 2-inch Si carrier wafer with In-Ga solder and held in place with a molybdenum spring plate. After thoroughly degassing at over 500 °C in a buffer vacuum chamber, the substrate is cleaned *in situ* by exposing it to a Ga beam equivalent pressure of 1.6×10^{-6} Torr for 1 hour while continuously ramping the substrate temperature up and down between 600 °C and 670 °C. These values were chosen such that at the low temperature Ga was accumulating on the substrate and the reflection high-energy electron diffraction (RHEED) pattern was significantly dimmed or gone, while at the high temperature the Ga evaporates from the substrate fast enough for the RHEED to fully brighten again before the next cycle. It appears that this cleaning procedure removes physisorbed or weakly bonded oxygen and other impurities through the formation of volatile Ga compounds. The plasma conditions were held constant throughout the growth, with a power of 300 W and a nitrogen flow rate of 1.2

sccm, yielding a 5×10^{-7} Torr beam equivalent pressure of active nitrogen and an average AlGaIn growth rate of around 275 nm/hour. Due to the reactivity of Al, the Al/N flux ratio alone is used to control the alloy composition when growing AlGaIn under Ga rich conditions.²¹

After sample growth, $400 \times 450 \mu\text{m}^2$ mesa-structure devices were fabricated using standard photolithography and reactive ion etching with Chlorine-plasma assisted where AZ-5214 photoresist used as an etching mask. Metal contacts consisting of a Ti/Al/Ti/Au multilayer film are then deposited on top of and around each mesa, with the top contacts patterned in the shape of one-dimensional gratings with 15- μm period and 50-% duty cycle. Since only the electric field component perpendicular to the QW layers (i.e., TM-polarized light) interacts with ISBTs²², the device geometry (one-dimensional grating in this case) must ensure that this condition is satisfied. Highly n-doped GaN substrate is being opaque at THz wavelengths, so that we could not perform polarization-resolved transmission and photocurrent measurements with angled backside excitation. Finally, another metallization step is performed to create Ni/Au bonding pads, and the samples are annealed in a forming gas environment at 500 °C for 2 minutes in order to passivate possible leakage paths on the mesa sidewalls. For the temperature-dependent measurements described below, the devices are mounted on the cold finger of a continuous-flow liquid-helium cryostat.

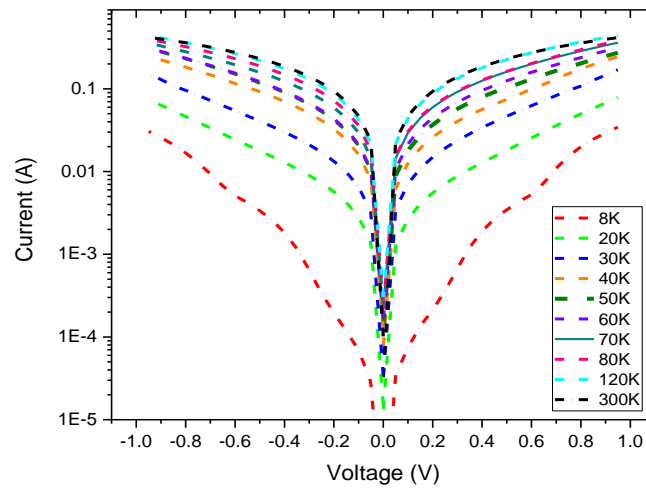


Fig. 2: Temperature-dependent dark I-V characteristics. The current at each voltage increases with increasing temperature.

The dark current-voltage (I-V) characteristics of the device at different heat-sink temperatures are shown in Figure 2. The shapes of these traces are qualitatively consistent with standard models of carrier transport in QWIPs,²² including the observation of a significant decrease in dark current with decreasing temperature, which indicates a large contribution from thermionic emission out of the QWs. The possible reason to have large measured dark current is could be the presence of electrical leakage, which may be due to defects in the epitaxial layers. Also, the doping density used in the QWs is relatively high for such long-wavelength QWIPs, which further increases the dark current. The symmetry in the I-V traces with respect to bias polarity confirms that rectangular QW profile and the absence of substantial band bending due to electric fields in these semi-polar III-nitride heterostructures.

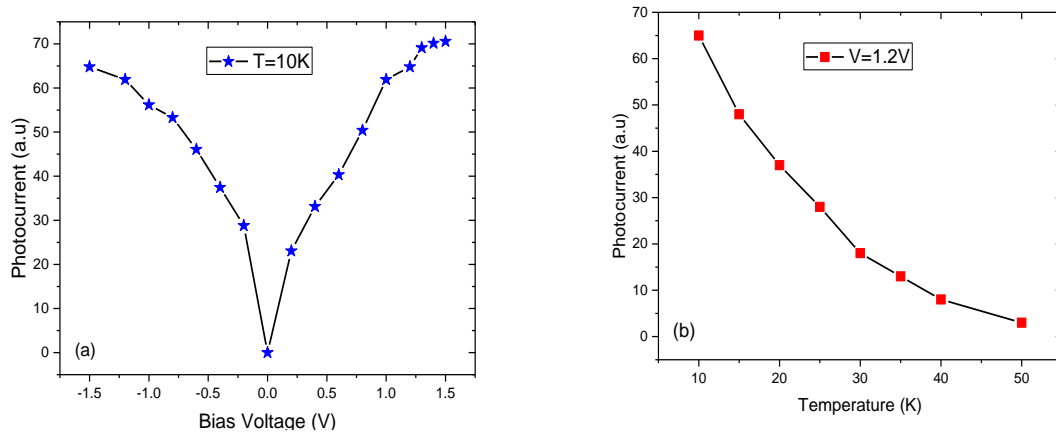


Fig. 3: (a) Photocurrent signal at a fixed temperature of 10 K measured as a function of applied voltage. (b) Photocurrent signal at a fixed bias voltage of 1.2 V measured as a function of heat-sink temperature.

The photocurrent spectra of the device were measured using Bruker Vertex 70V Fourier transform infrared spectrometer (FTIR) equipped with a globar source and Mylar beamsplitter, via step-scan phase modulation and lock-in detection (more details about the measurement setup can be found in ref. 13). In Figs. 3(a) and 3(b) the bias voltage and temperature dependence of the total photocurrent signal are presented, respectively. Fig. 3(a) shows that the behavior of photocurrent with respect to bias polarity is expected from bound-to-quasi-bound nature of the QWIPs under study. As voltage is increased in either forward or reverse direction, the height of the barrier is effectively decreased, and therefore the QW first-excited subbands (i.e., the quasi-bound states) become more strongly coupled to the adjacent continuum of unbound states. As a result the escape probability of the photoexcited carriers out of the wells is increased while at the same time, confinement of the upper states is reduced due to decrease in oscillator strength of the absorbing transitions. As a result, the photocurrent initially increases and eventually saturates with increasing bias voltage. As shown in Fig. 3(b), the signal can be resolved up to a maximum temperature of about 50 K, which is reasonable for THz-range QWIPs.²³⁻²⁶

The photocurrent spectrum of the same device at 10 K under an applied voltage of 1.2 V is shown in Fig. 4. The peak photon energy spectrum of the same device is centered at 41.1 meV (i.e., 10.1-THz frequency and 29.7- μ m wavelength), which is in excellent agreement with the calculated ISB transition energy of 42.8 meV shown in Fig.1. From Fig.4 it is clear that the device under study fully covers the reststrahlen band of GaAs (~33 to 37 meV), which is inaccessible so far. The photocurrent responsivity of the same device was compared with a calibrated pyroelectric detector and the peak responsivity of the device of Fig. 4 is found to be about 10 mA/W, which is comparable to the values reported previously based on GaAs/AlGaAs at low end of THz range.²⁶ A similar value (7 mA/W) was obtained with the *c*-plane III-nitride QWIP of ref. 13, based on the aforementioned double-step QW design. Also, the responsivity spectrum of Fig. 4 has a much more narrow linewidth of 16.1 meV FWHM (as opposed to 38.3 meV in ref. 13), which indicates reduced scattering from interface roughness and other defects and/or improved uniformity of the active QWs.

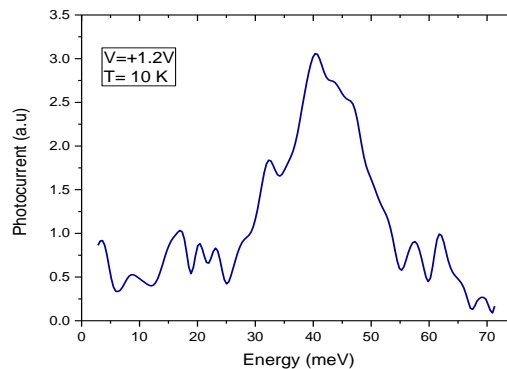


Fig. 4: Photocurrent spectrum measured at 10 K under an applied voltage of 1.2 V.

The results we presented in this work indicate that III-nitride THz ISB devices can be developed on semi-polar (20 $\bar{2}$ 1) GaN substrates, where the polarization-induced internal electric fields are strongly reduced compared to *c*-plane QWs. The combination of required structural quality of III-nitride QWs with further optimization of the growth process and

active material design, high performance QWIPs can be developed with a full operation at entire THz range, which is inaccessible by As-based devices. The same materials platform is also promising for the development of THz quantum cascade emitter with possibility of room temperature operation, since the absence of internal electric fields make the device design simple.

Acknowledgments

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Myxozoan Parasites of Some Teleost Fishes in the Black Sea

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Abstract: Myxozoan parasites of both freshwater and marine fishes include about 2400 identified nominal species so far. Members of the genera *Ceratomyxa* and *Myxobolus* are generally coelozoic in marine fishes and rarely histozoic in freshwater fishes while members of *Fabespora* and *Sinuolinea* are typically coelozoic in marine fishes. On the other hand, parasites belonging to the genus *Myxidium* are coelozoic, rarely histozoic parasites in marine and freshwater fishes. In the present study, a parasitological survey on myxosporean fauna of annular seabream *Diplodus annularis* (n:55), black scorpionfish *Scorpaena porcus* (n:103), common sole *Solea solea* (n:55) and European flounder *Platichthys flesus* (n:2) was conducted by conventional methods on fish samples collected from Sinop coasts of Black Sea. Gills, fins, skin, urinary bladder, kidney, gall bladder, intestine and gonads were examined using a phase contrast Olympus microscope (BX53) equipped with a digital camera (DP50) and DIC attachment. A total of six myxosporean species belonging to 5 genera have been identified from investigated fish species and they were *Ceratomyxa elegans* in the gall bladder of *S. porcus*; *Ceratomyxa* sp. in the gall bladder and *Sinuolinea rebae* in the muscle of *S. solea*; *Fabespora nana* and *Myxidium gadi* in the gall bladder of *P. flesus* and *Myxobolus muelleri* in the kidney of *D. annularis*. The prevalence of infection and the intensity of each parasite species were also determined, their morphometric characteristics were measured and morphological peculiarities were illustrated in detail. This research study makes more contributions to our current and limited knowledge on the myxozoan parasites of fish in Turkish coastal area of the Black Sea by recording *F. nana* on its new host species as well as *S. rebae* in the muscle of *S. solea* for the first time.

Keywords: Myxozoa, Myxospora, Fish, Sinop, Black Sea

1. INTRODUCTION

Myxozoan parasites of both freshwater and marine fishes include about 2400 identified nominal species so far Özer et al. 2015a; Abdel-Baki et al. 2018). Members of the genera *Ceratomyxa* and *Myxobolus* are generally coelozoic in marine fishes and rarely histozoic in freshwater fishes while members of *Fabespora* and *Sinuolinea* are typically coelozoic in marine fishes (Eiras et al. 2005, 2014, 2018; Lom and Dykova, 2006; Özer et al. 2015, 2017). On the other hand, parasites belonging to the genus *Myxidium* are coelozoic, rarely histozoic parasites in marine and freshwater fishes (Eiras et al. 2011; Özer and Yurakhno, 2013; Özer et al. 2017). The genus *Ceratomyxa* Thélohan, 1892 includes 149 species, which have two subspherical or spherical polar capsules and their trophozoites are mono- to polysporic, usually diasporic (Lom and Dykova, 1992). The genus *Sinuolinea* Davis, 1917 includes 24 species which are spherical or subspherical spores with two polar capsules and their plasmodia mono- to polysporic (Özer et al. 2015). Finally, the genus *Fabespora* Naidenova & Zaika, 1969 includes only 2 species with disporous trophozoites (Lom and Dykova, 2006). Thus far, 20 species, including 13 *Myxobolus* species, 4 *Ceratomyxa* species, 3 *Myxidium* species have been reported in Turkish waters and more studies are needed to reveal current myxosporean fauna of fishes in freshwater, brackishwater and marine environment in Turkey.

This study aimed to investigate myxosporean fauna of some Black Sea fishes and to provide more details on their infections as well as to make contribution to our current knowledge about Turkish parasite fauna.

2. MATERIALS AND METHODS

In the present study, a parasitological survey on myxosporean fauna of annular seabream *Diplodus annularis* (n:55), black scorpionfish *Scorpaena porcus* (n:103), common sole *Solea solea* (n:55) and European flounder *Platichthys flesus* (n:2) collected from Sinop coasts of Black Sea was conducted. Gills, fins, skin, urinary bladder, kidney, gall bladder, intestine and gonads were examined using a phase contrast Olympus microscope (BX53) equipped with a digital camera (DP50) and DIC attachment. Measurements of parasite spores were based on 20 fresh individuals and indicated as µm. Infection prevalence (%) of each parasite species was determined as the number of infected host among all investigated individuals. The intensity of infection of all species were semiquantitatively evaluated following a scale from 1+ (1 – 9 parasite individual); 2+ (10 – 19 parasite individual); 3+ (20 – 29 parasite individual); 4+ (30 – 39 parasite individual); 5+ (40 – 49 parasite individual); 6+ (>50 parasite individual).

3.RESULTS AND DISCUSSION

A total of six myxosporean species belonging to 5 genera have been identified from investigated fish species and they were *Ceratomyxa elegans* (Figure 1A) in the gall bladder of *Scorpaena porcus*; *Sinuolinea rebae* (Figure 1B) in the muscle and *Ceratomyxa* sp. (Figure 1C) in the gall bladder of *Solea solea*; *Fabespora nana* (Figure 1D) and *Myxidium gadi* (Figure 1E) in the gall bladder of *Platichthys flesus* and *Myxobolus muelleri* (Figure 1F) in the kidney of *Diplodus annularis*.



Figure 1. **A:** *Ceratomyxa elegans* from gall bladder of *Scorpaena porcus*, **B:** *Sinuolinea rebae* urinary bladder in the muscle of *Solea solea*, **C:** *Ceratomyxa* sp. in the gall bladder of *Solea solea*, **D:** *Fabespora nana* in the gall bladder of *Platichthys flesus*, **E:** *Myxidium gadi* in the gall bladder of *Platichthys flesus*, **F:** *Myxobolus muelleri* in the kidney of *Diplodus annularis*

Their morphometric characteristics were measured and provided in Table 1. The prevalence of infection and the intensity of each parasite species were also determined (Table 2).

Table 1. Measurements of identified parasite species (µm)

Parasite	Length of Spore	Width of Spore	Length of Polar Capsules	Width of Polar Capsules
<i>Ceratomyxa elegans</i>	6.9	29.0	2.4	2.2
<i>Sinuolinea rebae</i>	12.0	10.0	3.3	2.6
<i>Fabespora nana</i>	8.6	4.0	1.0	1.0
<i>Myxidium gadi</i>	13.9	5.7	5.1	2.7
<i>Myxobolus muelleri</i>	8.4	5.5	3.4	1.6

Table 2. The prevalence of infection and the intensity of each parasite species

Fish species	Parasite species	Prevalence (%)	Intensity ranges
<i>Scorpaena porcus</i> (n:103)	<i>Ceratomyxa elegans</i>	1.94	6+ (>50 parasite individual)
<i>Solea solea</i> (n:55)	<i>Ceratomyxa</i> sp.	5.45	2+ (10 – 19 parasite individual)
	<i>Sinuolinea rebae</i>	5.45	2+ (10 – 19 parasite individual)
<i>Platichthys flesus</i> (n:2)	<i>Fabespora nana</i>	50.00	1+ (1 – 9 parasite individual)
	<i>Myxidium gadi</i>	50.00	5+ (40 – 49 parasite individual)
<i>Diplodus annularis</i> (n:55)	<i>Myxobolus muelleri</i>	14.54	2+ (10 – 19 parasite individual)

Myxosporean taxonomy is primarily based on morphology and spore structure (Özer et al. 2016) and we therefore classified our myxosporean parasite species in their respective genera *Ceratomyxa*, *Sinuolinea*, *Fabespora*, *Myxidium* and *Myxobolus* using specific morphological criteria. The measurements of all myxosporean species identified in our material from their host fishes basically corresponded well in both spore and polar capsule dimensions to those reported from fish species elsewhere. Numbers of data for infection prevalence and intensity values of each parasite species found in the

present study are very rare in the literature, however, our data are similar when compared to previous reports (Yurakhno, 2013, Özer et al. 2015b).

This research study makes more contributions to our current and limited knowledge on the myxozoan parasites of fish in Turkish coastal area of the Black Sea by recording *F. nana* on its new host species as well as *S. rebae* in the muscle of *S. solea* for the first time. This study clearly reveals that more investigations on Black Sea fish species will yield both new myxosporean parasite and host records in Turkish coastal areas.

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Current Status of Myxosporean (Cnidaria: Myxozoa) Parasites of Marine and Freshwater Fishes in Turkey

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Abstract: Myxozoan parasites of fishes have a cosmopolitan distribution worldwide and myxosporean infections occur in a wide range of both marine and freshwater fish species. A total of about 2400 nominal species have been identified from many fish species inhabiting marine, brackish and freshwater environments. Myxosporea represent a major group of fish parasites and their impact on wild and cultured fish is significant and the majority of species are located in skeletal muscle, but also other target tissues in the gills, brain, heart, kidney, spleen, ovary, gall bladder, urinary bladder, oesophagus, intestine, mesentery, and smooth muscle. Studies on myxozoan fish parasites are scarce in Turkey and, in recent years, a significant increase has occurred in the number of myxosporean parasite species infecting especially marine fish in Turkish coastal areas. This study investigated aimed to provide insights on the current status of Turkish myxosporean fauna and make comparisons on how host and tissue specific occurrences of 36 myxosporean parasite species which have been identified from 25 fish species from mostly marine environment of Turkey. Tissue specificity is a very well-known issue in myxosporean parasites and the occurrences of identified species in Turkey indicated that several parasite species belonging to some families preferred either kidney, urinary bladder, gall bladder, muscle, gills or lower jaw of their hosts. When their occurrences either in marine and freshwater environments considered, recent studies in the Black Sea fishes dominated the number of identified parasites in Turkey.

Keywords: Myxozoa, Kudoa, Fauna, Fish, Turkey

1. INTRODUCTION

Myxozoan parasites of fishes have a cosmopolitan distribution worldwide and myxosporean infections occur in a wide range of both marine and freshwater fish species (Eiras et al. 2010; Gürkanlı et al. 2018). A total of about 2400 nominal species have been identified thus far from many marine, brackish and freshwater fish species (Özer et al. 2015a). Myxozoa also represent a major group of fish parasites and their impact on wild and cultured fish is significant (Kent et al. 2001). Heavy infections with some *Kudoa* species have been reported to be the cause of post-harvest soft flesh in fish meat creating serious economic losses for the fisheries industry (Moran et al. 1999; Lom & Dyková 2006; Pascual et al. 2012). In some recent studies, one *Kudoa* species, namely *K. septempunctata*, has been reported to be the causative agent of novel food poisoning outbreaks by consumption of infected raw fish in Japan and Korea (Kawai et al. 2012, Lee 2017). Moreover, some species, such as *Enteromyxum leii*, are also known to be highly pathogenic in mariculture (Özer et al. 2014). Host and tissue specificity is a well-known situation for the members of some myxozoan genera (Molnar and Eszterbauer. 2015). While, some species may only infect only one host, others may infect many host species belonging to different taxonomic groups. Depending on the parasite genus, some species known to be histozoic infecting organs such as gills, skin, intestine, on the other hand, some species are coelozoic in organs such as kidney, urinary and gall bladders of host fish. Of the reported more than 2400 myxosporean species, about 900 species belong to the most specious genus *Myxobolus*, followed by *Myxidium* with 232 species, *Ceratomyxa* with 232 species, *Kudoa* with about 100 species, *Sphaeromyxa* with 49 species, *Sinuolinea* with 24 species, *Ortholinea* with 22 species which have been reported from different tissues and organs of numerous fish species in the world (Eiras et al. 2011, 2014a,b, 2018; Özer et al. 2015b; Whipps and Zhao, 2015).

In Turkey, however, a total of 36 myxosporean species, including above mentioned genera have been identified from different tissues and organs of 25 marine and freshwater fish species. Here, we aimed to provide current data on host and tissue specificities of myxosporean parasites identified in fishes from different localities in Turkey.

2. MATERIALS AND METHODS

This study aimed to provide insights on the current status of Turkish myxosporean fauna and to make comparisons on how host and tissue specific occurred recorded. Thus, the current literature on this significant parasite group were evaluated for the details of host and tissue specificity of previously reported myxosporean species in Turkish waters.

3. RESULTS AND DISCUSSION

Thus far, a total of 36 myxosporean parasite species has been reported from 25 fish species mostly from marine environment of Turkey (Figure 1). When the host specificity of identified parasites considered, while some members of the genus *Myxobolus*, *Myxidium* and *Sphaeromyxa* infected several fish species, the rest of identified parasites showed

strict host specificity. Members of the genus *Myxobolus* infected mainly gills, kidney tubules and rarely urinary bladder, gall bladder and lower jaw; members of the genus *Myxidium*, *Ceratomyxa*, *Zschokkella* and *Sphaeramyxa* infected only gall bladder, members of the genus *Ortholinea* infected mainly urinary bladder and rarely kidney tubules, members of the genus *Kudoa* infected mainly musculature and rarely kidney tubules. This study is the first to provide a comprehensive and detailed data on the current status of the myxosporean parasite fauna of fishes in Turkey. When the occurrences of myxozoan parasites either in marine and freshwater environments considered, recent studies in the Black Sea fishes dominated the number of identified parasites in Turkey (see Table 1). Most myxosporean parasites reported thus far are host, tissue and organ species, and our results showed that they are mainly in accordance with the previous reports elsewhere with some minor differences. Considering the vast amount of marine and freshwater fish species and the culture potential of some species Turkey, it is very significant to conduct more studies on cultured fish species as well as wild ones to reveal the actual fauna of this significant group of fish parasites. Recent studies yielding new myxosporean species identifications in fish species in our country also support the need for further studies. Further studies are definitely needed to reveal actual myxosporean fauna in freshwater and marine fishes in Turkey, and this is also important to protect our aquaculture activities from these significant pathogenic parasites.



Figure 1. Distributional map of myxozoan parasites in Turkey. *Numbers on different regions of Turkey indicate the number of myxozoan species identified at each locality.

Table 1. Myxozoan parasite species, their hosts and microhabitats in different localities in Turkey

Parasite Species	Host	Microhabitat	Locality	Reference
Myxobolidae Thélohan, 1892				
<i>Myxobolus exiguus</i> Thelohan, 1895	<i>Mugil cephalus</i>	-	Aegean Sea	Altunel (1983)
<i>Myxobolus muelleri</i> Bütschli, 1882	<i>Mugil cephalus</i>	Gills	Samsun, Black Sea	Umur et al (2010)
"	<i>Diplodus annularis</i>	Kidney	Sinop, Black Sea	Özer et al. (2015b)
"	<i>Diplodus annularis</i>	Kidney	Sinop, Black Sea	Özkan (2015)
<i>Myxobolus episquamalis</i> Egusa, Maeno & Sorimachi, 1990	<i>Mugil cephalus</i>	Scales	Çamlık Lagoon, Mediterranean Sea	Özak et al. (2012)
<i>Myxobolus ichkeulensis</i> Bahri & Marques, 1996	<i>Mugil cephalus</i>	Gills	Çamlık Lagoon, Mediterranean Sea	Özak et al. (2012)
<i>Myxobolus anatolicus</i> Pekmezci, Yardımcı, Yılmaz & Polat 2014	<i>Capoeta tinca</i>	Gills	Samsun, Black Sea	Pekmezci et al. (2014)
<i>Myxobolus asymmetricus</i> (Parisi, 1912) Landsberg and Lom, 1991	<i>Parablennius tentacularis</i> ,	Kidney	Sinop, Black Sea	Özer et al. (2015a)
<i>Myxobolus asymmetricus</i> (Parisi, 1912) Landsberg and Lom, 1991	<i>Parablennius tentacularis</i> ,	Kidney	Sinop, Black Sea	Özkan (2015)
"	<i>Parablennius sanguinolentus</i>	Kidney	Sinop, Black Sea	Özer et al. (2015a)
"	<i>Parablennius sanguinolentus</i>	Kidney	Sinop, Black Sea	Özkan (2015)
<i>Myxobolus parvus</i> Shulman, 1962	<i>Liza saliens</i>	Gills, gall bladder, kidney tubules, lower jaw	Sinop, Black Sea	Özer et al. (2016b)
"	<i>Mullus barbatus</i>	Kidney tubules	Sinop, Black Sea	Özer et al. (2016b)
<i>Myxobolus rotundus</i> Nemeček, 1911	<i>Symphodus cinereus</i>	Kidney	Sinop, Black Sea	Özer et al. (2015b)
<i>Myxobolus</i> sp1	<i>Neogobius melanostomus</i> ,	Kidney	Sinop, Black Sea	Özer et al. (2015b)
	<i>Parablennius tentacularis</i>			Özkan (2015)
<i>Myxobolus</i> sp2	<i>Gobius paganellus</i>	Kidney	Sinop, Black Sea	Özer et al. (2015b)
<i>Myxobolus</i> sp3	<i>Gobius niger</i>	Kidney	Sinop, Black Sea	Özer et al. (2015b)
<i>Myxobolus</i> sp4	<i>Liza saliens</i>	Urinary bladder	Sinop, Black Sea	Özer et al. (2015b)
<i>Henneguya sinova</i> Özer, Özkan, Gürkanlı, Yurakhno & Çiftçi, 2016	<i>Parablennius tentacularis</i>	Gills	Sinop, Black Sea	Özer et al. (2016a)
Myxidiidae Thélohan, 1892				
<i>Myxidium</i> sp.	<i>Esox lucius</i>	-	Central Anatolia	Burgu et al. (1988)
<i>Myxobolatus gasterostei</i> Davis, 1944	<i>Gasterosteus aculeatus</i>	Kidney	Sinop, Black Sea	Özer (2003)
<i>Sigmomyxa sphaerica</i> (Thélohan, 1895)	<i>Belone belone</i>	Gall bladder	Sinop, Black Sea	Özer and Yurakhno (2013)
<i>Enteromyxum leei</i> (Diamant, Lom et Dykova, 1994)	<i>Chromis chromis</i>	Gall bladder	Sinop, Black Sea	Özer et al. (2014)
<i>Myxidium parvum</i> (Yurakhno, 1991)	<i>Parablennius tentacularis</i> ,	Gall bladder	Sinop, Black Sea	Özer et al. (2015a)
"	<i>Salarias pavo</i>	Gall bladder	Sinop, Black Sea	Özer et al. (2015a)
<i>Myxidium gadi</i> Georgevitch, 1916	<i>Merlangius merlangus</i>	Gall bladder	Sinop, Black Sea	Özer et al. (2017a)
<i>Zschokkella iskovi</i>	<i>Gaidropsarus mediterraneus</i>	Gall bladder	Sinop, Black Sea	Okkay et al. (2017)
<i>Sphaerospora</i> sp.	<i>Cyprinus carpio</i>	-	Central Anatolia	Burgu et al. (1988)



<i>Sphaerospora</i> sp.	<i>Tinca tinca</i>	-	Central Anatolia	Burgu et al. (1988)
<i>Sphaerospora elegans</i> Thelohan, 1892	<i>Gasterosteus aculeatus</i>	Kidney	Sinop, Black Sea	Özer (2003)
<i>Sphaerospora mugilis</i> Sitja-Bobadilla et Alvarez-Pellitero, 1995	<i>Liza saliens</i>	Kidney	Sinop, Black Sea	Özer et al. (2015b, 2017b)
Ceratomyxidae Thélohan, 1899				
<i>Ceratomyxa</i> sp.	<i>Dicentrarchus labrax</i>	Gall bladder	Aegean Sea	Özer and Öztürk (2011)
<i>Ceratomyxa beloneae</i> Lubat, Radujkovic, Marques & Bouix, 1989	<i>Belone belone</i>	Gall bladder	Sinop, Black Sea	Özer and Yurakhno (2013)
<i>Ceratomyxa merlangi</i> Zaika, 1966	<i>Merlangius merlangus</i>	Gall bladder	Sinop, Black Sea	Özer et al. (2017a)
<i>Ceratomyxa</i> sp.	<i>Scophthalmus maeoticus</i>	Gall bladder	Sinop, Black Sea	Yurakhno et al. (2017)
Ortholineidae Lom and Noble, 1984				
<i>Ortholinea divergens</i> Thélohan, 1895	<i>Parablennius sanguinolentus</i>	Urinary bladder	Sinop, Black Sea	Özer et al. (2015a)
<i>Ortholinea gobioides</i> Najdenova, 1968	<i>Neogobius melanostomus</i>	Urinary bladder	Sinop, Black Sea	Özer et al. (2015a)
<i>Ortholinea. orientalis</i> (Shulman et Shulman-Albova, 1953)	<i>Alosa tanaica, Mullus barbatus</i>	Urinary bladder	Sinop, Black Sea	Özer et al. (2015c)
<i>Ortholinea mullusi</i> Gürkanlı, Güneýdağ, Çiftçi, Yurakhno & Özer, 2018	<i>Mullus barbatus</i>	Kidney, Urinary bladder	Sinop, Black Sea	Gürkanlı et al. (2018)
Sinoulineidae Shulman, 1959				
<i>Sinoulinea rebae</i> Tripathi, 1948	<i>Solea solea</i>	Urinary bladder	Sinop, Black Sea	Özer et al. (2015a)
Kudoidae Meglistch, 1960				
<i>Kudoa niliferi</i> Özer et Yurakhno, 2018	<i>Neogobius melanostomus</i>	Muscle	Sinop, Black Sea	Özer et al. (2018)
<i>Kudoa anatolica</i> Özer et Yurakhno, 2018	<i>Atherina hepsetus</i>	Kidney, muscle	Sinop, Black Sea	Özer et al. (2018)
Sphaeromyxidae Lom and Noble, 1984				
<i>Sphaeromyxa sevastopoli</i> Najdenova, 1970	<i>Parablennius sanguinolentus,</i>	Gall bladder	Sinop, Black Sea	Özer et al. (2015a)
"	<i>Gaidropsarus mediterraneus</i>	Gall bladder	Sinop, Black Sea	Okkay et al. (2017)

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Infections of *Ortholinea mullusi* and *Myxobolus* sp. (Cnidaria: Myxozoa) in *Mullus barbatus* (Mullidae)

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Abstract: The red mullet *Mullus barbatus* is a teleost fish of great economic value in the Mediterranean Sea and the Black Sea including Turkish coastal areas. Myxozoan parasites are obligate parasitic cnidarians with more than 2400 species from marine and freshwater fish worldwide. The genus *Myxobolus* is the largest within the myxozoan fish parasites with more than 900 species reported mostly from freshwater fishes. On the other hand, the genus *Ortholinea* comprises a total of only 22 nominal species which are mostly coelozoic in the excretory system of mainly marine fishes. In the present study, a total of 215 red mullet were collected from the coastal zone of Sinop in the Black Sea, Turkey. Gills, fins, skin, urinary bladder, kidney tubules, gall bladder, intestine and gonads were examined for myxozoan parasites. Overall infection prevalence and intensity values of parasites were determined, their occurrences in relation with host length classes were also calculated. We have found two myxozoan parasites *Ortholinea mullusi* found in the kidney tubules and urinary bladder and *Myxobolus* sp. infecting only kidney tubules *Mullus barbatus*. Both parasite species were also found co-existed in kidney tubules of host fish. The prevalence of infection and intensity levels of *O. mullusi* in kidney tubules and urinary bladder were 23.3% and 3, respectively, while these values for *Myxobolus* sp. in kidney tubules were 23.3% and 1+, respectively. Both parasite species also co-existed with the prevalence value of 1.4% and intensity of 1+ only in the kidney tubules of *M. barbatus*. Gradual decreases in the prevalence of infections of both parasite species were determined as the length classes of fish increased. However, intensity of infections of both parasite species were similar at all length classes of fish. This study is the first to provide a detailed infection levels of two recently described parasite species in *M. barbatus* and it is clear that more studies are needed to reveal actual myxosporean parasite – fish host related infections in the Black Sea.

Keywords: *Ortholinea mullusi*, *Myxobolus*, *Mullus barbatus*, Sinop, Black Sea.

1. INTRODUCTION

Myxozoan parasites are obligate parasitic cnidarians with more than 2400 species from marine and freshwater fish worldwide (Özer et al. 2015a). The genus *Myxobolus* is the largest within the myxozoan fish parasites with more than 900 species reported mostly histozoic and some coelozoic from marine and freshwater fishes (Eiras et al. 2005, 2014). On the other hand, the genus *Ortholinea* comprises a total of only 22 nominal species which are mostly coelozoic in the excretory system of mainly marine fishes (Gürkanlı et al. 2018). The identification of myxozoan parasites is primarily based on the morphology and morphometry of the spores and molecular characterizations are included in recent studies (Lom and Dykova, 2006, Özer et al. 2016a,b, Gürkanlı et al. 2018, Özer et al. 2018).

Quite recently in 2018, one species of *Ortholinea* namely *O. mullusi* has been described in *Mullus barbatus* in the Black Sea by our research team (Gürkanlı et al. 2018). Here, we aimed to provide details on both individual and co-infections of two parasite species in this host fish collected from Sinop coasts of the Black Sea.

2. MATERIALS AND METHODS

In the present study, a total of 215 red mullet *Mullus barbatus* collected from the coastal zone of Sinop in the Black Sea (42° 05' 68" N, 35° 10' 55" E) were examined for their myxosporean parasites using standard methods. Gills, fins, skin, urinary bladder, kidney tubules, gall bladder, intestine and gonads were investigated. A phase contrast Olympus microscope (BX53) equipped with a digital camera (DP50) and DIC attachment was used at x400 and x1000 magnification for species identification and photography. Overall infection prevalence and intensity values of parasites were determined according to Bush et al. (1997) and Özer et al. (2017), their occurrences in relation with host length classes were also calculated.

3. RESULTS AND DISCUSSION

In the present study, two myxosporean species were recovered. The identified parasites were *Ortholinea mullusi* Gurkanlı, Okay, Çiftçi, Yurakhno, Ozer 2018 (Figure 1A) in the kidney tubules and urinary bladder; *Myxobolus* sp. (Figure 1B) infecting only kidney tubules of red mullet *Mullus barbatus*.

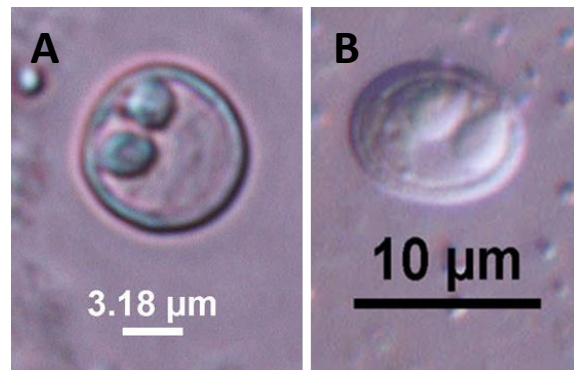


Figure 1. A: *Ortholinea mullusi* parasitising the urinary bladder and kidney of *Mullus barbatus*, **B:** *Myxobolus* sp. parasitising the kidney tubules of *Mullus barbatus*

Moreover, both parasite species were also found co-existed in kidney tubules of host fish. The calculated prevalence of infection and intensity levels of *O. mullusi* were 23.3% and 3, respectively (Table 1). These values for *Myxobolus* sp. were 23.3% and 1+, respectively (Table 1). Both parasite species also co-existed with the prevalence value of 1.4% and intensity of 1+ only in the kidney tubules of *M. barbatus* (Table 1). The infection values of both parasite species showed gradual decreases as the length of infected host fish increased (Table 1). On the other hand, intensity of infections of both parasite species were similar at all length classes of fish (Table 1).

Table 1. Overall infection values of *Ortholinea mullusi* and *Myxobolus* sp. as well as their occurrences in relation with host fish length classes.

Parasite species/Fish length	N	Prevalence (%)	Intensity
<i>Ortholinea mullusi</i>			
Fish Length Classes			
≤11.9 cm	56	17.8	2+
12.0 – 13.9 cm	102	30.4	3+
≥14.0 cm	57	17.6	2+
Overall (13.1 ± 0.1)	215	23.3	3+
<i>Myxobolus</i> sp.			
Fish Length Classes			
≤11.9 cm	56	35.8	1+
12.0 – 13.9 cm	102	20.6	1+
≥14.0 cm	57	17.6	1+
Overall (13.1 ± 0.1)	215	23.3	1+
<i>O. mullusi</i> + <i>Myxobolus</i> sp.			
Fish Length Classes			
≤11.9 cm	56	3.6	2+
12.0 – 13.9 cm	102	1.0	1+
≥14.0 cm	57	0.0	0
Overall (13.1 ± 0.1)	215	1.4	1+

This study provided first detailed report of infection levels of two parasite species, one of which was recently described as new for science (*O. mullusi*) and co-existing *Myxobolus* sp. in Turkish coastal area of the Black Sea. Mixed infections of some myxosporean parasites have been reported in Turkey (Özer, 2003, Özer et al. 2017). Overall infection prevalence (%) values of individual *O. mullusi* and *Myxobolus* sp. parasites fell within the reports published previously in Turkey (Özer et al. 2015b, 2016a,b, 2017). This is also provided details on host length related myxozoan occurrences. Özer (2003) determined increases on infection prevalence of *Sphaerospora elegans* and *Myxobilatus gasterostei* in the kidney of three-spined stickleback *Gasterosteus aculeatus*. Overall and length class related infection prevalence and intensity values in the present study are somehow similar to those above mentioned myxosporean infections. We believe that higher levels of infection prevalence and intensities were the result of increasing probability of fish encountering infective stages over the time as was mentioned by Alvarez-Pellitero and Sitja-Bobadilla (1993). However, some myxosporean species may appear to infect young hosts in their early years (Özer, 2003). In our study, decreases in infection prevalence levels of both parasite species as the length of host fish increased occurred and it could be resulted from increasing immunity

against parasites. Infection intensity levels stayed more stable indicating that once infection was started, their developmental stages replace the released mature parasites in the urinary system.

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The Evaluation of the Effectiveness Level of Management in the Soğuksu and Yozgat Çamlığı National Parks

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Abstract: In order to ensure the expected benefits of national parks from protected areas, there is a need for effective management and well-prepared long-term development plans. Since the principle that unmeasured things cannot be managed in all management processes is valid, the level of management efficiency of national parks should be also determined and evaluated according to international criteria in terms of protecting and using resource values. For this reason; Soğuksu National Park (SNP) and Yozgat Çamlığı National Park (YÇNP), which are from protected areas, having long-term development plans and located in the area of the 9th Regional Directorate of General Directorate of Nature Conservation and National Parks of Ministry of Forestry and Water Affairs in Turkey, were selected as sample areas and the level of management efficiency of them was comparatively examined, scored, and evaluated. The data derived from both long-term development plans of the national parks and field observations, from interviews with managers, and from the management evaluation form (METT-Management Effectiveness Tracking Tool) developed by World Commission on Protected Areas attached to the International Union for Conservation of Nature were used as material. The implementation of METT, which is used as a means of determining the effectiveness of management, was made by an expert/evaluation commission of three people consisting of National Park managers and researchers in terms of 41 criteria based on planning, inputs, processes and outputs. Effectiveness level of the SNP and YÇNP was scored between 0 and 3 for each criterion and results were evaluated over 102 points. The collected data were compared through a scoring table, evaluated and interpreted in terms of the effectiveness of management. As a results, it was determined that SNP had total of 67 and an average of 1.63 point of management effectiveness, and YÇNP had total of 60 and an average of 1.46 points of management effectiveness. It was also found that both national parks had a management effectiveness between “medium and good”, but the SNP was 7 overall in total and was 0.17 points better in the average than the YÇNP. The evaluations, which will shed light to the sustainable management of two national parks, were made and some suggestions were developed based on the results.

Keywords: Protected areas, national parks, effectiveness of management, long term development plan, METT method.

1.INTRODUCTION

Protected areas are an effective and widespread statue recognized worldwide, as it is an important means of moving into the future, protecting natural and cultural resources with national and international precaution and biological diversity as a fortune. In this respect, countries take measures to protect the diversity and integrity of resources, to ensure ecological continuity and to operate resources according to their aims, by making internal legal regulations on one side and international agreements on the other side (İlter ve Ok, 2012). The most important of the protected areas are; national park, nature park, nature monument, nature conservation area and wildlife development areas.

In order to achieve all the benefits expected from protected areas for sustainable development, they need to be effectively managed and well-prepared management plans are needed. The management plans used for this purpose in Turkey are long-term development plans prepared for the field. According to Article 4 of the National Parks Act and Article 11 of the National Parks Regulation, it is necessary to prepare long-term development plans for national parks that are protected areas (Alkan and Korkmaz, 2009; URL-1, 2016; URL-2, 2016). Long-Term Development Plan (LTDP) refers to development plans outside the scope of the Construction Law No. 3194 covering the establishment, development and operation of the national park in order to realize the objectives of conservation and utilization, taking into account the characteristics of the areas separated as national parks (URL-3, 2016). The main aim of these plans is to ensure the sustainability of the resource values of the protected areas, to establish a conservation-use balance and to make land use decisions that will allow the people living in the protected area to develop without harming this area (Korkmaz et al., 2005).

The concept of a national park was first described at the international level in the Congress of the Flora and Fauna of Africa, which was held in London in 1933. National park studies in Turkey have found an application area with the 3rd and 25th articles of the Forest Law No. 6831 dated 1956 and have reached legal status with the National Parks Law No. 2873 which was enacted in 1983. According to this law, national park is defined as "natural and cultural resource values

that are nationally and internationally rare in scientific and aesthetic terms, and nature pieces that have protection, rest and tourism areas" (Daşdemir and Akça, 2002). Currently there are 41 national parks in Turkey and a total of 834,614 ha are used for this purpose.

This study has been dealt with in order to determine the efficiency level of management according to international criteria in the Soğuksu and Yozgat Çamlığı National Parks, which are protected areas in Turkey. For this reason, the Soğuksu National Park (SNP) and the Yozgat Çamlığı National Park (YÇNP) have been compared and evaluated in terms of management efficiency.

2.MATERIALS AND METHODS

The research area is the Soğuksu National Park and the Yozgat Çamlığı National Park located in the study area of the 9th Regional Directorate of the General Directorate of Nature Conservation and National Parks (GDNCNP) of the Ministry of Forestry and Water Affairs (MOFWA). Both national parks have a long-term development plan, close to the Ankara province with a large urban population, and are open to intensive visitor use (Figure 1).



Figure 1. SNP and YÇNP's Location on the Map

In the study; the data obtained from the implementation of the Management Effectiveness Tracking Tool (METT) developed by the World Commission on Protected Areas (WCPA) attached to the International Union for Conservation of Nature (IUCN), from interviews with the managers, from field observations, from the LTDPs of both national parks. The general framework of the METT method is given in Table 1. The METT method was applied to the three-person commission consisting of National Park managers and researchers in September-December 2015, and the criteria were scored and evaluated between 0 and 3.

Table 1. WCPA General Framework of Management Assessment Criteria in Protected Areas (DKMPGM, 2015)

Assessment Elements	Explanation	Evaluation Criteria	Evaluation Focus
Environment	<i>Where are we now?</i> The importance of the area, the threats to the area and the evaluation of the policy environment	-Importance, -Threats -Sensitivity, -National environment -Partners	Status
Planning	<i>Where do we want to be?</i> Evaluation of protected area design and planning	-Protected area legislation and policy -Design of the protected area system -Protected area design -Management planning	Relevance
Inputs	<i>What do we need?</i> Evaluation of the inputs needed for effective management of the protected area	-Resource needed by the institution -Resources needed by the protected area	Resources
Processes	<i>How is the process running?</i> Evaluation of management structure	- Suitability of managerial processes	Productivity and Suitability
Outputs	<i>What are the results?</i> Implementation of management programs and managerial actions and assessment of realization status of targeted products and services	-Results of managerial actions -Products and services	Efficiency
Results	<i>What have we done?</i> Assessing the extent to which results and outcomes achieve goals	-Effects; the effects of management on objectives	Efficiency and Suitability

3.RESULTS AND DISCUSSION

Findings of the Research Area

General findings about the Soğuksu National Park and the Yozgat Çamlığı National Park, which were selected as the research area, are given below:

The Soğuksu National Park (SNP): The SNP was established in 1959 in an area of 1195 ha in the Kızılcahamam district of Ankara. It has black forests, rich flora, rare natural beauty, hot springs and drinking water on the Central Anatolian steppe ecosystem transition region. There are 4 ecosystems including forest, steppe, meadow and creek. 128 families, 108 genera and 659 species were identified as flora. There are 50 endemic plant species. 128 rare birds in Turkey (as black vulture) and 14 mammal species (such as the grizzly bear) are located there. Among the most important resource values of the SNP are "silicified trees" (SMP UDGP, 2007). It is a very important outdoor recreation resource of Ankara city because it is 80 km away from Ankara province and is suitable for all sorts of social, cultural, touristic and recreational activities with its resource values (Akesen, 1978). The most preferred recreational activities are; picnicking outdoors, watching the landscape, taking photos, walking, riding a bicycle, watching wildlife and plants.

The Yozgat Çamlığı National Park (YÇNP): It is Turkey's first national park established in 1958 with 266 ha of area. It is 2 km far from the center of Yozgat province. There are two main ecosystems, forest and bush. The forest ecosystem is larch and hairy oak. The shrub ecosystem constitutes species such as astragalus and tar. 144 families and 212 plant species belonging to 43 families. 26 of them are endemic species. Fauna include species such as golden eagle, red hawk, hawk, dove, crazy, yellow vine, magpie and thrush bird (YÇMP UDGP, 2011). It is open area for recreational use due to its rich plant species, its proximity to the provincial center, its scenery beauty, its suitability for trekking and accommodation.

Determining the Effectiveness Level of the Management of Protected Areas

There are many methods for tracking and evaluating the level of efficiency of management of protected areas (Stanciu et al., 2010). In Turkey, RAPPAM (Rapid Assessment and Prioritization of Protected Area Management) method has been used in the past (Ervin, 2003). In this method, the effectiveness of the management is mainly scored and evaluated by the commission of experts on the basis of *planning, inputs processes and outputs*. For effective tracking and evaluation, it is essential to repeat the method every four years.

In this context, all protected areas in Turkey were rapid evaluated by the RAPPAM method. The first application was made to national parks by the WWF-Turkey Cooperation and expertise of WWF-International with the participation of 100 people in 2005. The method was secondly implemented in 2009 with the participation of 108 people in the WWF Danube and Carpathian Program Office (WWFDCPO) expertise to include national parks as well as nature parks (Stanciu et al., 2010). When comparing 2005 and 2009 in terms of planning, inputs, processes and outputs, it is seen that there is an increase in management efficiency. The most significant increase was experienced in the processes and inputs (Çokçalışkan et al., 2010). However, because the method was insufficient to evaluate the management process and due to the low level of participation, it did not go beyond the practice of the administration. In addition, the results have not been well respected and have not been found in practice due to the weakness of nature protection policies.

In order to improve the potential of protected areas and improve administrative processes, it is necessary to understand the strengths and weaknesses of managing these areas and the threats they face. For this, the WCPA affiliated IUCN has laid out a general framework for assessing the management effectiveness of protected area systems for both individual and protected areas in order to guide protected area authorities and experts from the year 2000 onwards and align the assessment methods of various parts of the world. Thus, METT method developed by IUCN-WCPA is started to be used in protected areas.

Determination of the Level of Efficiency of Management in the SNP and YÇNP by METT Method

The detailed METT form consisting of 30 main assessments and 4 additional questions with three items was implemented in a three-person commission (researcher, Director of the Department of Nature Conservation and National Parks and related National Park Supervisor) in the SNP and YÇNP after analyzing the LTDPs of both national parks, making observations and reviews in the sites, and seeing the GDNCNP headquarters and national parks' managers. The commission discussed and assessed the requirements of each measure on the basis of the issues/questions, and accordingly gave the scores 0, 1, 2, 3 (Ersoy, 2016).

A maximum of 102 points can be provided for 30 original questions and 4 additional questions in the METT form. However, the maximum score that the national park management can get is 99 because the 23rd question (indigenous peoples) is undesirable for Turkey to be answered. Accordingly, as a result of the assessment and scoring, a total of 41 questions, including 29 additional questions and 29 additional questions, the SNP has 67 points, the YÇNP has 60 points (Table 2)

Table 2. Management Effectiveness of the National Parks on the basis of Evaluation Elements

Evaluation Elements	Question Number	Scores	
		SNP	YÇNP
Environment	1	3	3
Planning	11	14	13
Inputs	6	12	10
Processes	12	20	18
Outputs	1	2	2
Results	5	6	6
Planning/Outputs	1	2	2
Planning/Processes	1	1	1
Processes/Outputs	2	4	3
Inputs/Processes	1	3	2
TOTAL	41	67	60

Accordingly, it can be said that *management processes, planning, inputs and results* are given importance respectively for evaluating the effectiveness of the National Park Administration. In this context, the SNP is a step ahead of the YÇNP in terms of planning, inputs (resources use) and processes. In terms of other assessment elements, both national parks are almost identical. According to this, the average management efficiency score of the SNP is 1.63 (67/41) and the YÇNP's score is 1.46 (60/41). If a classification of 0 = Weak, 1 = Moderate, 2 = Good and 3 = Very good is to be made to evaluate the national park management as a whole, it is understood that both national parks have *moderate-good* management efficiency. However, the SNP is 7 overall in total and 0.17 points in the average according to the YÇNP.

Ecological, economic and social dimension should be considered together for the planning of national parks and sustainable management. Recreational activities in national parks should be in accordance with the nature values of the national park, conservation-use balance, and respectful to nature. Despite the fact the ecological dimension has been given to a certain extent in the LTDP's and management processes of both national parks, the socioeconomic dimension has not been given enough space. In national parks, it is necessary to calculate the physical transport capacity correctly and to receive visitors according to the physical capacity. While this issue is partly covered in the SNP management plan, it has never been included in the YÇNP management plan. In addition, excessive and unnecessary construction should be avoided and the necessity should be thoroughly analyzed and discussed before the facilities are built in national parks. Likewise, circulation in both national parks must be done via electric-powered silent vehicles.

In conclusion, LTDPs of national parks should be constructed via the planning delegations consisting of experts in accordance with the principles of conservation-use and participation in technical, economic, social and administrative integrity in accordance with national development plans, scientific plans and planning principles. Also, the effectiveness of the management in national parks should be periodically tracked, evaluated and developed according to international criteria and accordingly, appropriate policies should be applied with determination.

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Comparison of Different Extraction Methods for the Extraction of Tannin from Taurus Cedar Bark

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Abstract: This study is aimed to investigate the effect of different extraction methods on bark tannin yield of Taurus cedar and phenolic composition of the tannins. The waste bark sample of cedar was collected as a result of logging production of naturally grown Taurus cedar tree (*Cedrus libani* A. Rich.) in Adana district. Using different extraction parameters, conventional process, ultrasound-assisted extraction (UAE) and microwave-assisted extraction (MAE) methods were applied and the extraction stage was tried to be optimized. After the extraction, chemical composition of the phenolic extracts was determined by stiasny number method. The amount of free sugars in the extracts was also determined by DNS reducing sugar method. According to the results obtained in the study, the highest tannin yield values for Taurus cedar bark were determined by microwave-assisted extraction method. The extracts obtained by microwave-assisted extractions have highly phenolic compounds and the ratio of non-tannin compounds is lower. Functional group analysis of the tannin samples were investigated by using an attenuated total reflectance with Fourier Transform Infrared Spectroscopy (ATR-FTIR).

Keywords: Tannin, extraction, ultrasound, microwave, FTIR

1. INTRODUCTION

It is possible that the bio-waste materials as tree barks can be converted to renewable raw material by different processes. Tannins are the most common secondary components of the tree barks and extractives in the phenolic structure (Bisanda et al. 2003). The most important step in the tannin production process from lignocellulosic materials such as tree bark is extraction stage with high efficiency and low energy consumption without causing condensation reactions, enzymatic reactions as well as the oxidative and thermal effect caused by light, air, high temperature. High efficiency and low energy consumption of the extraction and high purity of the extract can be achieved using the right extraction methods and parameters (Azmir et al. 2013; Ghitescu et al. 2015). In recent years, studies on the application of new extraction techniques in the isolation of bioactive phenolic compounds from plants have been rapidly increasing. Khoddami et al. (2013) report that alternative extraction techniques with advantages such as low extraction time, toxic contaminants, organic solvent consumption and easy application are used for the extraction of plant phenolics. Ultrasound-assisted extraction (UAE), microwave-assisted extraction (MAE), ultrasound-microwave assisted extraction (UMAE), supercritical fluid extraction (SFE), subcritical water extraction (SCWE) and high hydrostatic pressure techniques are commonly used methods.

This study is aimed to investigate the effect of different extraction methods on tannin yield of Taurus cedar bark and, phenolic composition of the tannins. Thus, the extraction stage was tried to be optimized. Using different extraction parameters, conventional process, soxhlet extraction, ultrasound-assisted extraction and microwave-assisted extraction methods were applied. After the extraction, chemical composition of the phenolic extracts were determined by stiasny number method, total phenolic content and proanthocyanidin (butanol/HCl) assay. The amount of free sugars in the extracts was also determined by DNS reducing sugar method.

2. MATERIALS AND METHODS

The bark sample of cedar was collected in Adana region. Afterwards, the samples were cleaned from impurities and they were air dried up to 10-12% humidity, then ground into a fine powder in a laboratory mill. Stiasny reaction was used to determine the polyphenol content of extracts according to Yazaki and Hillis (1977). The free sugar impurities in the tannin extract was estimated by DNS reducing sugar method according to Miller (1959) and Hu et al. (2008).

The tannin samples were dried in a hot oven at 60°C for 12 hours. Functional group of the ground tannin samples were investigated by using an attenuated total reflectance with fourier transform infrared spectroscopy (ATR-FTIR, Bruker, Tensor 37). The spectra were recorded in the wavenumber range from 400-4000 cm and 32 scans per sample with a resolution of 4 cm were used. The evaluation of the spectra were carried out using the Bruker OPUS software.

3.RESULTS AND DISCUSSION

The extraction yield, stiasny number and DNS reducing sugar results of conventional process in different extraction parameters for tannin production are given in Table 1.

Table 1. Extraction Parameters and the Results of Conventional Process

Sample	Solution	Bark:Solvent Ratio	Temperature (°C)	Time (min)	Yield (%)	Stiasny Number	DNS Reducing Sugar (mg/g)
CC1	Su	1:8	70	60	12.37	37.53	40.81
CC2	% 2 Na ₂ SO ₃ + 0,50 Na ₂ CO ₃	1:8	70	60	13.99	38.53	36.54
CC3	20:80 (ethanol:water)	1:8	70	60	11.53	38.22	38.23

The results obtained with ultrasound-assisted extraction are presented in Table 2.

Table 2. Extraction Parameters and the Results of Ultrasound-Assisted Extraction (UAE)

Solution	Ultrasound Frequency (kHz)	Bark:Solvent Ratio	Temperature (°C)	Sample	Time (min)	Yield (%)	Stiasny Number	DNS Reducing Sugar (mg/g)
Su	35	1:8	60	CU1	10	10.80	39.40	35.16
				CU2	20	11.18	37.77	36.24
% 2 Na ₂ SO ₃ + 0,50 Na ₂ CO ₃	35	1:8	60	CU3	10	14.41	39.55	34.08
				CU4	20	14.83	39.42	34.26
20:80 (Ethanol:Water)	35	1:8	60	CU5	10	15.04	39.25	35.74
				CU6	20	15.39	39.90	36.13

The result of microwave-assisted extractions that performed at two different microwave powers are shown in Table 3.

Table 3. Extraction Parameters and the Results of Microwave-Assisted Extraction (MAE)

Microwave Power (W)	Solution	Bark:Solvent Ratio	Sample	(Yield) (%)	Stiasny Number	DNS Reducing Sugar (mg/g)
90	Water		CM1	17.04	40.10	32.29
	% 2 Na ₂ SO ₃ + 0,50 Na ₂ CO ₃	1:8	CM2	19.21	40.25	32.38
	20:80 (Ethanol:Water)		CM3	23.14	41.73	33.45
	Water		CM4	17.84	41.15	33.14
360	% 2 Na ₂ SO ₃ + 0,50 Na ₂ CO ₃	1:8	CM5	20.22	41.08	32.32
	20:80 (Ethanol:Water)		CM6	24.16	42.80	33.58

As a result of classical extraction method with three different extract solutions, the highest extraction yield and stiasny number values were determined as 13.99% and 38.53 in CC2 sample, respectively. In this sample, DNS reducing sugar values are the lowest value with 36.54 mg/g. According to the results of ultrasound-assisted extractions, the highest extraction yield and stiasny number values were obtained in the 20:80 (v/v) ethanol: water solution, and the DNS reducing sugar assay results shows that sample has high percentage of carbohydrate impurities. For this extraction method, the lowest DNS reducing sugar value was obtained in a solution containing 2% sodium sulphite and 0.5% sodium carbonate. As stated in the microwave-assisted extraction results, the highest extraction yield and stiasny number values at 90 W and 360 W microwave power were determined as 20:80 ethanol: water solution. For ethanol: water (20:80 v/v) extraction solution, 11.35% extraction yield value was obtained at 60 minutes of extraction time in conventional method, while that exhibited 15.39% the yield at 20 minutes of extraction time in ultrasound assisted extraction and 24.16% the yield at 3 minutes of extraction time in microwave-assisted extraction. In the same extraction solution, the highest values of stiasny number was also demonstrated in the study.

The FTIR spectrums of obtained the dried tannin sample are recorded as shown in Figure 1, Figure 2 and Figure 3.

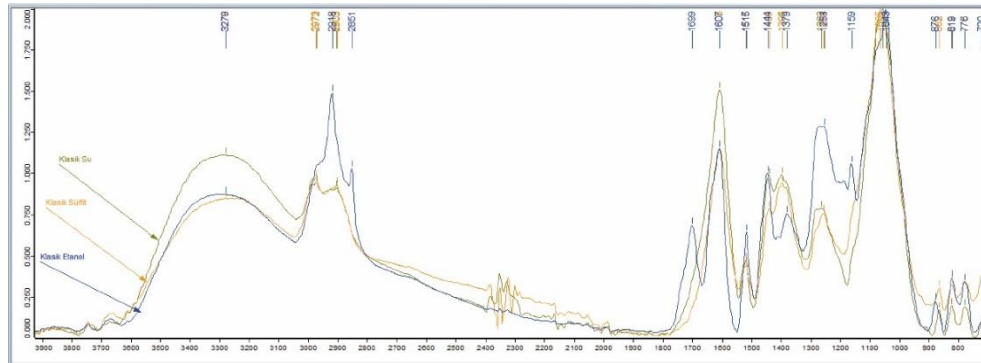


Figure 1. FTIR Spectrum (In conventional process with different solvents: water, sulphite, ethanol)

The 1800 to 1680 cm^{-1} is carbonyl stretching region. It is reported that this region gives strong signal in extracts containing monomeric compounds (Ricci et al. 2015). This peak is determined in the tannin samples extracted with ethanol:water in the extract solution, whereas the peak did not found in the other samples. The vibrations of the $\text{C}=\text{C}$ bonds in the aromatic ring were determined at 1607 cm^{-1} and this peak is characteristic for condensed tannins (Ricci et al. 2015; Murugananthan et al. 2005; Kim and Kim 2003). It gives a bigger peak area in water extractions. It is thought that the peak to at 1515 cm^{-1} could be originated from catechin units in the tannin samples (Ricci et al. 2015; Fernandez and Agosin 2007; Jensen et al. 2008). For the tannin samples obtained with ultrasound-assisted extractions and microwave-assisted extractions showed an increase in spectrum peak areas compared with conventional extraction method.

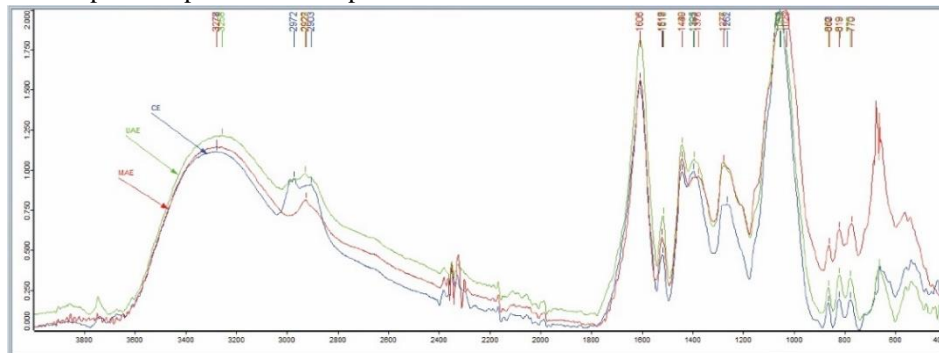


Figure 2. FTIR Spectrum (In different extraction methods, water as solvent)

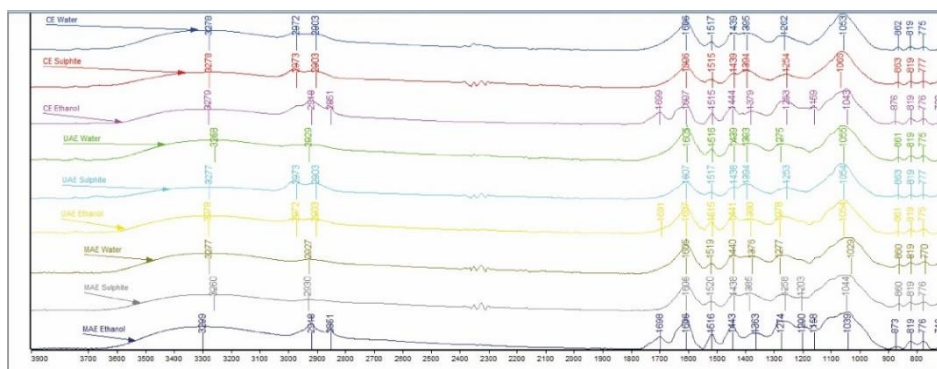


Figure 3. FTIR Spectrum of All Samples

According to the results obtained in the study, the highest tannin yield values for Taurus cedar bark were obtained by microwave-assisted extraction method in 20:80 ethanol:water solution. The bark tannin extracts obtained by microwave-assisted extractions have highly phenolic compounds and the ratio of non-tannin compounds is lower, as stated in the results of stiasny number and DNS reagent method. The tannins obtained in the microwave-assisted extraction have high values of purity and efficiency. Microwave-assisted extractions have the advantage of extremely short extraction time. FTIR analysis results show that the properties of bark tannins are affected with the applied extractions methods, parameters and extraction solutions.

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The Investigations of Excavation Techniques of Bulldozer at Forest Road Construction (A Case Study of Gursu Forest Enterprises)

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Abstract: In this study, environmental damages and road construction techniques by using bulldozer were investigated in forested regions in Antalya in Turkey. The excavation techniques and productivity of bulldozer were investigated according to slope, ground type and power of machine. Also, the number of damaged trees and undamaged trees were determined between two cross sections as gradient groups. Another a damage type, stream beds were investigated filling with excavation materials during forest road construction operation. In this study, the amount of damages at trees were founded during forest road construction. Along the road section, some areas were determined fill of stream bed. The amount of excavation material was changed to bulldozer blade size, slope and ground type. The amount of excavation materials and rolling distance of materials were investigated in this study.

Keywords: Forest road, bulldozer, excavation techniques, rolling distance, damage

1. INTRODUCTION

Forest roads are necessary to provide access to forests for general management, maintenance, timber extraction, recreation (Ryan et al., 2004), regeneration, production (Demir and Hasdemir, 2005), and fire and pest control (Tehrani et al., 2015). Forest roads construction activities must be carefully executed by considering economical, environmental, and social requirements (Akay and Sessions, 2005). Construction of a forest road network is considered as the key element for a successful forest management (Krc and Begus, 2013). Planning a forest road network depends on social requirements since such roads provide access to forest villages, rural settlements and recreational areas (Acar and Eker, 2003). A proper design and routing of forest roads will reduce the need for major repairs and save on maintenance costs over time (Edwards, 2011).

The environmental impacts of forest road constructions vary according to conditions of a terrain, that is whether it is a rocky, loose rock, soil, gentle or steeper terrain, and so forth. In addition, in general, environmental damage may increase depending on situations such as stands (average tree diameters, average tree lengths, stand ages, canopy closures, etc.), choice of machines, tree species, and road construction techniques (Sentürk et al., 2018). Building forest roads involves removal of vegetation and soil, thus favoring run-offs, pollution of streams, and the risk of erosion and mass movement on steeper terrains (Edwards, 2011; Hernandez-Diaz et al., 2015). Moreover, stream beds can fill up with excavated materials, which is very concerning in terms of freshwater ecology, fish health, and rerouted stream beds. Bulldozers are commonly preferred on terrains with gentle to moderate hillside slopes and on soil and loose rock grounds. However, in steep and rocky terrain conditions, the efficiency of bulldozers diminishes, and excessive environmental damages may occur because of the difficulty to keep excavated materials alongside the road (Ozturk, et al., 2009).

In this study, a forest road construction was investigated in the southern part of Turkey. The construction was carried out by using a bulldozer. Environmental damages to trees and to the stream bed caused by the forest road construction were investigated. In addition, productivity and cost of the bulldozer were evaluated, and some suggestions were offered.

2. MATERIALS AND METHODS

The study area is selected from the office zone Gursu Forest Enterprise in Kas Forest Management in Antalya (Figure 1). In this enterprise, dominant commercial tree species include *Pinus brutia*, *Cedrus libani* and *Juniperus* sp. The elevation ranges from 500 m to 1200 m with ground slopes of 25% to 80%. The forest road density in this area is 16 m/ha. Total length of the sample road examined in this study was about 1575 m and the average road width of 5 meters. In this study area, the road alignment consists of soil and losses rock.

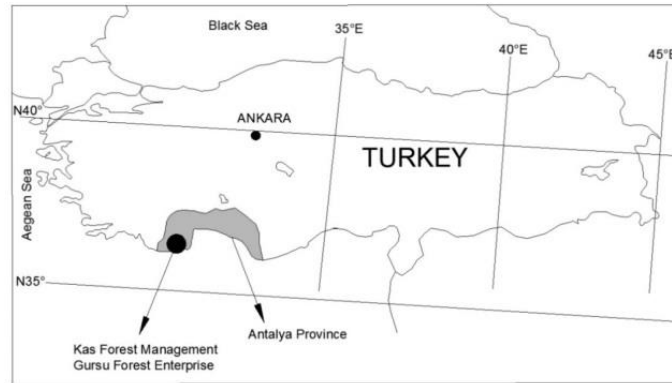


Figure 1. The location of the study area in Antalya region

The Equipment Specifications

Komatsu D85ex type bulldozer was used in forest road construction operations. This bulldozer is a very strong machine and it is suitable for forest road operations on soil and loose rock region. The technical specifications of the bulldozer are shown in Table 1.

Table 1. Technical features of the Komatsu D85ex (Anonymous, 2015)

Specifications		Values
Bulldozer Weight		21220 kg
Engine Power		266 HP
Maximum Travel Speed	Forward	10.1 km/h
	Reverse	13.0 km/h
Blade capacity		7.0 m ³
Fuel Tank		490 liter
Bulldozer height		3330 mm
Bulldozer length		5795 mm
Bulldozer width		3635 mm

The excavation methods and environmental damages were investigated to forest road construction. Also, environmental damages to the stream bed caused by the excavated materials were investigated. In this study, primarily, the cross sections were determined along the forest road. Every cross section included different variables. These variables include cut-slope height , cut-slope width , road width (Road + Ditch), fill-slope width, fill-slope length, road construction zone width, cut slope length and ground slope.

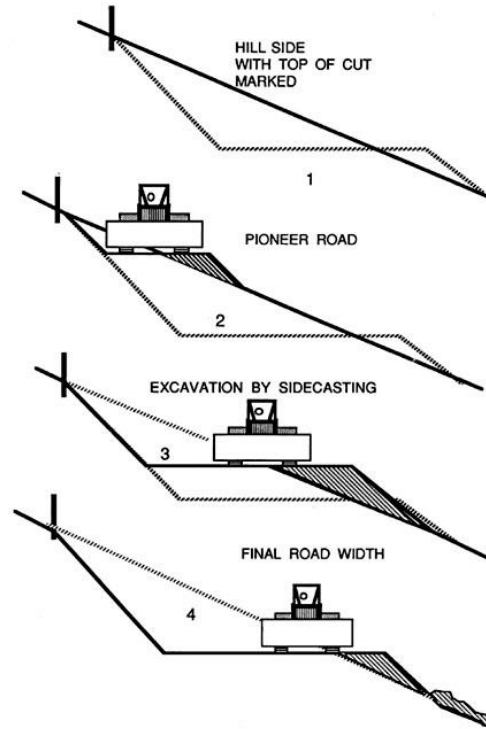


Figure 2. The excavation types of forest road construction with bulldozer

In this study, along the 1,575 m of road section, decision variables were collected from 52 cross sections, which were 30 m apart from each other. The number of damaged and undamaged trees were determined in each cross section as a gradient group. The types of damage such as bending of a tree and wounding of tree bark were also observed. Using the data that were collected, distribution of damage types in relation to the construction techniques associated with the bulldozer and the effect of positional values of damaged trees were investigated. The data were entered into a spread-sheet program to compute simple statistics such as arithmetic averages and standard deviations. The average excavation speeds and productivities of the bulldozer were found throughout the forest road operation. Every cross section was shown in percent slopes, differently for cut-slopes and fill-slopes. The shapes of the cross sections were measured, and the difference between the lengths of cut-slopes and fill-slopes was shown.

3.RESULTS AND DISCUSSION

The results indicated that the total amount of excavated materials along the roadway was 12,195.00 m³. The percentages of soil, loose rock and soft rock of those materials were 59%, 36% and 5%, respectively. The average operation time of the bulldozer was 8 hours per day. The research was conducted in August 2015. The research area is very hot in the summer season, which affected the forest road operation.

Cross Sections

In this study, the data from the cross sections were collected on the sample road. In this region, the types of materials on the ground are soil and loose rock along the forest road construction route. Table 2 lists the values of the specific variables measured from the cross sections.

The average construction zone width was 11.32 m; therefore, the sample road section affected approximately 1.78 ha of the forested area ($11.32 \text{ m} \times 1,575 \text{ m} = 17,829 \text{ m}^2 = 1.78 \text{ ha}$) during the road construction activity.

Table 2. The values of decision variables measured on the cross sections

Variables	Symbol	Average	Standard Deviation	Max. Values	Min. Values
Ground slope (%)	S	58.8	17.73	80	25
Cut-slope height (m)	Ch	3.51	1.43	7.8	1.7
Cut length on road width (m)	Crw	4.31	1.10	6.5	2.9
Fill length on road width (m)	Frw	2.34	1.79	8.5	0.5
Road width (m)	Rw	6.56	1.72	12.0	4.2
Cut-slope length (m)	Cl	6.55	1.85	10.8	3.9
Fill-slope length (m)	Fl	5.67	3.82	16.2	1.9
Construction zone width (m)	Czw	11.32	3.40	19.5	6.9

In this study, the rates of cut-slopes in the forest road were mostly between 3/1 and 5/1 depending on the cut-slope heights and road widths. Excavated materials were scattered down the side of the roadway, and the fill-slope lengths varied between 1.9 and 16.2 meters depending on the fill-slope gradients. The gradient of study area was found to be between 25 and 80%.

Some of the cross sections did not have any damaged trees, whereas the others had damaged trees (Figure 5). The damaged trees usually had bending and wounding damages (Figure 3 and 4). The number and rate of the damaged trees in the study area is shown in Table 3.



Figure 3. Bending damages of trees



Figure 4. Wounding damages of trees

Table 3. Number and rate of damaged trees in study areas

Cross section number	Average of grade fill slope (%)	Total number of trees	Number of bending trees	Number of wounding trees	Average of distance rolling (m)	Bending Percent (%)	Wounding Percent (%)
Ort.	60.8	26	8	2	10	26.3	6.1

The number of damaged trees in the steep and gentle terrain was found to be greater. In 25–80% of the sloped areas, there were an average of 8 bent trees and 2 wounded trees. In addition, in the cross sections, the average number of undamaged trees was counted to be 26. Along the forest road, the average gradient was found to be 61%. The length of fill-slopes increases with increasing slope gradients, and consequently, the damage grows. When the sliding and rolling distance of excavated materials increase, the environmental damages to trees and to the river basin are increased. All the excavated materials were dumped down the side of the roadway by the bulldozer. As the second type of environmental damage, the stream bed was filled with excavated materials. In this case, the direction of the stream flow was diverted. This change was very serious in terms of freshwater ecology, fish health, and rerouted stream beds (Figure 6).



Figure 6. The fill with excavated material of stream bed

The main reason for dumping excavated materials over the stream bed was the fact that the forest road was very close to the stream. A buffer zone should be allowed between a road and a stream so that the stream can be protected from excavated materials. According to Akgül, the width of a buffer zone should be increased depending on the slope rate. The width of a buffer zone ranges between 25 and 150 meters on productive forest areas (Akgül, 2012). Stream beds are protected from flow of sediments by buffer zones, and thus, the speed of rainwater is reduced in such areas (Wenger, 1999; Wood and Armitage, 1997).

Productivity and Cost of Bulldozer

The production rate of the bulldozer is generally computed as the length of constructed road per hour. In this study, the average productivity of the bulldozer in soil, loose rock and soft rock were found to be 221.41, 125.00 and 86.5 m³/hrs., respectively (Table 4).

Table 4. Productivity of bulldozer at different excavated materials

Cross number	section	Excavated ground type	materials	Average slope (%)	Distance of between cross sections (m)	Productivity of bulldozer (m ³ /hr)	of
1		Soil		55	25	221.41	
2		Loose rock		66	25	125.00	
3		Soft rock		63	30	86.50	

The average slopes of soil, loose rock and soft rock in the study area were 55, 66 and 63%, respectively. The fuel consumption of Komatsu D85ex bulldozer varied between 18–20 liter/hrs. In this study, the average zone width of the constructed sample road was 11.32 meters. The amount of forest area impacted along the road was 1.78 ha. A study conducted in the Antalya region reported that a road construction operation in the same region resulted in a zone width of 12.18 meters (Wood and Armitage, 1997). Another study conducted by Ozturk (Ozturk, et al., 2010) — in which a bulldozer was used — in the Bolu region of Turkey indicated that the average zone width of the construction was 7.27 meters, and the ground type was soil.

There are two types of environmental damages caused by forest road constructions. These are damages to trees and damages to stream beds. The tree damages include bending and wounding of trees. The damages to stream beds include the filling of stream beds with excavated materials. In this study, in the 25–80% ground slopes, 26.3% of the trees below the forest road construction zone were bent, and 6.1% of the trees were wounded. In a similar study conducted by Tunay (Tunay and Melemez, 2004) in Antalya, 55% of trees under the forest road construction zone in a terrain with a ground slope of 51% were damaged. Another study conducted by Caliskan in the Trabzon region of Turkey revealed that 44% of trees were damaged in soil, loose rock and rock areas of a terrain that had a ground slope of 59% (Caliskan, 2013). Damage types in those areas included bending, crushing and wounding. Although the area in this study was a sloping area, the number of trees that were damaged was less than those that were observed in the other studies. The reason might be that the types of ground were mostly soil and loose rock. The soil load usually bends trees. The rate of wounding observed on the trees was less. In this study, dumping the excavated materials on the stream bed was a more serious problem for the environment. It appears, the risk of erosion will increase in this road area in the consequent years.

In this study, constructing a road using a bulldozer were evaluated in soil and loose rock areas by considering economic and environmental requirements. The following are recommended:

- A buffer zone should be maintained between a forest road and a stream. The buffer zone protects the stream bed from excavated materials.
- Damaged trees should be removed from sensitive areas where bark beetles are abundant. Especially the wounded trees will increase the number of bark beetles. This situation is very dangerous for sensitive forest areas.
- Bulldozer operators should be well trained to improve the efficiency of construction activities, which affect economical and environmental aspects.

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Grafted-Rooted Vine Production by a New Motorized Grafting Machine

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Abstract: This study was designed to increase the efficiency of grafted-rooted vine production. Grafted-rooted vine production is usually done by using of Omega grafting-machine. All around the callus formation remains small and weak because the length of cambium which Omega grafting-machine makes on the joint surface of scion and rootstock is not enough and a firm grip does not occur between the scion and the rootstock. This condition reduces the efficiency of vine production up to 20-25%. To eliminate those problems a grafting machine which works with a rotating disc-shaped blades system has been developed by us. In the preliminary experiment, the quality of first class rooted vine increased to 55-60 %. This grafting machine provides a firm grip between the rootstock and the scion by making desired depth and length of intrusion and ridge; though the length of contact surface of cambium of rootstock and scion is 6 cm in the standard grafting machine, this length reaches to 16 cm by making 2.5 cm depth and length of intrusion and ridge by the new grafting machine. This is important in increasing efficiency of 1st class saplings as well as increasing callus formation. This new grafting machine can also be used for grafting of rooted fruit rootstocks such as apple and walnut. In this research, the usability of the new motorized grafting machine which works with a disc-shaped circular knife was developed to increase the efficiency of 1st class grafted-rooted vine production was compared with Omega grafting-machine.

Keywords: Grafting, rooted vine, omega, callus, callusing

1. INTRODUCTION

Especially in orcharding and viniculture there are different reproduction methods. One of these methods is grafting. In order to establish a new vineyard or fruit garden, absolutely seedlings are needed. The grafted seedlings are multiplied by the grafting method. The main grafts used in the production of saplings in orcharding and viniculture are scion and rootstock grafts. Two main materials are needed, namely rootstock and scion, which are compatible with each other in the grafting (1,28, 34).

Generally, a part of a plant, called a grafting, scion or rootstock, is placed on another plant part, called a rootstock, in a special way, to fuse it together and develop as a single plant (23,24,25,30,31).

The main aim of orcharding and viticulture is to obtain new production material (grafted seedlings) and to use them in production which are resistant to diseases and harmful effects and which have high economic value on rootstocks affecting fertility (5,6,7,16, 34).

Today, grape seedling production in vineyards is usually done with omega grafting device on a table top. The grafted cuttings, after they have been fused to the callusing room at 22 days at 28 ° C and 85-90% humidity and paraffinization, planted to nursery [8,9, 10,11,12,13,14,15]. The yield of grafted- rooted vine of 1st nursery stock are produced by this omega machine does not exceed 20-25%. The main reason for this is; the total contact length of the cambium layer at the wound of this grafting machine, in total is not exceed 6.0 cm. This causes both the germination chamber and the nursery to be lost as it can not generate full callus (scar tissue) all around enough [20,21,22,33,35].

Despite the fact that the number of annual seeded grafting-rooted grape saplings is 10 million in our country, we can produce almost 3 million saplings as public and private sectors (18,19). World ranked 5th with a total area of 472.790 Ha among the grape countries; It is necessary to increase the production of seedlings with a new understanding of production, since this seedling production is extremely inadequate in our country (17, 18, 19,32) which is ranked 6th with 4.296.352 tons of grape production.

The main aim of this study is; we have compared the motorized device machine we have developed to increase the yield of the first class certified grafted vine seedlings and the omega machine which is still in production.

2. MATERIALS AND METHODS

Merlot grape variety and **SO4** (*Vitis berlandieri* x *Vitis riparia* Teleki Selek No.4) were selected as hardy-wood material. A total of 200 single-eye scion and a total of 200 standard (35-40 cm length) rootstocks of the same diameter (10 mm)

with scion, were used for both the Motorized and Omega grafting machines to compare two device machines in terms of first-year seedling yield (2,4).

A total of 100 grafted cuttings, of which 4 in each case, 25 in each, were planted to the nursery after passing through the conventional production stage. Grafted –cutting vines that were maintained during the vegetation cycle were removed in the autumn and their yields were calculated by comparing them according to the standard criteria of 1st grade certified saplings. The levels of grafting and callus formation in saplings were taken into account both at the exit from the callusing chamber and at the dismantling from the nursery (3).

The total length of the cambium contact surfaces at the wound of both grafting machines, in the rootstocks and in the scion is not equal. This causes a significant increase in the formation of wound tissue and graft retention.

The blade of the Omega grafting machine is a scion-shaped letter in the shape of a letter, and opens a protrusion in the rootstock (or vice versa) and they are joined and grafted (Fig.1.a,b,c) is a layer of cambium that forms callus (scar tissue) just below the skin at the wound site. Omega is not more than 6.0 cm in length due to the constant camber length of the camel in contact with the scion and the rootstock in the omega machine. In the motorized grafting machine, the total length of the cambium contact surfaces of the blades in the form of cove and protrusion is 16 cm. In addition, the recess and protrusion length of rootstock and scion can be increased or decreased by special settings (Fig.2.d,e,f).

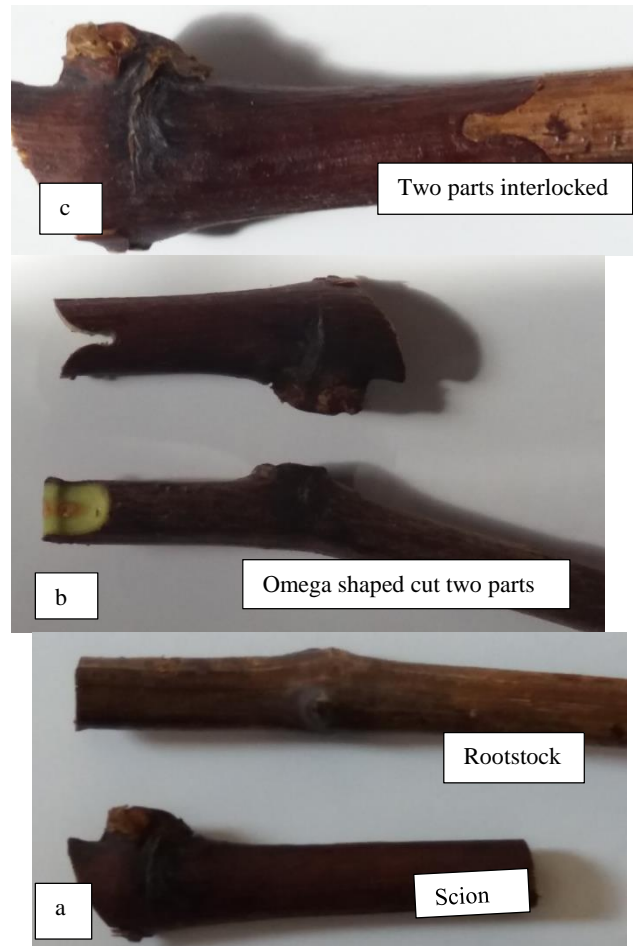


Figure 1. Grafting with omega (a,b,c,)

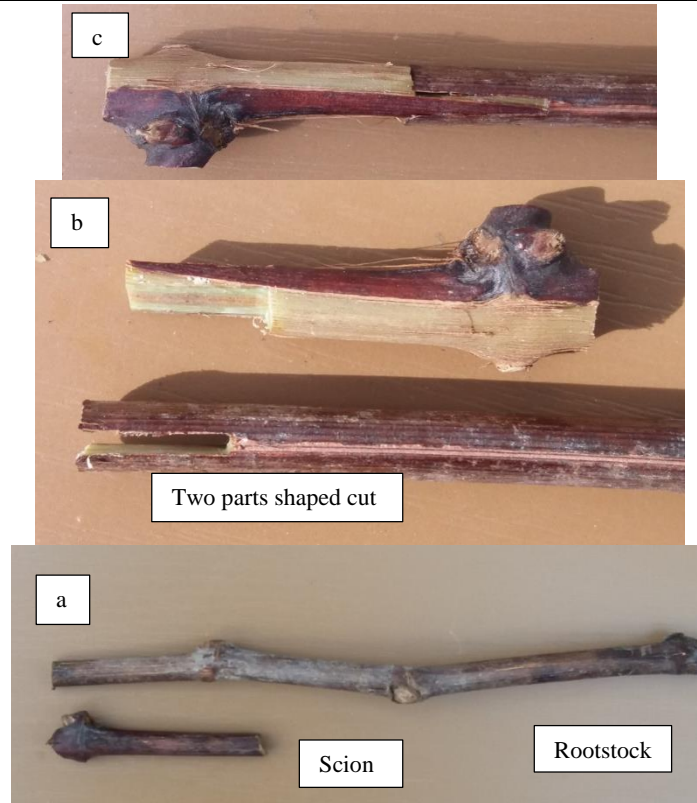


Figure 2. Grafting with new machine (d,e,f)

Structure of Motorized Machine

The motorized graftin machine is made up of three stainless steel cutting gears, which are mounted on a table with 180 W (1/4 HP) power and 2900 rpm electric motor, which acts as a shaft knife (Fig.3A/ 2, 4, 6). Two washers are placed between these cutting teeth. Gears 2 and 4 have a thickness of 5 mm, a diameter of 10 cm, and 80 teeth, each of which serves as a cutting blade. The gear, numbered 6 is the same diameter (10 cm) and has a thickness of 2.5 mm and carries 100 cutting teeth. The center hole diameter of all three gears passing through the motor shaft is 12 mm (26,27,29).

To adjust the length of the protrusion of the scion (or root), a washer (Fig. 3A/3) with a diameter of 2.5 mm and a diameter of 7 cm is inserted between two teeth No. 2 and No. 4; a second washer of 7 mm in diameter and 10 mm in thickness was placed between the gears No. 4 and No. 6 to adjust the depth of the groove in the root (or scion) (Fig. 2/5)

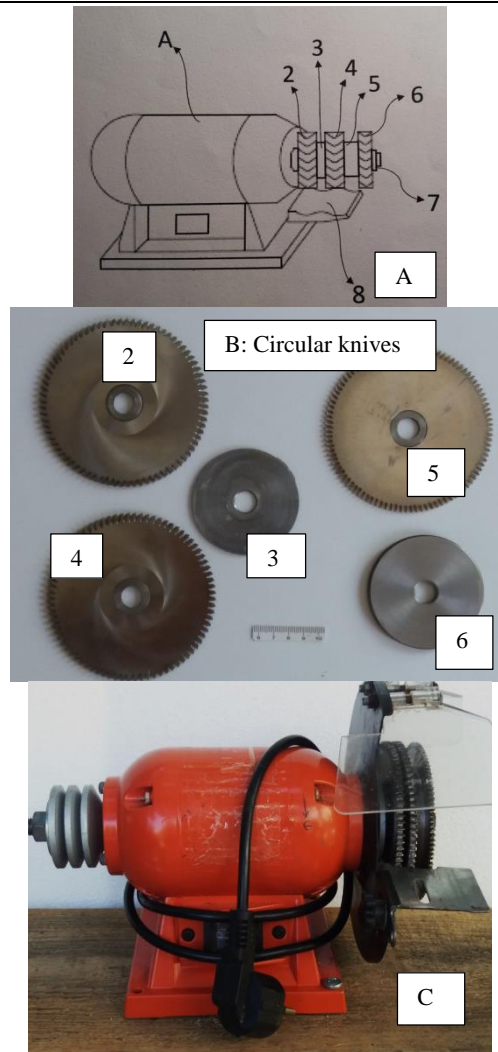


Figure 3. New grafting machine (A: Schematic , B: Circular knives, C: Actuel).

Working Principles of Motor Grafting Machine

It is desired that the rootstock and the scion used in the production of grafted rootstock seedlings have the same thickness, that is, 7-12 mm in diameter. To make a protrusion-shaped wound on a scion with 5 to 6 cm length and carrying an eye, insert the scion between cutter blades 2nd and 4th in motion and trim it until the touch to 3rd washer.

If the rootstocks are prepared 35-40 cm long and the eyes are blunted, the number 6th blade is used to open a suitable burrow for scion protrusion-shaped. The depth of the burrow is adjusted to the desired length by the number 5 washer. The same size (2.5 cm) and width (2.5 mm) recess and protrusions can be opened by the same diameter but different thickness of number 3 washer (diameter 7 cm, thickness 2.5 mm) and number 5 washer (diameter 7 cm, thickness 10 mm). The reverse can also be done if these chopping operations are done on the rootstock and scion.

Since the indentations and protrusions in the rootstock and scion are of the same size, they are tightly interlocked and there is no need to make the wrapping. The grafts are paraaffinized and stratified in moistened sawdust for 22 days at 28 °C and held at 85-90% humidity, then re-paraaffinized and planted in the nursery (22,26).

In order to avoid accumulation of the cutting tooth coming out of the chipped pieces in the motorized layer, tooth depth was chosen as 4.5 mm, the distance between the teeth was 3.5 mm and the tooth angle was 30°.

3.RESULTS AND DISCUSSION

The same grape variety (Merlot) and rootstock (SO4) were grafted to each other by means of the conventional production stages and were planted in the nursery to test the usability of the motorized grafting machine and to compare with the

current omega grafting machine in terms of 1st grade grafted-young vines yield. The grafted-young vines that were removed from the nursery in the autumn were compared in terms of both first class quality criteria and efficiency. With this preliminary experiment, the yield of grafted-rooted young vines exceeding 1 st class was found to be 20% in the omega grafting machine, but 60% in the motorized grafting machine. As can be seen in Table 1, a higher rate is obtained in the motorized grafting machine at the exit from the callusing chamber.

Table 1. Yield of grafted-rooted young vines

	Omega grafting machine	Motorizedgrafting machine
Number of grafted cuttings	100	100
Exit rate in callusing chamber (%)	55	85
1st grafting yield from nursery(%)	20	60

The study was not preliminary trial, so no statistical analysis was done

Total first class grafted vine production is about 3 million But Turkey needs 10 million. This ratio, between two devices is very important in Turkey.

The high ratio of the motorized grafting machine is due to the excess of the cambium contact surface on the rootstock and scion. For example, in a 10 mm diameter rootstock and a scion, the cambium contact surface of the omega graft is 6 cm in length, whereas the length of the cambium on the contact surface is 16 cm when the protruding length and protrusion length of the scion and the rootstock of the motor are selected to be 2.5 cm. It improves the rate of grafting through overfitting and reduces the losses in production phases (22,26,27). By varying the diameter of the washers placed between the cutting blades of the motorized grafting machine (Fig.3A/, 3,5), the length of the indentation and protrusion in the rootstock and the scion can be changed. Although omega grafting is used to graft scion and rootstocks that are 7-12 mm in diameter, thicker rootstocks and scion (20 mm) can be grafted together with a motorized graft. Motorized graft device can also be used to graft rooted of apples, walnuts and some forests and ornamental plants . In the production of grafted vines, the use of this tool in a wider form will continue.

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Investigation of Specific Surface Area and Pore Size Distribution Changes of CaSO_4 in the Presence of Poly (Sodium 4-Styrenesulfonate)

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Abstract: Although, people does not desire the calcium sulfate (CaSO_4) fouling deposits in the industrial heat exchangers, CaSO_4 has been widely used in many areas. Its anhydrous form is used as a desiccant. Calcium sulfate hemihydrate ($\text{CaSO}_4 \cdot 0.5\text{H}_2\text{O}$) is used in building sector, and also used in dentistry as cast or die, and in medicine for drug carriers. $\text{CaSO}_4 \cdot 0.5\text{H}_2\text{O}$ is transformed into calcium sulfate dihydrate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), called gypsum by reacting with water. Gypsum is quite common in nature. Generally, it is burned in kiln in process and thus some part of the water is removed and converted into hemihydrate form for commercial product. The properties of hemihydrate or anhydrate form affect the properties of the final product synthesized after reacted with water. The differentiation in the structures of the synthesized powder product can possible with the using additives during the crystallization. The changes in properties such as crystal morphology, particle size distribution, BET specific surface area and pore size distribution of these synthetically produced materials may be investigated instrumentally. The aim of this work is to investigate the change in BET specific surface area, pore volume and pore radius after CaSO_4 produced in the presence of poly (sodium 4-styrenesulphonate) is calcined.

Keywords: Crystallization, Specific Surface Area, Pore Size Distribution, Calcium Sulfate, Additive

1. INTRODUCTION

Calcium sulfate (CaSO_4) is an odorless, white powder, crystalline solid. It exists in various hydrate forms such as gypsum - $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. Besides gypsum, there are two other types in nature: calcium sulfate hemihydrate - $\text{CaSO}_4 \cdot 0.5\text{H}_2\text{O}$ and calcium sulfate anhydrite - CaSO_4 . Solubilities of them are very less in water. Its usage areas are binder for building material, bone graft materials, periodontal disease treatment, endodontic lesions, alveolar bone loss, maxillary sinus augmentation, filler for plastic, rubber, coating, and construction materials, desiccant, coagulant, and catalysts. The need for high porosity and specific surface area for calcium sulphate arises in applications such as desiccants, catalyst, medicine and dentistry.

Non-porous solids can be recognized by low specific surface area and low specific pore volume. On the contrary, porous solids are defined by high specific surface area and high specific pore volume. IUPAC has been classified pores as follow:

micropores (Diameter of pore < 2 nm),
mesopores ($2 < \text{Diameter of pore} < 50$ nm),
macropores (Diameter of pore > 50 nm).

The nitrogen adsorption technique is widely used for detecting open pores mainly in the micro- mesopore region. The specific surface area (SSA) was generally determined from the adsorption isotherms by the BET method. The pore volume was calculated from the adsorbed mass near saturation using the density of liquid nitrogen at 77 K (0.808 g/cm^3) and assuming that pores are filled subsequently with condensed adsorbate in the normal liquid state.

Finally, the average pore size distribution was deduced according to BJH and DFT method using adsorption-desorption isotherms. Also, the pore volume and pore radius were estimated by the same methods.

Poly (sodium 4-styrenesulfonate) (PSSS) as additive in this study was chosen by reason which it has not been used previously as additive for CaSO_4 crystallization. In addition to affecting growth during crystallization, the additive material also enters the structure. Then pores are formed by removal of additive from the structure.

2. MATERIALS AND METHODS

Synthesis of CaSO_4 was carried out in a water-jacketed glass reactor of 1 L capacity at 20°C , 30°C , and 40°C . The concentration of $[\text{Ca}^{2+}]$ was changed between 0.24 and 0.72 mol/L. $[\text{Ca}^{2+}]/[\text{SO}_4^{2-}]$ ratio was selected 0.5, 1 and 2.

Supersaturated solutions for experiments were prepared by mixing of 250 mL volume of calcium chloride (CaCl_2) and 250 mL volume of sodium sulfate (Na_2SO_4) solutions.

In the experiments where PSSS was used a similar procedure was followed. PSSS polymer was added to the calcium solution. The amount of the PSSS was varied from 0.008 to 0.152 g/L. In this study, molecular weight of PSSS polymers were 70,000 and 1,000,000 g/L; and entire chemicals were purchased from Sigma-Aldrich.

For this study, Taguchi experimental method was selected and in design of experiment, four factors and three levels were used with PSSS. Table 1 is summarized L^9 orthogonal experimental design. Therefore, number of experiments has decreased due to the avoiding full factorial design.

Table 1. Selected factors and levels for the study

Factor	Level 1	Level 2	Level 3
[Ca ²⁺] (mol/L)	0.24	0.48	0.72
[Ca ²⁺]/[SO ₄ ²⁻] ratio	0.5	1	2
Temperature (°C)	20	30	40
[PSSS] (g/L)	0.008	0.08	0.152

Table 2. Taguchi L^9 orthogonal experimental design for the study

	A	B	C	D
Exp. No.	[Ca ²⁺] (mol/L)	[Ca ²⁺]/[SO ₄ ²⁻]	Temperature (°C)	[PSSS] (g/L)
Exp 1	0.24	0,5	20	0.008
Exp 2	0.24	1	30	0.08
Exp 3	0.24	2	40	0.152
Exp 4	0.48	0,5	30	0.152
Exp 5	0.48	1	40	0.008
Exp 6	0.48	2	20	0.08
Exp 7	0.72	0,5	40	0.08
Exp 8	0.72	1	20	0.152
Exp 9	0.72	2	30	0.008

The CaSO₄ samples from all experiments were burned in an oven at 500 °C for 5 hours. BET specific surface area, pore size distribution, and pore radius analyzes of calcined samples were performed by using Quantachrome NovaTouch Lx⁴.

3.RESULTS AND DISCUSSION

BET specific surface area results are presented in a summary table (Table 3). The result of comparing the same experiment sets can be concluded definitively, that the specific surface area is increased in the presence of high molecular weight PSSS. For material produced using PSSS with low molecular weight, it is not right to use this generalization.

Table 3. BET specific surface area (m²/g) responses

Exp. No.	R1 (no additive)	R2 (PSSS 70)	R2 (PSSS1M)
Exp 1	7.52115	8.26269	64.9434
Exp 2	4.85763	10.5698	65.8015
Exp 3	10.8559	11.6692	145.597
Exp 4	4.10831	20.3538	37.7225
Exp 5	16.1973	20.3714	44.4754
Exp 6	12.3431	9.3586	20.2583
Exp 7	6.25209	2.84077	48.5697
Exp 8	4.2245	17.7046	34.209
Exp 9	4.0991	6.9047	33.3927

When Table 4 is examined, it is clearly seen that the pore volume increases in the presence of PSSS polymer. However, the high molecular weight polymer is more effective in increasing pore volume

Table 4. Pore volume (cm³/g) responses

Exp. No.	R1 (no additive)	R2 (PSSS 70)	R2 (PSSS1M)
Exp 1	0.0054	0.0085	0.0585
Exp 2	0.0056	0.0224	0.0731
Exp 3	0.0114	0.0366	0.1244
Exp 4	0.0042	0.0207	0.0177
Exp 5	0.0066	0.0225	0.0519
Exp 6	0.0049	0.0256	0.0388
Exp 7	0.0045	0.0062	0.0449
Exp 8	0.0062	0.0194	0.0405
Exp 9	0.0053	0.0113	0.0310

From Table 5 it can be seen that the pore radius remains almost the same and the results are not going to allow generalization.

Table 5. Pore radius (nm) responses

Exp. No.	R1 (no additive)	R2 (PSSS 70)	R2 (PSSS1M)
Exp 1	1.5799	1.5849	1.58134
Exp 2	1.58934	1.8668	1.59217
Exp 3	1.72169	1.59179	1.72549
Exp 4	1.85801	1.58158	1.85455
Exp 5	1.86092	1.58634	1.7248
Exp 6	1.85455	1.5824	2.01745
Exp 7	1.86023	1.86579	1.58591
Exp 8	1.59847	1.57841	1.57934
Exp 9	1.57887	1.86741	1.71589

When looking at the tables, in the presence of PSSS the pore radius are almost the same, but the pore volume increases. This case shows that pores increases towards the material depth.

As a result of the Taguchi design analysis it was possible to optimize separately for the BET specific surface area (Fig. 1), pore size distribution (Fig. 2) and pore radius (Fig. 3).

- To produce the highest BET surface area:

In the absence of additive, it should be applied the [Ca²⁺] concentration of 0.48 M, reactant ratio of 2 and the temperature of 40 °C (Fig. 1a).

In the presence of PSSS70K, it should be applied the additive concentration of 0.152 g/L, the [Ca²⁺] concentration of 0.48 M, reactant ratio of 1 and the temperature of 20 °C (Fig. 1b).

In the presence of PSSS1M, it should be applied the additive concentration of 0.152 g/L, the [Ca²⁺] concentration of 0.24 M, reactant ratio of 2 and the temperature of 40 °C (Fig. 1c).

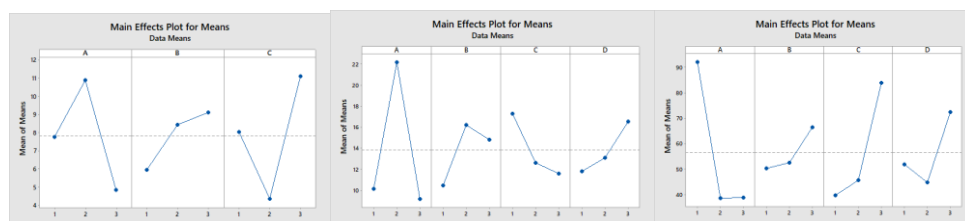


Figure 1. Optimization analysis of BET SSA: (a) no additive, (b) in the presence of PSSS70K, (c) in the presence of PSSS1M

- To maximize the pore volume:

In the absence of additive, it should be applied the [Ca²⁺] concentration of 0.24 M, reactant ratio of 2 and the temperature of 40 °C (Fig. 2a).

In the presence of PSSS70K, it should be applied the additive concentration of 0.152 g/L, the [Ca²⁺] concentration of 0.48 M, reactant ratio of 2 and the temperature of 40 °C (Fig. 2b).

In the presence of PSSS1M, it should be applied the additive concentration of 0.152 g/L, the [Ca²⁺] concentration of 0.24 M, reactant ratio of 2 and the temperature of 40 °C (Fig. 2c).

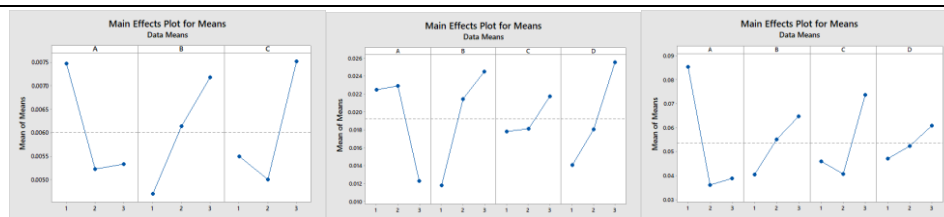


Figure 2. Optimization analysis of pore volume: (a) no additive, (b) in the presence of PSSS70K, (c) in the presence of PSSS1M

- To maximize the pore radius:

In the absence of additive, it should be applied the $[Ca^{2+}]$ concentration of 0.48 M, reactant ratio of 0.5 and the temperature of 40 °C (Fig. 3a).

In the presence of PSSS70K, it should be applied the additive concentration of 0.08 g/L, the $[Ca^{2+}]$ concentration of 0.48 M, reactant ratio of 0,5 and the temperature of 40 °C (Fig. 3b).

In the presence of PSSS1M, it should be applied the additive concentration of 0.08 g/L, the $[Ca^{2+}]$ concentration of 0.48 M, reactant ratio of 2 and the temperature of 20 °C (Fig. 3c).

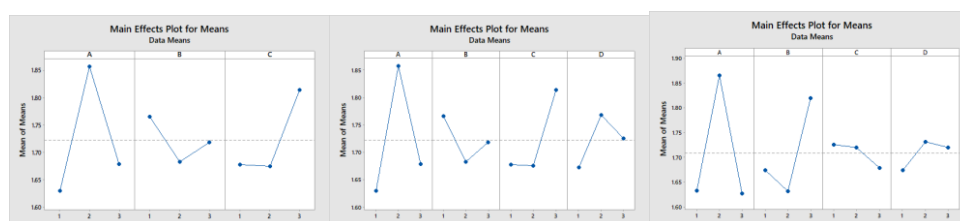


Figure 3. Optimization analysis of pore radius: (a) no additive, (b) in the presence of PSSS70K, (c) in the presence of PSSS1M to maximize the pore radius:

The main results obtained from this study are listed below

- BET SSA, pore volume and pore radius has been optimized for calcium sulfate synthesis.
- The PSSS polymer has been shown to be effective on BET SSA and pore volume.
- When the molecular weight of the PSSS polymer is increased, the BET SSA, pore volume values are increased.

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Effect of Parameters on Borax Extraction from Ulexite at Atmospheric Pressure

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Abstract: In today's world, where science and technology are developing rapidly, it is of utmost importance that materials with industrial, economical, safe and aesthetic qualities are presented and used. Among the most important factors affecting the development of materials, the countries' underground wealth is of great importance. Over the world, considering the total production value, thanks to 53 different metals and minerals located in Turkey is the 28th among top 132 countries in mining. Boron ores are one of Turkey's most important mineral assets. In Turkey, the processing of these ores is vital in terms of both employment and added value. The boron ores produced commercially in Turkey are colemanite, tincal and ulexite. Boric acid from colemanite and boraxes from tincal are produced as finished product, while ulexite is exported as concentrated ore. In this study, the interaction of ulexite with water at atmospheric pressure was investigated. The work was carried out in a jacketed glass reactor. In the studies the temperature (30, 50, 70, 90 °C), solid / liquid ratio (1/100, 2/100, 3/100, 4/100, 6/100, 10/100 g.mL), particle size (-590+350, -350+250, -250+180, -180+150 µm) and mixing speed (350, 450, 550 rpm) were used as parameters. As a result, it was determined that extraction of borax was performed in the form of dissolution of ulexite mineral in studies and chemical structure was not observed any change. Solubility was not affected solid to liquid ratio, particle size and stirring speed. But, temperature was effect on solubility.

Keywords: Ulexite, Boron Mineral, Extraction, Solubility

1.INTRODUCTION

Boron minerals are natural compounds containing boron oxide (B_2O_3) in different proportions in their structure. There are more than 230 boron minerals in the nature, commercial importance include: tincal, colemanite, kernite, ulexite, boracite, szaybelite and hydroboracite.

Ulexite, which has the chemical formula $Na_2O \cdot 5B_2O_3 \cdot 16H_2O$, has a triclinic crystal system. It has a hardness of 2.5 Mohs and a density of 1.955 g/cm^3 . The white colorless, silky and glassy structure of ulexite has a fragile structure. In its pure state it contains 42.95% B_2O_3 and 13.79% CaO. Ulexite is less soluble in cold water, more soluble in hot water, and readily soluble in acid.

In some countries, this mineral reacts with H_2SO_4 in the boric acid production process to form boric acid, gypsum and sodium sulfate. But, in Turkey, it can not be processed and exported in form of concentrated ore.

Boron ores mined contact with water in concentration processes and /or on open areas thrown it away. Boron contents of wastewaters becoming in these processes are important environmentally. These wastewaters increase boron concentration of soil, surface waters and ground waters in the area they are in. The greater the solubility of boron in the water, the greater the effect. In this respect, it is important to determine the water solubility of the boron ores.

Many studies have been carried out on the dissolution of ulexite in various acids. These studies are generally directed at examining the kinetics, optimization and dissolution mechanism of the dissolution.

In this study, the water solubility of ulexite is examined, the effect of various parameters on solubility is evaluated and an empirical model is presented for solubility change with temperature.

2.MATERIALS AND METHODS

Pure ulexite samples obtained from Bigadiç Operation of Eti Mining General Directorate were used in the studies. These specimens were mechanically cleaned and then milled with a laboratory grinder and sieved with standard sieves to separate into fractions and -590 + 350 µm fraction was used in experiments. In chemical analysis of the sample which XRD is given in Figure 1, it was found that it contained 7.50% Na_2O , 13.70% CaO, 43.02% B_2O_3 and 35.40% H_2O .

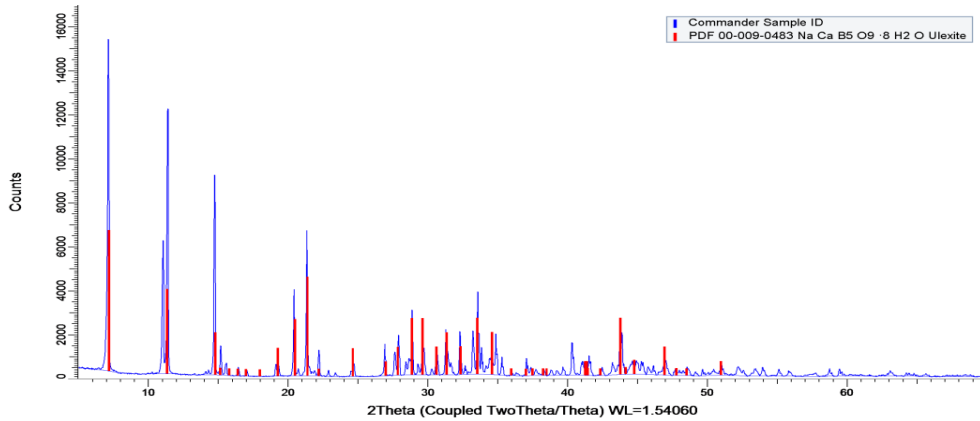


Figure 1. X-Ray diffractogram of the ulexite example used in experiments

The experiments carried out at 30, 40, 50, 60 and 70°C with samples of -590 + 350 µm. Solid to liquid ratio was taken as 2 g/100 mL water and stirring speed 350 rpm.

In the experiments, 500 mL of water was added to the reactor, and after the desired temperature was reached, ulexite was added to reactor stirred at a constant stirring speed. B₂O₃ analysis was performed on taken liquid samples at defined intervals. Also, in solid samples B₂O₃, CaO and Na₂O analyzes were also performed.

In B₂O₃ analysis, the pH of the solution was brought to 7.6 using HCl and NaOH solutions and then, mannit has been added enough and titrated with 0.05 M NaOH solution until the falling pH is 7.6.

To calculate the amount of B₂O₃ in the solid samples, a certain amount of sample was dissolved with HCl, filtered and then B₂O₃ was analyzed as above. Also Na₂O and CaO analysis were carried out with another sample from the solution, using AAS.

The amount of B₂O₃ from the obtained NaOH solution consumption was calculated by the following equation:

$$\text{B}_2\text{O}_3 \text{ amount(g)} = \frac{V \cdot F \cdot M \cdot 35}{1000} \quad (1)$$

Where V is the volume of used NaOH solution to titrate B₂O₃ in total liquid, F is the solution factor, and M is the molarity of the solution.

From this, the concentration of ulexite (g/L) in solution can be calculated as follows:

$$\text{Concentration of ulexite } \left(\frac{\text{g}}{\text{L}}\right) = \frac{\text{B}_2\text{O}_3 \text{ amount} \cdot 812/350}{400} \cdot 1000 \quad (2)$$

In addition, XRD graphs were taken the solid residues obtained at the end of the experiments.

3.RESULTS AND DISCUSSION

Effect of Temperature on the Solubility of Ulexite

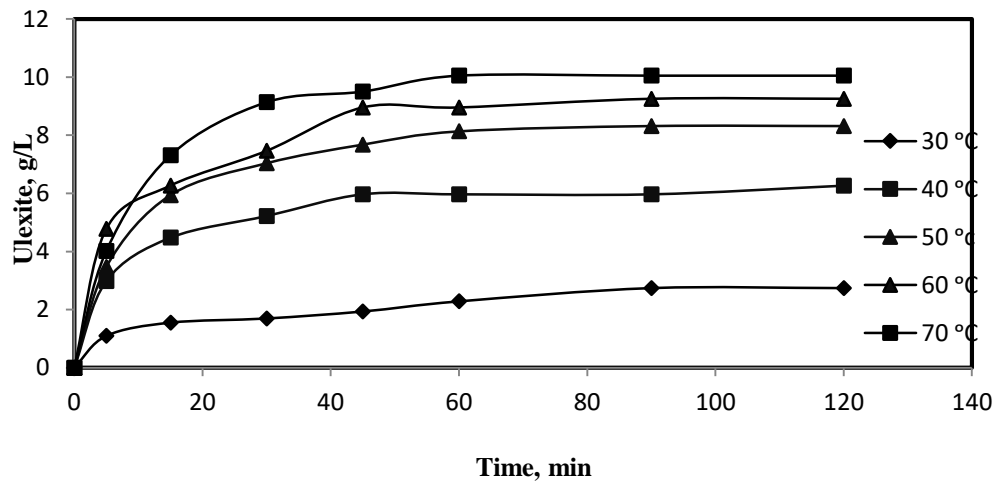


Figure 2. Effect of temperature in solubility of ulexite

Effect of temperature in solubility of ulexite is shown in Figure 2. It is seen that the solubility increased with increasing temperature. At 30 °C, the solubility reaches equilibrium in 90 minutes, while at other temperatures the it reaches equilibrium between 45-60 minutes. In other words, solubility rate increases with increase of temperature.

Solution Mechanism

Both the solubility values obtained at different temperatures and the analysis of the solid waste indicate that there is no chemical change during solution. As a matter of fact, according to the results of the analysis given in Table 1, the analysis results of the solid wastes obtained in the experiments with the analysis of the ulexite sample used in the experiments are the same. This means that ulexite shows solution behavior like a normal salt in studied temperatures. The XRD of the solid waste shown in Figure 3 confirms this, too.

Table 1. Analysis result of solid residue obtained an ulexite sample in experiments

Temperature(°C)	Sample	Component (%)			Total	Component (%)		
		Na ₂ O	CaO	B ₂ O ₃		Na ₂ O	CaO	B ₂ O ₃
30	8				7.58	7.56	13.5	42
50		7.5	13.7	43.02	4.7	7.51	13.5	42
70					4.61	7.53	13.5	42

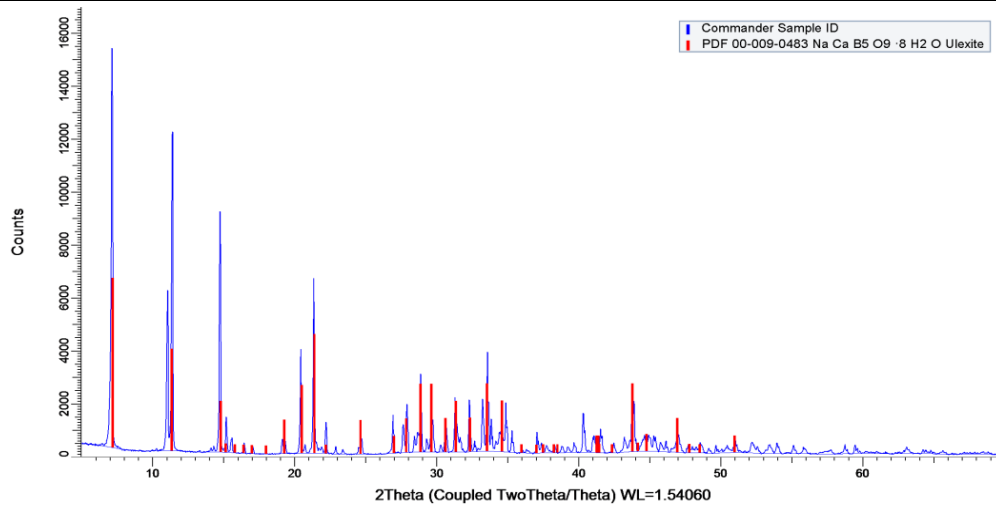


Figure 3. XRD analysis result of solid residue at 70 °C

Modeling the Solubility

The solubility values obtained at different temperatures were used for the mathematical modeling of the solubility. As a result, first and second pre-mathematical models were obtained from the graphs given in Figure 4. First degree model is as

$$\text{Solubility of ulexite (g/L)} = 0.1852T - 2.1808 \quad (R^2 = 0.9101) \quad (3)$$

Second degree model is as

$$\text{Solubility of ulexite (g/L)} = -0.0047T^2 + 0.6506T - 12.88 \quad (R^2 = 0.9907) \quad (4)$$

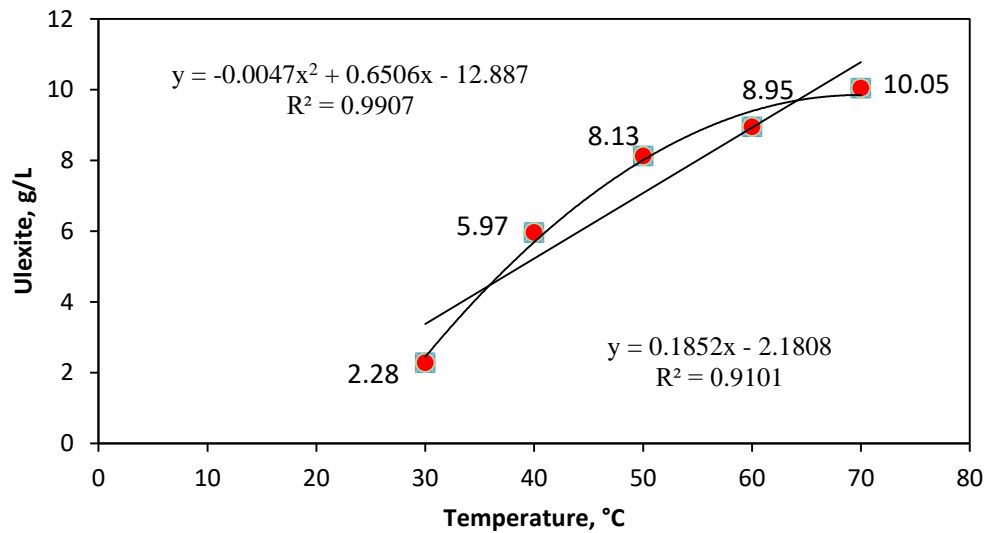


Figure 4. Effect of temperature on solubility of ulexite

Kinetics of Solution of Ulexite in Water

Firstly, the initial velocities of the temperature curves in Figure 2 was calculated. Then, taking into account the expression

$$\ln r_o \propto \frac{E}{RT}, \quad (5)$$

$$\ln r_o \text{ versus } \frac{1}{T} \text{ was drawn.} \quad (6)$$

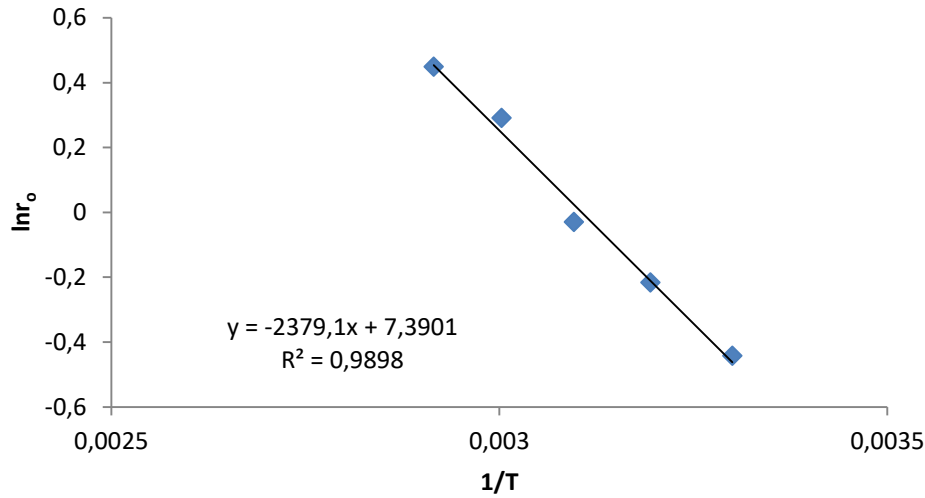


Figure 5. Graph of $\ln r_o$ versus $\frac{1}{T}$

For activation energy of solution, it was found the following expression

$$r_o = -2379,1 / T + 7,3901 \quad (R^2 = 0,9898)$$

(7)

Using above equation, the activation energy was calculated as 19.78 kJ/mol.

Obtaining the different solubility values at different grain sizes and different solid/liquid ratios are related to the change in dissolution conditions. As a matter of fact, the values given in the literature regarding the solubility of slightly soluble salts are generally different from each other.

The activation energy of the solubility of 19.78 kJ/mol is compatible with the dissolution process being a physical process.

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Sustainable Urban Open-Green Areas and Xeriscape Approach: The Example of Nevşehir

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Abstract: Today, the demand for water is increasing due to the global climate change, industrial development and accordingly increasing environmental problems. Excessive consumption of water resources has led to the reduction of usable water resources, and this is a major problem all over the world. In this context studies have begun on the concept of xeriscape, where water is used effectively in open-green areas. The aim of this study is to determine the suitability of the plants for xeriscape used in Nevşehir, which is an Central Anatolian city with arid climatic conditions, and to bring proposals solutions. As a result, considering of the natural ecology of the region natural plant species in landscape design or drought-resistant species should be especially careful to choose and use.

Keywords: Xeriscape, landscape design, urban green spaces

1. INTRODUCTION

Water is a vital resource for the continuity of the nation by being the most basic necessity of the individual and the source of the main economic activities (Anonymous, 2018a). It has also been one of the basic elements of human life throughout history due to its functions such as irrigation, drinking, defense, cleaning, transport, rest and entertainment. However, along with the increase of the world population, increasing unconscious consumption of natural resources and drought, the water resources of our country and all over the world are gradually decreasing.

The water economy of a city should be calculated by considering landscape elements within the development process of the city and the path of sustainable utilization of its natural resources must be followed (Çepel, 1988). In the past years, especially in applications of the landscape architecture, while the first goal was to increase the quality of the environment-ambiance relationship; today, the main goal is to remove the problem arisen due to global warming by using drought tolerant species in the work of planting (Ertop, 2009). In this context, other than those the traditional landscaping approaches such as Water-Efficient Landscaping, Water-Wise, Water-Smart, Low-Water and Natural Landscaping, new approaches of landscape design emerged. Among these approaches, the most preferred one of today's applications is the approach of Xeriscape Design (Barış, 2007).

The main purpose of Xeriscape Design is to reduce water use to the minimum and to protect water resources by using plants with less need of water (xerophytic plants) (Barış, 2007). In this context, a successful Xeriscape landscaping can be realized by following 7 basic principles (Gary L. Wade et al., 2007). These principles are; correct design, improvement of soil conditions and soil, choosing suitable plant species, reduction of lawn areas, effective irrigation, use of mulch and proper care (Tülek and Barış, 2011; Barış 2007; Yazgan and Özyavuz, 2008; Gary L. Wade et al., 2007; Çakırcıoğlu, 2011; Bayramoğlu and Demirel, 2015).

The green areas arranged in the framework of these principles are aesthetically satisfactory and provide water saving, material saving and time saving. It is also ecologically beneficial because it provides water conservation without deteriorating the structure of the soil and selecting the right plant species. However, today, exotic plant species that are not unique to the region are used in both refuges and parks, large lawn areas are created, and seasonal plant groups based on visual effects are included (Gül et al., 2012). Plant species used in xeriscape design are usually natural, consuming less water and drought-tolerant plants (Vasishth, 2008). In this context, the ability of adaptation of natural plant species to be high and durability to draught increases the continuity and success of landscape designs (Gül et al., 2012).

In this study, it was aimed to determine the appropriateness of the plants used in the central refuges of the main road axes of the city of Nevşehir in the direction of xeriscape principles within the scope of sustainable green areas and to offer appropriate solutions in accordance with the principles of xeriscape approach.

2. MATERIALS AND METHODS

(1) Zübeyde Hanim Street, (2) 80. Year Boulevard, (3) Ürgüp Street, (4) Necip Fazıl Kısakurek Boulevard, (5) Kayseri Street -Atatürk Boulevard, (6) Ali Dirikoc Boulevard and (7) Aksaray Street-Fevzi Çakmak Street which form the main road axes of Nevşehir city constitute the main material of the work (Figure 1). Central refuges and crossroads were studied

theoretically in terms of xeriscaping in the context of sustainable green areas and their suitability for Xeriscape Design was analyzed.



Figure 1. Study area

Geographical Location, Climate and Soil Characteristics of Nevşehir Province

Nevşehir is located between 38° 12' and 39° 20' northern latitudes and 34° 11' and 35° 06' east longitudes in the Central Anatolia Region. Apart from the Derinkuyu district in closed basin of Konya, the total area of the province that enters in the Middle Kızılırmak Basin as a whole is 5392 km² and its altitude is 1259 meters (Anonymous, 2017).

Nevşehir has a typical continental climate with hot and dry summers and cold and rainy winters. There is steppe vegetation cover dominates the general. Rainfall in the city falls in autumn and early spring. However, in recent years, depending on the climatic changes, the winters have been raining for a short time rather than snow. Depending on the planetary and geographical factors, the precipitation regime in Central Anatolia is a sign of continentality. 400 mm. isopleth draws the passing boundaries of the steppe (semi-arid) and semi-humid areas in Central Anatolia. According to Erinc; 400 mm isopleth is considered to be the lower limit of areas with moderate level of rainfall (Erinc, 1969). The annual average precipitation amount of the province is 422.9 mm. According to this value, Nevşehir is on the transition border of the steppe (semi-arid) and semi-humid areas. The highest temperature in summer is 39.5 °C, while the lowest in winter is -23.6°C (Anonymous, 2018b). In recent years, the spring months are generally rainy. The steppe vegetation cover that becomes green in these months is dried at the beginning of the hot weather of summer.

Most of the soils in the province are made of volcanic tuff. For this reason, the soil has permeable nature with medium and light structure. The soils that show the most spread area (diffusional area) in the province in general are Brown Soils, Colluvial Soils and Alluvial Soils (Şikoğlu, 2017).

Method in study consists of data collection, in-situ observation, analysis and evaluation phases. For this purpose, necessary information was obtained from the Nevşehir Municipality Parks and Gardens Directorate and the plants used in the central refuges and intersections were determined. The current situation was determined with the help of the information obtained after on-site observations and examinations; problems were identified, conclusions and recommendations were made.

3.RESULTS AND DISCUSSION

49 different species of plants are used in central refuges and intersections on (1) Zübeyde Hanim Street,(2) 80. Yıl Boulevard, (3) Ürgüp Street, (4) Necip Fazıl Kısakurek Boulevard, (5) Kayseri Street -Atatürk Boulevard, (6)Ali Dirikoc Boulevard and (7) Aksaray Street-Fevzi Çakmak Street which constitutes the main path axes of Nevşehir province and were chosen as the study area (Table 1).

When Table 1 is examined, it was determined that 26 of the total plant species that are used in the study area have low water demand, while 17 species have medium, 5 species have low / middle and 1 has high water demand (Figure 2). When species of plants that are used are examined; the species suitable for the Central Anatolia region with low water demand and tolerant to draught are used in Nevşehir city. But *Buxus sempervirens*, which is one of the species that could be well-grown in humid and calm regions with high level of water demand that has been preferred for hedging and bordering purposes. Since the root system of *Buxus sempervirens*, which is well-grown in well-drained and moist soil is superficial, its tolerance to draught is less(Karaca and Kuşvuran 2012). For this reason, *Eleagnus ebbingei*, *Mahonia aquifolium*, *Nandina domestica* can be used among the shrub groups which are always green with less water demand are more suitable for Central Anatolia region instead of *Buxus sempervirens*.



Figure 2. Refuges constitutes provincial axes roads (a: 80. Year Boulevard; b: Kayseri Street; c: Ali Dirikoc Boulevard; d: Ürgüp Street)

All across the study area; not much lawn surfaces are included since the regional climate is continental climate and the region is arid. However, the grass species used in the lawn area is a ready-to-use mixture including 20% *Festuca rubra rubra* (BARUSTIC); 20% *Festuca rubra commutata* (CALLIOPE), 20% *Lolium perenne* (BARSUNNY), 20% *Lolium perenne* (BARBLACK), 10% *Poa pratensis* (BARON) and 10% *Festuca arundinacea* (BARLEXAS II). This mixture is drought-tolerant, suitable for adverse environmental conditions, is resistant to diseases, is very suitable for dewatering and wasting, but the demand for water is high. The choice of large lawn areas leads to excessive water consumption (Tülek 2008). In this context, the lawn areas are not used intensively in the central refuge landscaping works in the whole city (Figure 3).



Figure 3. Lawn areas in central refuge in Nevşehir province

Instead of lawn areas, groundcover plant groups that increase the quality of visual aesthetic and consume less water could be preferred in order to be used together with the plant species in the area. In the study of Tülek and Baris (2011), it was suggested to use *Hypericum calycinum*, *Juniperus conferta* 'Blue Pacific', *Juniperus horizontalis*, *Phlox subulata*, *Trachelospermum asiaticum*, *Ajuga reptans*, *Sedum acre*, *Sedum sieboldii*, *Sedum spurium*, *Santolina chamaecyparissus*, *Sempervivum* sp., *Thymus serpyllum*, *Veronica liwanensis*, *Vinca minor* 'Alba' in Central Anatolian climatic conditions. By choosing these species, lawn areas with less water and less care demand could be created.

In areas where continental climate is dominant, such as Central Anatolia, the use of mulch is important in terms of water saving (Karaguzel ve Atik, 2007). However, mulching is not used in the study area.

With the increasing global warming in recent years, drip irrigation system is preferred in landscape design works in order to save water (Bayramoğlu et al., 2012). In the research area, sprinkler system was preferred as a method of irrigation system in the central refuges (Zübeyde Hanım Street, 80. Yıl Boulevard, Aksaray-Fevzi Çakmak Street, Ürgüp Street, Necip Fazıl Kısakürek Boulevard) where the trees are located, however drip irrigation system was preferred as a method of irrigation system in the central refuges (Kayseri Street -Atatürk Boulevard, Ali Dirikoç Boulevard, Ürgüp Street, Necip Fazıl Kısakürek Boulevard) where the shrub groups and trees are used together.

Table 1. Nevşehir kenti orta refüjlerde kullanılan bitkiler

No	Latin Names of plants	Turkish names of plants	Species	Water demand
1	<i>Acer negundo</i>	Dişbudak yapraklı akça ağaç	Tree	Medium
2	<i>Cedrus libani</i>	Toros sediri	Tree	Medium
3	<i>Fraxinus excelsior</i>	Adi dişbudak	Tree	Medium
4	<i>Pinus nigra</i>	Kara çam	Tree	Medium
5	<i>Robinia pseudoacacia</i>	Beyaz çiçekli yalancı akasya	Tree	Low
6	<i>Berberis thunbergii</i> 'Atropurpurea'	Kırmızı yapraklı kadın tuzluğu	Shrub	Low
7	<i>Gaura lindheimeri</i>	Gaura çalısı	Shrub	Low
8	<i>Juniperus chinensis</i> 'Pfitzeriana Aurea'	Altuni çin ardıcı	Shrub	Low
9	<i>Rosa sp.</i>	Gül	Shrub	Medium
10	<i>Rosmarinus officinalis</i>	Biberiye	Shrub	Low
11	<i>Ligustrum japonicum</i>	Japon kurtbağrı	Tree	Low/ Medium
12	<i>Cupressocyparis leylandii</i>	Melez servi	Tree	Medium
13	<i>Aesculus hippocastanum</i>	Beyaz çiçekli at kestanesi	Tree	Low
14	<i>Koeleria paniculata</i>	Fener ağacı	Tree	Low
15	<i>Tilia tomentosa</i>	Gümüşü ıhlamur	Tree	Low
16	<i>Pyracantha coccinea</i>	Ateş dikenini	Shrub	Low
17	<i>Thuja orientalis</i> 'Pyramidalis Aurea'	Altuni piramit mazı	Shrub	Low
18	<i>Malus sp.</i>	Süs elması	Tree	Low
19	<i>Cotoneaster salicifolius</i>	Söğüt yapraklı dağ muşmulası	Shrub	Low/ Medium
20	<i>Euonymus japonica</i> 'Aurea'	Altuni taflan	Shrub	Low/ Medium
21	<i>Juniperus horizontalis</i>	Sürünücü ardıç	Shrub	Low
22	<i>Catalpa bungei</i>	Catalpa ağacı	Tree	Low/ Medium
23	<i>Cupressus arizonica</i> 'Glaucua'	Mavi Arizona servisi	Tree	Low
24	<i>Cornus alba</i>	Kızılçık	Shrub	Medium
25	<i>Hibiscus syriacus</i>	Ağaç hatmi	Shrub	Medium
26	<i>Juniperus squamata</i> 'Blue Carpet'	Mavi yayılcı ardıç	Shrub	Low
27	<i>Lavandula sp.</i>	Lavanta	Shrub	Low
28	<i>Pyracantha coccinea</i> 'Nana'	Bodur ateş dikenini	Shrub	Low
29	<i>Thuja orientalis</i> 'Compacta Aurea Nana'	Altuni top mazı	Shrub	Low
30	<i>Eleagnus angustifolia</i>	Kuş iğdesi	Tree	Low
31	<i>Morus nigra</i> 'Pendula'	Siyah ters dut	Tree	Medium
32	<i>Picea pungens</i>	Mavi ladin	Tree	Medium
33	<i>Platanus orientalis</i>	Doğu çınarı	Tree	Medium
34	<i>Prunus ceracifera</i> 'Atropurpurea'	Kırmızı yapraklı süs eriği	Tree	Medium
35	<i>Robinia hispida</i>	Pembe çiçekli akasya	Tree	Low
36	<i>Robinia pseudoacacia</i> 'Umbraculifera'	Top akasya	Tree	Low

37	<i>Sophora japonica</i> 'Pendula'	Ters sofora	Tree	Medium
38	<i>Cupressus macrocarpa</i> 'Goldcrest'	Limoni servi	Tree	Medium
39	<i>Juniperus sabina</i>	Sabin ardıcı	Shrub	Low
40	<i>Juniperus virginiana</i> 'Skyrocket'	Kurşun kalem ardıcı	Shrub	Low
41	<i>Picea conica</i>	Konik ladin	Shrub	Medium
42	<i>Buxus sempervirens</i>	Adi şimşir	Shrub	High
43	<i>Chaenomeles japonica</i>	Japon ayvası	Shrub	Orta
44	<i>Hibiscus syriacus</i>	Ağaç hatmi	Shrub	Low
45	<i>Juniperus virginiana</i> 'Skyrocket'	Kurşun kalem ardıcı	Shrub	Low
46	<i>Syringa vulgaris</i>	Leylak ağacı	Shrub	Low
47	<i>Berberis crataegina</i>	İç Anadolu karamuğu	Shrub	Low
48	<i>Cotoneaster horizontalis</i>	Yayılıcı dağ muşmulası	Shrub	Low/ Medium
49	<i>Prunus mahleb</i>	Mahlep ağacı	Tree	Medium

The study area that forms the main axes of the city of Nevşehir is suitable for the xeriscape design approach in terms of planning and designing sustainable urban open-green areas. Plant species preferred in planting works in the field are plants with aesthetic contributions to the city and with low and moderate water demand.

The use of plant species with low water demands in xeriscape design works as well as the preference of natural species that are in harmony with the environmental conditions of the region is of great importance in terms of effective use of water. The majority of the plant species used in the central refuge and intersections throughout the study area are naturally propagated. Natural species preferred in conjunction with the concept of sustainability in xeriscaping require less maintenance than exotic species. In this context, in vegetation designs to be made in the region, natural (naturalistic) designs should be preferred in which the functionality is more important than aesthetic concern. Thus, holistic designs with less maintenance and costs that are suitable for the extreme climatic conditions of the region will be introduced.

Unless compulsory, it should be avoided from large lawn areas, and perennial groundcoverings should be used instead of flowers in terms of water consumption (Karaguzel and Atik, 2007). In this context, especially in the summer months, the use of grass intensively in the middle refugees and intersections increases the need for water, and if there is not enough irrigation, the grass burns in the fields and this situation shall be seen as the area is rank. Therefore, it is necessary to reduce the lawn surfaces in landscape designs of central refuges in Nevşehir city. In these areas, groundcoverings such as *Cotoneaster horizontalis*, *Juniperus horizontalis* and *Pyracantha coccinea* and *Sedum sp*, *Serpervivum sp*, *Carpobrotus edulis*, *Saxifraga paniculata* succulent which are aesthetically effective, perennial and need less water consumption as suitable for the purpose should be preferred. However, in order to keep the plant root area and soil surface moist, mulching must be done and in this context, large pebbles and dried leaves should be preferred.

As a result, Nevşehir, located in the Central Anatolia region where continental climate dominates, has plant species resistant to extreme heat. Plant species used within the scope of study are low or moderate in water demand, which is a favorable condition for the xeriscape design. Priority should be given to the use of natural plant species in landscape design work to be done in Nevşehir, and the use of exotic species should be avoided. In addition, the preference of natural species will contribute to the effective use of water in landscape design works.

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The Impact of Ork y Activities of the Giresun Regional Directorate of Forestry on Sustainable Rural Development

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Abstract: This study was handled to investigate and evaluate the impacts of activities of the ORK Y (Forest and Village Relations) of the Giresun Regional Directorate of Forestry (GRDF) on developing forest villages, reduction rural poverty, providing employment, prevention immigration etc., and thus to determine how successful of the ORK Y is in rural development. For this aim, the GRDF having intensive forestry and the ORK Y activities (economic and social credits, informing and training-consulting services etc.) was selected as the study area. The data obtained from the records of the GRDF and affiliated forest enterprises related to the ORK Y and forestry activities in the period of 2012-2016, and the information obtained from the questionnaires conducted on the forest villagers and forest managers were used as material in this study. The data was evaluated by graphs, charts and statistical analyses. At the end of the study, between 2012-2016, it was determined that the ORK Y gave total 12,613,594 TL credits to forest villagers to economic and social purposes, provided annual average 2,522,719 TL economic contribution, and the GRDF made total 1,406,898 TL fuelwood surplus (subvention) to forest villagers. In addition, it was determined that satisfaction levels of both forest villagers and forest managers from the activities of the ORK Y were “good”, that the ORK Y activities made positive contributions to rural development and to socioeconomic structure of forest villagers, to rural poverty reduction, immigration prevention, forest protection and sustainable forest management. Thus, it was understood that the ORK Y was effective and successful at “medium-good” level (50-75%) in sustainable rural development, and according to this results some recommendations were developed for implementation.

Keywords: Giresun Regional Directorate of Forestry, forest village, forestry, ORK Y, sustainable rural development

1.INTRODUCTION

The concept of sustainable development, which first appeared in our Common Future Report prepared by the World Environment and Development Commission in 1987, is described as *trying to meet the needs of present generations without jeopardizing the right of future generations to meet their own needs*. Sustainable development includes the use and conservation of all resources that society has and can achieve (Simula, 1997; Geray, 1998). In the sustainable development process, it is desirable that all activities and lives be sustainable in the urban, rural, local, regional, sectoral and social basis. Rural development needs to be ensured, especially considering the relation of rural life to environment and forest resources and the expectation of the community.

Sustainable forest management and sustainable forestry concepts gained importance at the United Nations Conference on Environment and Development (Rio Summit) in 1992. These concepts are defined as managing forest resources in an ecologically appropriate, economically feasible and socially beneficial way in line with the concept of sustainable development (Da demir, 2015). Meeting people’s future needs for food, water, health, energy and housing depends largely on how world forests are managed. So the path of sustainable development goes through sustainable forestry. Consequently, in order to ensure both sustainable forestry and sustainable development, it is necessary to develop the population living in the rural area. Ensuring sustainable rural development, the development of forest villages and the sustainable management of forest resources have a significant share (Da demir & Yılmaz, 2016).

To plan development in Turkey, it was passed in 1963 and the planned development period made. Fast, balanced and sustainable development approach was taken as basis in all development plans. Along with the planned period, various strategies have been developed in order to provide infrastructure services to rural areas and to accelerate rural development. In this context, a special attention has been given to the social and economic development of forest villagers who living in forest and adjacent to forest, and consisting of the poorest sections in Turkey.

In order to provide rural development and reduce the negative effects on forests, “the Village Development Branch” was first time established in 1957 in the General Directorate of Forestry (GDF). This branch was attached to the Ministry of Rural Affairs in 1964 as the “Head of Forest Villages Development”. In 1970, the General Directorate of Forestry and Village Relations (ORK Y) affiliated to the Ministry of Forestry was established *in order to protect the forests, to improve the social and economic situation of the forest villagers, to reduce the pressure on the forests and to prevent rural migration*. The ORK Y completed the foundation in 1970-1974 period, village development plans were made on the basis of districts and important studies were initiated accordingly. In 1982, the ORK Y was reduced to the level of

department head and attached to the GDF, and it was closed down in 1984 and its duties were transferred to the General Directorate of Organization and Support of the Ministry of Agriculture, Forestry and Rural Affairs. In 1991, with the establishment of the Ministry of Forestry for the second time, the ORKÖY was placed under the roof of the Ministry of Forestry (Tolunay & Korkmaz, 2005). In 2003, the Ministries of Environment and Forestry were merged and the ORKÖY was attached to this Ministry as General Directorate, and it served as Provincial Directorates of Environment and Forestry in the provinces. In 2011, the General Directorate of ORKÖY was closed, and the head of department was organized in the center of the GDF and the ORKÖY branch directories in the Regional Directorates of Forestry in the provinces. Its duties on the forest enterprises were given to the forest management chiefs and they still carry out its duties in this way.

ORKÖY, in the direction of its foundation purposes, made village development plans based on district to improve the socioeconomic structure of forest villages, lending credits for the development of forest villages, provided grants to village legal entities, presented informing and training-consultancy services and carried out many successful projects, and thus, contributed to sustainable rural development. However, failed reorganizations and institutional problems in the historical process of the ORKÖY have prevented services from fulfilling. After each reorganization, its staffs have moved away from the workplace or have changed their mission. Expert personnel were not adequately utilized and forest villagers were left to their own dynamics. In spite of this problem, the ORKÖY has undertaken a very important task such as the development of forest villages, carried out successful projects, contributed to sustainable rural development and became a brand. Therefore, the effects of the activities of ORKÖY, which has a historical past and a mission related to the future, on sustainable rural development and forestry studies should be examined (Daşdemir & Yılmaz, 2016). Additionally, the socio-economic and socio-political structure of the rural area needs to be analyzed to solve the problems in rural development (Tolunay, 2006).

Although some studies have been done regarding the development of forest villages in order to contribute to rural development in Turkey (Yurt et al., 1971; Acun, 1983; Acun & Geray, 1980; Çağlar, 1986; Daşdemir, 2002; Coşgun, 2005; Yılmaz, 2005; Soydan, 2010; Önal & Bekiroğlu, 2011; Alkan, 2014; Çok et al., 2016; Daşdemir & Yılmaz, 2016; Okutucu et al., 2016; Daşdemir & Köse, 2017; Daşdemir & Yıldırım, 2018), it is not yet sufficient.

Therefore, this study was conducted to examine the effects of the ORKÖY activities on the development of forest villages, forestry activities and sustainable rural development in the Giresun Regional Directorate of Forestry and its forest enterprises (Giresun, Espiye, Dereli, Tirebolu, Şebinkarahisar, Ordu, Ünye, Akkuş, Mesudiye, Koyulhisar) in the period of 2012-2016. By assessing the obtained data, it has been determined how effective and successful the ORKÖY activities are on the development of forest villages, rural poverty reduction, employment creation, migration prevention and forestry activities (forest growing, erosion and pasture work, wood production and forest crime).

2.MATERIALS AND METHODS

This study was carried out in the Giresun Regional Directorate of Forestry (GRDF) (Figure 1). The GRDF covers 16 districts of the Giresun province, 19 districts of the Ordu province and 4 districts of the Sivas province. The GRDF has 10 forest enterprise directorates, 5 in Giresun, 4 in Ordu and 1 in Sivas.



Figure 1. Study Area (GRDF, 2017)

The study area is 1,595 thousand hectares. 35% of this is forested and 65% is open. There are totally 1,534 villages in the study area. 797 (52%) of these are forest villages. In the study, data on economic and social credits, informing, training and consulting services, forest growing, erosion and pasture work, wood production and forest crime obtained from the records of branches and forest enterprise directorates of the GRDF for the period 2012-2016 were used as materials. Furthermore, according to the following formula (Orhunbilge, 2000; Daşdemir, 2016), which gives sample size in limited communities, considering the number (N = 1,663 persons) of forest villagers who received the ORKÖY credits in the GRDF,

$$n \geq \frac{Z^2 \times N \times p \times q}{N \times D^2 + Z^2 \times p \times q}$$

(1)

a questionnaire consisting of 19 questions was made on 140 forest villagers using 10% sampling error (D) and 95% confidence level and determined by random sampling method. The first 10 questions relate to the socioeconomic characteristics of villagers and the last 9 questions concern the evaluation of the ORKÖY activities. The last 9 questions were also applied to the 33 forest managers and technical staff. Questionnaires were conducted by face-to-face interview in 2016. All data obtained are evaluated and interpreted via graphics, charts and statistical analyzes.

3.RESULTS AND DISCUSSION

ORKÖY Credits

ORKÖY's credits to the forest villagers are divided into individual credits and cooperative credits. However, since all of the credits given by the ORKÖY in the GRDF are individual credits, only individual credits were evaluated in the study. Individual credits are divided into two types as economic purposes credits (beekeeping, milk and fattening cattle, milk and fattening sheep, carpentry, greenhouses, viticulture, olive farming, micro-credit etc.) and social purposes credits (roof covering, heating-cooking, solar water heating, exterior insulation and heating system, etc.). The distributions of the credits granted by the ORKÖY in the period of 2012-2016 to the provinces, districts, villages, houses, credit types and forest enterprises over the years are given in Tables 1, 2, 3 and 4.

Table 1. Distribution of the ORKÖY Credits by Years in the GRDF (2012-2016)

Years	Credit			Credit Amount (TL as of 2016)
	District Number	Village Number	Number of Unit (House)	
2012	18	59	234	1,484,534
2013	20	62	238	2,203,168
2014	14	54	490	2,948,620
2015	25	57	444	3,281,225
2016	11	33	257	2,696,047
Total	28	265	1663	12,613,594

*Monetary values were reproduced in 2016 by using the Yİ-UFE index table consisted of taking as 2003 = 100 and published by TÜİK.

Table 2. The ORKÖY Credits to the Provinces and Districts by Years in the GRDF (TL as of 2016)

Province	District	2012	2013	2014	2015	2016	Total	%
Giresun	Alucra	2,091	0	245,250	21,200	291,632	560,173	4.4
	Bulancak	6,273	0	137,013	63,600	0	206,886	1.6
	Çamoluk	94,265	0	0	0	0	94,265	0.7
	Çanakçı	0	6,171	74,393	90,948	0	171,512	1.4
	Dereli	2,091	553,817	386,242	252,280	240,260	1,434,690	11.4
	Espiye	4,182	194,689	417,743	167,427	0	784,041	6.2
	Eynesil	0	0	0	15,267	0	15,264	0.1
	Görece	0	28,435	0	98,792	78,768	205,995	1.6
	Keşap	6,273	87,120	99,844	42,400	170,560	406,197	3.2
	Merkez	0	10,285	0	95,400	95,940	201,625	1.6
Ordu	Şebinkarahisar	443,415	310,365	0	148,400	373,932	1,276,112	10.1
	Tirebolu	69,003	41,624	53,410	127,412	264,942	556,391	4.4
	Yağlıdere	8,364	91,960	0	142,676	0	243,000	1.9
	Province Total	635,957	1,324,466	1,413,894	1,265,799	1,516,034	6,156,150	48.8
	Akkuş	159,039	214,896	371,559	274,752	369,000	1,389,246	11.1
	Altınordu	33,456	363,000	139,956	0	0	536,412	4.3
	Aybastı	0	0	0	228,665	0	228,665	1.8
	Gölköy	270,477	104,907	249,686	98,474	0	723,544	5.7
	Gürgentepe	0	18,150	90,252	0	0	108,402	0.9
	Kabadüz	87,084	100,067	0	0	0	187,151	1.5
Sivas	Kumru	0	0	0	194,637	0	194,637	1.5
	Mesudiye	0	24,684	0	213,696	461,250	699,630	5.5
	Perşembe	8,364	18,150	0	31,800	0	58,314	0.5
	Ulubey	197,169	2,057	10,028	106,848	0	316,102	2.5
	Ünye	92,988	32,791	35,621	165,127	0	326,527	2.6
	Province Total	848,577	878,702	897,103	1,313,999	830,250	4,768,631	37.8
	Akıncılar	0	0	0	106,625	110,036	216,661	1.7
	Gölova	0	0	0	213,201	0	213,201	1.7
	Koyulhisar	0	0	637,524	290,016	239,727	1,167,367	9.3
	Suşehri	0	0	0	91,584	0	91,584	0.7
General	Province Total	0	0	637,624	701,427	349,763	1,688,814	13.4
	General Total	1,484,534	2,203,168	2,948,620	3,281,225	2,696,047	12,613,594	100

Table 3. The ORKÖY Credits Given to Years and Credit Types in the GRDF (TL as of 2016)

Credit Type		2012	2013	2014	2015	2016	TOTAL	%
Economic Purpose	Beekeeping	0	426,525	608,705	985,800	415,740	2,436,830	19.3
	Milk Sheep		392,040	546,613	381,444	369,000	1,689,097	13.4
	Milk Cattle	1,117,625	310,365	517,070	1037,096	1,605,727	4,587,883	36.4
	Buffalo Breeding	0	620,730	265,088	0	154,980	1,040,798	8.3
	Cutting Flower Breeding	0	254,100	69,760	0	0	323,860	2.6
	Micro Credit	0	0	0	11,448	0	11,448	0.1
Total		1,117,625	2,003,760	2,007,296	2,415,788	2,545,447	10,089,916	80.0
Social Purpose	Solar Water Heating	366,909	199,408	585,603	326,268	150,600	1,628,788	12.9
	Roof Covering	0	0	0	82,680	0	82,680	0.7
	Exterior Insulation	0	0	156,175	343,175	0	499,350	4.0
	Exterior Covering	0	0	199,546	66,674	0	266,220	2.1
	Solid Fuel Heating Systems	0	0	0	46,640	0	46,640	0.4
Total		366,909	199,408	941,324	865,437	150,600	2,523,678	20.0
General TOTAL		1,484,534	2,203,168	2,948,620	3,281,225	2,696,047	12,613,594	100

Table 4. The ORKÖY Credits Given to Provinces, Years and Forest Enterprises in the GRDF (TL as of 2016)

Province	Forest Enterprise	2012	2013	2014	2015	2016	Total	%
Giresun	Dereli	2,091	415,877	386,242	252,280	272,240	1,328,730	10.5
	Espiye	12,546	271,403	417,743	302,471	0	1,004,163	8.0
	Giresun	8,364	235,345	236,857	201,400	234,520	916,486	7.3
	Şebinkarahisar	539,771	310,365	245,250	169,600	665,564	1,930,550	15.3
	Tirebolu	73,185	91,476	127,803	340,048	343,710	976,222	7.7
Ordu	Akkuş	159,039	214,896	371,559	274,752	369,000	1,389,246	11.0
	Mesudiye	0	24,684	0	213,696	461,250	699,630	5.5
	Ordu	596,550	606,331	489,922	237,122	0	1,929,925	15.3
	Ünye	92,988	32,791	35,621	588,429	0	749,829	5.9
Sivas	Koyulhisar	0	0	637,624	701,427	349,763	1,688,814	13.4
Total		1,484,534	2,203,168	2,948,620	3,281,225	2,696,047	12,613,594	100

Accordingly, in the GRDF, a total of 12,613,594 TL credit for economic and social purposes was given to 1663 units in 28 districts and 265 villages in the period of 2012-2016. In other words, the ORKÖY provided an economic contribution to the forest villagers with an annual average of 2,522,719 TL. The highest credit was given in 2015, followed by 2014, 2016, 2013 and 2012 respectively. 48.8% of the total credit within 5 years period was given to 13 districts in the Giresun province, 37.8% to 11 districts in the Ordu province and 13.4% to 4 districts in the Sivas province. Within the provinces, the most credit was given to the Dereli (11.4%) and Akkuş (11.1%) districts, followed by the Şebinkarahisar and Koyulhisar districts, respectively. 80% of the credits are for economic purposes, 20% are for social purpose credits to reduce the consumption of fuelwood and the suppression on forests. In the period of 2012-2016, the highest amount of the ORKÖY credit was given at Şebinkarahisar, Ordu, Koyulhisar, Akkuş and Dereli Forest Enterprises and at least credit Mesudiye Forest Enterprise.

ORKÖY's Informing and Training-Consulting Activities

The ORKÖY performs a number of informing and training-consulting activities both before and after the credit application. Table 5 shows the distribution of such activities carried out by the ORKÖY branch directorate engineers and forest enterprise chiefs in the GRDF by years. According to this, in the 5-year period, 3469 informing and training-consulting activities were carried out in 322 villages in total. Such activities were carried out in 2013 at the most, and at least in 2011.

Table 5. ORKÖY's Informing and Training-Consulting Activities

Activity	2011	2012	2013	2014	2015	Total
Informing and Training-Consulting	238 activities in 65 villages	603 activities in 65 villages	29 activities in 73 villages	886 activities in 68 villages	968 activities in 56 villages	3469 activities in 322 villages

Socioeconomic Characteristics of Villagers Receiving the ORKÖY Credit

Findings and evaluations related to the socioeconomic characteristics obtained from the first 10 questions of questionnaire interviewed on 140 forest villagers who received the ORKÖY credit are presented in Table 6.

Table 6. Some Socioeconomic Characteristics of Villagers Received the ORÖY Credit

Feature	Groups	Number	Percent	Mean (\bar{x})
Age	18-40	33	24	49 year
	41-50	37	26	
	51-64	60	43	
	≥ 65	10	7	
Number of Households	1-2 people	31	22	4 people
	3-4 people	40	29	
	5-6 people	46	33	
	≥ 7 people	23	16	
Education Status	1. Illiterate	4	3	2,1 (Elementary School)
	2. Elementary School	118	84	
	3. High School	17	12	
	4. University	1	1	
Social Security	1. Yes	100	71	1,3 (Yes)
	2. No	40	29	
Land Amount	≤ 5 da	46	33	11 da
	6-10 da	36	26	
	11-15 da	24	17	
	16-25 da	19	14	
	≥ 26 da	15	11	
Animal Number	No	35	25	2,3 animals
	1-2 animals	49	35	
	3-4 animals	34	24	
	5-6 animals	14	10	
	≥ 7 animals	8	6	
Annual Income	$\leq 10,000$ TL	75	54	12.142 TL
	10,001-20,000 TL	38	27	
	20,001-30,000 TL	19	14	
	$\geq 30,001$ TL	8	6	
Annual Fuelwood Consumption	1-5 steres	30	21	8 steres
	6-10 steres	73	52	
	11-15 steres	32	23	
	≥ 16 steres	5	4	
Annual Fuelwood Cost	≤ 500 TL	27	19	754 TL
	501-750 TL	56	40	
	751-1000 TL	20	14	
	≥ 1001 TL	37	26	
Main Income Source	Agriculture-Animal husbandry	109	78	Agriculture-Animal husbandry
	Forestry	0	0	
	Other (salary, rent income etc.)	31	22	

The average age of forest villagers who received ORKÖY credits in the GRDF is 49, and the education level of their majority is low. 84% of them are primary school graduates and 4% are illiterate. Forest villagers are poor both income and land and animal assets. In forest villages, 8 steres of fuelwood are consumed per household per year. The forest villager pays an average of 754 TL for 8 steres fuelwood obtained from state forest enterprise. However, if they buy 8 steres of fuelwood from the market, they have to pay 1,600 TL. In other words, the state forest enterprise provided 846 TL (1,600-754) consumer surplus per year per household to the forest village.

Evaluation of the ORKÖY Activities

The last 9 questions of the questionnaire regarding the evaluation of the ORKÖY activities were applied to the 140 forest villagers who received both the ORKÖY credits and to the 33 managers in the state forest enterprise and the results are given in Table 7.

Table 7. Evaluation of the ORKÖY Activities

Evaluation Criteria		Villagers	Managers	All
1	Generally effectiveness of the ORKÖY activities	2	3	Medium-Good
2	Satisfaction level of the ORKÖY activities	3	3	Medium
3	Sufficiency of the ORKÖY credits	2	2	Medium
4	Sufficiency of the ORKÖY informing and training-consulting services	2	3	Medium-Good
5	Contribution of the ORKÖY activities to rural development	2	3	Medium-Good
6	Contribution of the ORKÖY activities to the socioeconomic structure of forest villagers	2	3	Medium-Good
7	Contribution of the ORKÖY activities to prevent migration	2	2	Medium
8	Contribution of the ORKÖY activities to prevent unemployment	1	1	Weak
9	Contribution of the ORKÖY activities to the conservation and sustainable management of forests	2	3	Medium-Good
0= Non (%0), 1= Weak (25%), 2 = Medium (50%), 3 = Good (75%), 4 = Well (100%)				

While forest villagers assessed the effectiveness of the ORKÖY activities, sufficiency of informing and training-consulting services, contributions to rural development, to socioeconomic structure of forest villagers, to protection of forests and to sustainable forest management as “medium”, forest enterprise managers assessed at a “good” level. Additionally, while both villagers and managers evaluated the satisfaction level of the ORKÖY activities as “good”, they evaluated the adequacy of ORKÖY credits and the contribution of the ORKÖY activities to preventing migration as “medium”. However, both groups stated that the contribution of ORKÖY activities to the prevention of unemployment is “weak”.

Impact of the ORKÖY Activities on Forestry Studies

Table 8 was drawn up to explain the relation between the ORKÖY activities and forestry activities, and thus to determine the effects of the ORKÖY activities on forestry activities.

Table 8. Forestry and the ORKÖY Activities by Years in the GRDF

Activity			2012	2013	2014	2015	2106	Total
Forest Growing (FG; ha)	1	Afforestation, Regeneration	18,825	1,615	3,735	3,820	5,017	33,012
	2	Regeneration-Culture Care	7,295	7,199	7,449	7,665	8,432	38,040
	3	Transforming to high forest	1,125	876	770	0	0	2,771
	4	Density Tending-First Thinning	6,268	2,788	6,561	7,795	8,716	32,128
	5	Erosion-Range Improvement	10,020	3,650	2,450	2,850	3,454	22,424
Total (FG)			43,534	16,127	20,965	22,130	25,619	128,375
Wood Production (WP; m ³)	6	Industrial wood	446,359	383,349	508,427	500,976	530,949	2,370,060
	7	Fuelwood	91,997	68,804	72,476	87,711	75,085	396,073
Total (WP)			538,356	452,153	580,903	588,687	606,034	2,766,133
Forest Crimes (FC; number)	8	Cutting-Transport-Containment-Consumption	368	332	337	239	258	1,534
	9	Opening-Settlement-Occupation-Utilization	290	346	279	289	241	1,445
	10	Other Crimes	12	34	25	12	11	94
Total (FC)			670	712	641	540	510	3,073
ORKÖY Activity	IT	Informing and training-consulting services (number)	238	329	1,048	886	968	3,469
	AC	Amount of credit (TL)	1,484,534	2,203,168	2,948,620	3,281,225	2,696,047	12,613,594

According to Table 8, an average of 25,675 hectares of forest growing activities were carried out in the GRDF, 553.227 m³ wood raw materials were produced, 615 forest crimes were processed, 694 informing and training-consulting activities were carried out and 2,522,719 TL was granted to forest villagers. Using the values in Table 8, the relationships between the ORKÖY activities and forestry studies were examined by means of correlation analysis (Table 9).

Table 9. Relations between the ORKÖY and Forestry Activities

Variables	FG	WP	FC	IT	AC
FG	1,00	0,17	0,06	-0,44	-0,68
WP		1,00	-0,85	0,80	0,55
FC			1,00	-0,72	-0,63
IT				1,00	0,88*
AC					1,00

*Significant at 0.05 confidence level.

According to Table 9, there is a significant positive correlation ($r = 0.88$ *) between the ORKÖY informing and training-consulting activities (IT) and the amount of the credit (AC) at 0.05 confidence level. In other words, as the amount of credit given by the ORKÖY increases, the activities of informing and training-consulting to the forest villagers also increase. On the other hand, there is no significant relationship between the ORKÖY activities (IT, AC) and forest growing (FG), forest crimes (FC) and wood production (WP). A similar finding was also found in a study conducted in the Kütahya Regional Directorate of Forestry (Daşdemir & Yıldırım, 2018). However, in a study conducted in Samsun (Daşdemir & Yılmaz, 2016), it was determined that as the amount of ORKÖY credit increased, both informing and training-consulting activities, as well as the amount of wood production and its productivity, and thus social pressures decreased.

In the Giresun Regional Directorate of Forestry, between the years 2012-2016, 12,1613,594 TL of the ORKÖY credit to the forest villagers were given by the year 2016 prices. Approximately 2,522,719 TL credits were given to the forest villagers annually and the GRDF provided a total of 1,406,898 TL fuelwood surplus (subvention) for five years period. In addition, the ORKÖY has implemented 3469 informing and training-consulting activities in a total of 322 villages over the period of five years. 80% of the ORKÖY credits are for economic purposes (beekeeping, milk cattle, milk sheep, buffalo breeding, cutting flower breeding and micro credit). The remaining 20% are for social purposes (solar water heating, roof covering, exterior insulation, exterior covering and solid fuel heating systems) given to reduce the consumption of fuelwood and the suppression on forests. Credits for economic purposes were given mostly in 2016 and credits for social purposes were given in 2014 at most. The amount of these economic credits given to the forest villagers must be increased, supported by social credits, and more forest villagers must be reached.

While forest villagers assessed the effectiveness and adequacy of ORKÖY activities, their contributions to rural development, protection of forests and sustainable forest management as “medium”, and forest enterprise managers evaluated at “good” level. Additionally, both the villagers and managers evaluated the adequacy of the ORKÖY credits and the contribution of the ORKÖY activities to prevention of migration as “medium”. In other words, the monetary support given by the ORKÖY is not enough. Especially, increasing social lending and the creation of employment opportunities in rural areas will prevent migration and reduce the pressure on forests.

Consequently, the development of forest villages, the support of agriculture and animal husbandry in forest villages, the increase of credits for this purpose, the creation of jobs and employment opportunities in rural areas, the elimination of insufficiencies in social security system, dissemination of entrepreneurial cultures, organization and training of forest villagers in production and marketing processes is required for sustainable rural development. Furthermore, the ORKÖY needs to be strengthened in terms of staffs and funding and to have a strong organization structure. Likewise, the development of forest villages should not be left to the responsibility of ORKÖY alone. It must be the responsibility of all the facilities and institutions of the state.

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Inhibitory Effects of Some Sulfonamides' on Lactoperoxidase

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Abstract: Lactoperoxidase (LPO, E.C. 1.11.1.7) is an important milk-protein with oxidoreductase activity. The main functions of the enzyme are to catalyze the oxidation of molecules in the presence of hydrogen peroxide and aid in production of molecules with a wide range of antimicrobial activity. Sulfonamide compounds ($R-SO_2-NH_2$) are aromatic molecules used as medicines. Sulfonamides form the basis for several drug classes, and they are the first drugs used systemically against bacterial infections with a selective action on bacteria. The present study aimed to investigate the *in vitro* inhibitory kinetics of some sulfonamide derivatives (2,5-Dichlorothiophene-3-sulfonamide; Naphthalene-2-sulfonamide; 6-aminopyridine-3-sulfonamide) on the lactoperoxidase enzyme (LPO) purified from bovine milk using affinity chromatography method. Bovine milk LPO was purified by 509.09 folds, with 168 EU / mg specific activity and 34.67% yield using Amberlite CG-50 H^+ resin and CNBr-activated Sepharose-4B-L-tyrosine-5-amino-2-methylbenzenesulfonamide affinity chromatography. Afterwards, enzyme activities were measured and Lineweaver-Burk diagrams were constructed for each enzyme; K_i constant and inhibition types were calculated from these diagrams. K_i values of these molecules varied between 0.5055 – 4.7135 μM . Naphthalene-2-sulfonamide demonstrated the most effective inhibitory characteristics of LPO, K_i values of $0.5055 \pm 0.1603 \mu M$ with a non-competitive type of inhibition.

Keywords: Lactoperoxidase, Purification, Sulfonamide, Kinetics, Enzyme Inhibition

1.INTRODUCTION

Milk contains a variety of constituents that protect the neonate and the milk itself from a host of deleterious microorganisms. One of the constituents is the lactoperoxidase (LPO) system (Ueda et al., 1976). This system is a naturally-occurring antimicrobial system (Elliot et al., 2004) which is inherently available in raw milk and human body fluids such as saliva. There are three primary components in the LPO system: haeme-containing LPO, hydrogen peroxide (H_2O_2), and thiocyanate (SCN^-). Additionally, LPO is released from mucosal glands and can be found in secretions like saliva, milk or tears. The potential of LPO to inhibit bacterial growth in milk has been recognized (Sisecioglu et al., 2012). LPO catalyses the H_2O_2 -dependent oxidation of thiocyanate (SCN^-) to hypothiocyanite ($OSCN^-$). The latter ion is a potent antimicrobial agent against gram-negative and gram-positive bacteria, fungi, and viruses (Koksals et al., 2016b). This reaction makes the LPO system potentially useful in improving food safety [6,7]. LPO has crucial applications in various fields. For example, LPO protects the intestinal tract system of newborn infants against pathogenic microorganisms by catalysing halides and pseudohalides. LPO is one of the important proteins in bovine whey, and it has been known to play a key role in protection of the lactating mammary gland and the intestinal tract of newborn infants against pathogenic microorganisms (Kussendrager et al., 2000).

The aim of the present study was to assess the inhibition effects of a some sulfonamides against LPO enzyme, one of the prominent enzymes generally found in several sources, such as bovine milk, saliva, and tears.

Lactoperoxidase (LPO) (E.C.1.11.1.7) is a mammalian peroxidase and plays an important role against pathogens (Kussendrager et al., 2000). Primarily LPO was isolated from bovine milk and usually found in secretions from human mammary, salivary, lacrimal glands, and secretory glands (Dumonte et al., 1983). It preferentially oxidizes thiocyanate ions (SCN^-) to hypothiocyanate ions ($OSCN^-$) at the expense of hydrogen peroxide (H_2O_2) (De Wit et al., 1996). $OSCN^-$ oxidizes the -SH groups of vital enzymes such as hexokinase, glyceraldehyde-3-phosphate dehydrogenase in bacteria and cause to lose biological functions of these enzymes. The resulting bacterial cytoplasmic membranes are damaged structurally, glucose, purine, pyrimidine and amino acid uptake protein, DNA and RNA synthesis is inhibited (Siragusa et al., 1989). So, LPO system plays an important role in the immune defense system.

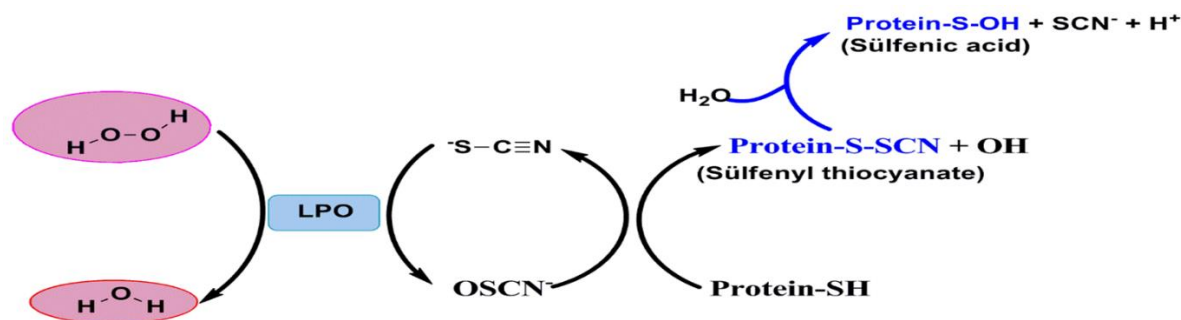


Figure 1. Antibacterial effect of the lactoperoxidase enzyme

Additionally, LPO system has wide applications area for example preservative in food as well as in oral care, shelf-life, cosmetic, and other products (Sisecioglu et al., 2010).

Sulfonamides constitute a privileged class among pharmacological agents by possessing properties including carbonic anhydrase enzyme (CA) inhibition, as well as diuretic, hypoglycemic, anticancer, antibacterial, antiviral, and metalloprotease inhibitory effects. Although many years passed since their first discovery in the 1930s as a chemotherapeutic agent for antibacterial properties they are receiving increasing attention due to their newly-discovered pharmacological properties (Supuran et al., 2004).

Sulfonamides possessed some biological activities as antibiotics (sulfamethoxazole), PDE5 inhibitors for the treatment of erectile dysfunction (sildenafil), protease inhibitor for treatment of HIV (darunavir), sulfonylureas for treatment of diabetes mellitus (glibenclamide), hepatitis C anti-viral RNA polymerase inhibitors, and non-steroidal anti-inflammatory COX-2 inhibitors (oxicam class) (Burhop et al., 2017).

Because sulfonamides have been reported to be effective agents, in this study, some sulfonamide drugs compounds were examined.

2. MATERIALS AND METHODS

Chemicals and Instruments

Bovine milk was obtained from the local dairy. CNBr-activated Sepharose-4B, L-tyrosine, 5-amino-2-methylbenzenesulfonamide, Amberlite CG-50- NH₄⁺ resin, BSA (lyophilized powder), chemicals for electrophoresis, 2,5-Dichlorothiophene-3-sulphonamide, Naphthalene-2-sulphonamide, 6-aminopyridine-3-sulphonamide and other chemicals were obtained from Sigma-Aldrich Co. (Sigma-Aldrich Chemie GmbH Export Department Eschenstrasse 5, 82024 Taufkirchen, Germany). Standard protein markers for electrophoresis were obtained from Thermo Scientific (Vilnius, Lithuania).

Measurement of LPO Activity

The activity of the lactoperoxidase enzyme was measured using the procedure based on modifications of Shindler and Bardsley method. This method depends on the principle of oxidation of 2,2'-azino-bis(3-ethylbenzthiazolin-6-sulfonic acid) (ABTS) chromogenic substrate by H₂O₂ and monitoring of the absorbance increase due to resultant colored compound at 412 nm (Shindler et al., 1975).

Activity was determined through the following procedure: 2.8 ml 1mM ABTS and 0.1 ml 3.2 mM H₂O₂ were transferred to 3 ml spectrophotometer cuvette by pipetting. 0.1 ml of enzyme solution was added, the cuvette was rotated upside down and placed into the spectrophotometer. Absorbance increase relative to the blank sample was measured at 412 nm, at 15 seconds intervals for 3 minutes. Each activity measurement was repeated three times. The blank sample consisted of 0.1 M phosphate buffer at pH=6 instead of enzyme solution, and the other solutions were used at the same proportions (Koksall et al., 2016a).

Purification Procedure of LPO from Bovine Milk

One liter of fresh mammalian milk was firstly centrifuged at 2.700 rpm, 4°C for 15 minutes and centrifugation was repeated for three times to completely remove butter. Amberlite CG50 NH₄⁺ resin was added at a proportion of 4.4 g / 150 mL. Then, the resin was washed with distilled water and sodium acetate solution (0.5 mM, pH 6.8). Bound proteins

were washed with sodium acetate solution (2 M, pH 6.8). To purify LPO, the obtained solution was applied on Sepharose-4B-L-tyrosine-5-amino-2-methylbenzenesulfonamide affinity column (Koksall et al., 2017).

SDS-PAGE-Protein Determination

The SDS-PAGE method was used to determine the purity of the enzyme. Protein concentration was measured based on Bradford method using bovine serum albumin as standard (Bradford 1976).

In vitro Inhibition Studies

Activity levels of each inhibitor at five different inhibitory concentrations in a fixed substrate concentration (ABTS) were calculated, then, % Activity values and the inhibitor concentrations achieving 50% inhibition IC_{50} were estimated. Afterwards, K_i values and inhibition types were determined by using Lineweaver–Burk diagrams at three different fixed inhibitory concentrations for each inhibitor and five different fixed substrate concentrations. Data collected were analyzed by *t*-test and the results were given as $X \pm SD$.

3.RESULTS AND DISCUSSION

Using CG-50 H^+ resin and CNBr-activated Sepharose-4B-L-tyrosine-5-amino-2-methylbenzenesulfonamide affinity chromatography, LPO was purified from bovine milk at a specific activity of 168.00 EU/ mg and a yield of 34.67 % (Table 1; Figure 2).

The enzyme, purified by affinity chromatography, was visible as a single band in SDS-PAGE (Figure 2). Then, the purified enzyme was used for inhibition studies. The inhibitory effects of some sulfonamides on enzyme activity were tested *in vitro*; IC_{50} values were calculated using activity% - [inhibitory] diagrams.

IC_{50} values were found as 0.693 μM (R^2 : 0.9947) for Naphthalene-2-Sulfonamide; 1.193 μM (R^2 : 0.9207) for 2,5-Dichlorothiophene-3-Sulfonamide; 11.95 μM (R^2 : 0.9774) for 6-aminopiridin-3-sulfonamide. K_i values were calculated using the Lineweaver–Burk curves. Regarding the K_i values of the tested compounds (Figure 3), varies against LPO in the ranges of $0,50 \pm 0,1603 \mu M$ - $4,71 \pm 1,5388 \mu M$ (Figure 4). The results clearly indicated that all molecules had effective LPO inhibition. All molecules exhibited noncompetitive inhibition effect (Figure 4).

Table 1: Summary of purification of lactoperoxidase from bovine milk.

Purification steps	Total Volume (ml)	Activity (EU/ml)	Protein (mg/ml)	Total Activity (EÜ)	Total Protein (mg)	Specific Activity (EU/mg)	Yield%	Purification Fold
Crude Homogenate from Amberlite CG-50-NH ₄ ⁺ resin	10.00	4.36	13.00	43.60	130.0	0.33	100	1.00
Purified LPO from Sepharose 4B-L-tyrosine 5-amino-2-methylbenzenesulfonamide Affinity Chromatography	3.00	5.04	0.03	15.12	0.09	168.00	34.67	509.09

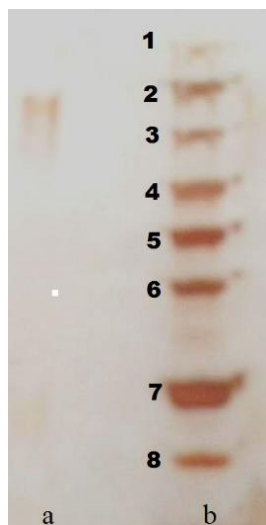


Figure 2. Sodium dodecyl sulfate-polyacrylamide gel electrophoresis analysis of purified bovine milk lactoperoxidase. Lane a: Purified bovine milk lactoperoxidase enzyme Lane b: Standard proteins (kDa). 1. (130 kDa), 2. (100 kDa), 3. (70 kDa), 4. (55 kDa), 5. (40 kDa), 6 (35 kDa), 7. (25 kDa), 8. (15 kDa)

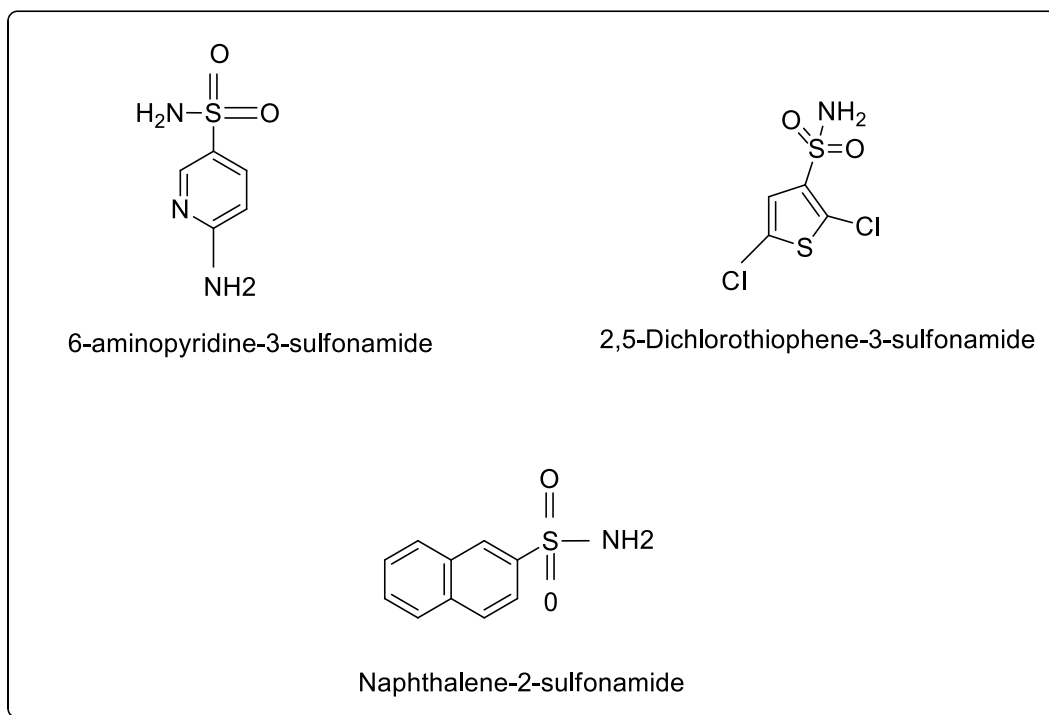


Figure 3. Molecular structure of Sulfonamides used in this study

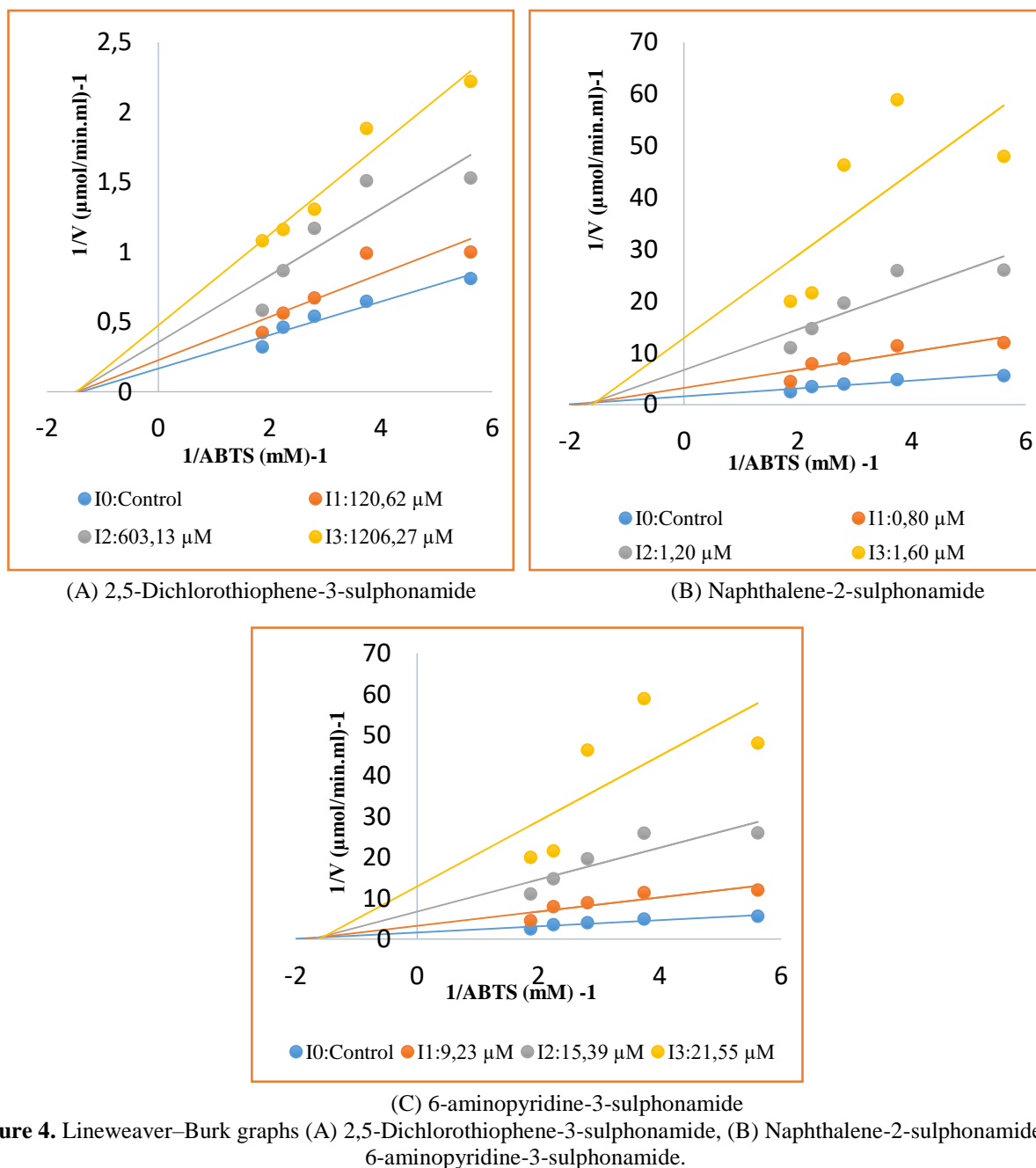


Figure 4. Lineweaver–Burk graphs (A) 2,5-Dichlorothiophene-3-sulphonamide, (B) Naphthalene-2-sulphonamide, (C) 6-aminopyridine-3-sulphonamide.

In this study we investigated the *in vitro* inhibitory effects of some sulfonamides on bovine milk LPO activity. There is not any research in the literature that investigated the inhibitory activity of these sulfonamide derivatives on LPO.

Sulfonamides form an important drug class, including various pharmacologic agents with anti-carbonic anhydrase, diuretic, hypoglycemic or anti-thyroid activities. Data reported in the literature indicated that sulfanilamide is an effective and competitive inhibitor of LPO, with a K_i value of 3.55×10^{-5} M and IC_{50} value of 0.848 mM (Atasever et al., 2013).

In a previous study performed for this purpose, the inhibitory kinetics of 16 commercial sulfanilamide derivatives on mammalian milk were investigated, and the highest inhibitory activity was demonstrated with 5-amino-2-methylbenzenesulfonamide molecule, which displayed a non-competitive type of inhibition at 0.69 μ M IC_{50} and 0.41 ± 0.12 μ M K_i values (Koksall et al., 2017).

In this study, LPO was purified from bovine milk by using Amberlite CG-50 H^+ resin and CNBr-activated Sepharose-4B-L-tyrosine-5-amino-2-methylbenzenesulfonamide affinity chromatography (Table 1, Figure 2). The IC_{50} values were found by Activity%/[Inhibitor] graphs and the K_i values were found by Lineweaver-Burk graphs (Figure 4). According

to K_i values we obtained, Naphthalene-2-sulphonamide molecule had the strongest inhibition on the bovine milk LPO and this result is consistent with the IC_{50} result.

According to these results, all molecules caused to inhibition by binding to enzyme somewhere other than active site and other molecules lead to inhibition by binding to the active site of the enzyme.

LPO plays a vital role in innate immune system. LPO activity and thiocyanate content in milk are significant during lactation. Hence, decreased enzyme activity reflects an impairment in the immune system (Fonteh et al., 2002). Today, LPO has potential areas of application. Among those, the most popular areas of application for LPO system include food production for protection of raw milk, pasteurized milk and cheese milk during transfer to storage and processing facilities LPO system is preferred in the absence of cooling and it may be used to extend the shelf life (Koksal et al., 2016). As you can see LPO system is very important for metabolism and industry so we thus need to be careful while using sulfonamide derivatives as active drug substances.

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The Influence of Surface Material on Pool Boiling Process in n-Pentane

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Abstract: In this paper, an experimental study of pool boiling heat transfer was conducted for two smooth heated substrates; copper and 304 stainless steel (SS). All experiments were performed at a saturated condition under atmospheric pressure. In the experiments, n-pentane was used as a working fluid. The test surface was the upper surface of copper and SS materials, having a diameter of 40 mm and horizontally oriented. Three K-type thermocouples of 0.1 °C accuracy was used to measure surface temperature and the fourth thermocouple was used to measure the temperature of working fluid. Pool boiling curves for two base materials were obtained and compared. It was found that the type of surface material has significant effects on the boiling heat transfer coefficient (HTC) as well as critical heat flux (CHF). The experimental results indicated that the CHF for the steel surface improved up to 20% compared to the copper surface. The boiling HTC for the copper surface was significantly improved by more than 200% as compared to the steel surface, which was reasoned because of the density of active nucleation cavities.

Keywords: Pool boiling, enhanced heat transfer, critical heat flux, heat rate, surface material

1. INTRODUCTION

Boiling is the fluid change process from the liquid phase to vapor phase. This process starts at the saturation temperature of liquid with a certain pressure. Boiling heat transfer is an efficient method for heat removal of various engineering systems such as the electronic devices, nuclear reactors and gas turbines due to the latent heat of phase change.

In a typical boiling phenomenon, the boiling HTC and the CHF are effective parameters on system performance. They are affected by many factors including surface orientation, surface material properties, aging process, etc. In order to determine these effects on the pool boiling, some experimental investigations have been carried out. Many researchers have been experimentally studied on the effect of surface orientation on HTC and CHF and they have developed many correlations for the SS [1-3], Cu [4-8] and other modified boiling surfaces [9-11]. However, there are some controversies existing in experimental results.

In this study, a set of experiments are performed to determine the role of surface materials on pool boiling. All experiments are performed at a saturated condition under atmospheric pressure. The pool BHT and CHF performance of n-pentane on for the copper and 304 SS surfaces are experimentally evaluated and briefly discussed.

2. MATERIALS AND METHODS

Experimental Setup and Procedure

The experimental setup as shown in Fig. 1a mainly includes a boiling vessel, the boiling surface which is an upper part of the test samples, the coil condenser to condense the generated vapor, the power supply, and the data acquisition system. The boiling vessel containing test fluid made of Pyrex glass with dimensions Ø100x200mm. With these boiling facility, the performance parameters such as the liquid saturation temperature and the temperature of the test surface were extracted to calculate the heat flux and boiling HTC.

Fig. 1b illustrates a cross-section of the test samples which represents the orientations and placement of K-type thermocouples. These samples were machined to generate steps from 103 mm to 40 mm in diameter and this 40 mm surface acts as the boiling surface. Before each test, the boiling surface is mechanically polished by using emery paper and then with α -alumina for a mirror finish. The test surface is finally washed with deionized water. Three holes for the embedding of K-type thermocouples were drilled to measure the temperature at different orientations. Another is vertically installed into the boiling vessel to record the fluid temperature, as shown in Fig. 1a. The elapsed time, the surface and the fluid temperature are recorded using the data acquisition system (National Instruments, NI USB-6363). The sealing between the specimen and the boiling vessel is provided by a silicone seal resistant to high temperature.

The heater was powered by an AC power supply (2.5 kW power capacity), positioned to under the test sample. The heat flux was controlled by changing the voltage via 5 kW AC power supply. The test sample and AC heater are placed on a refractory brick. In order to reduce the environmental heat loss and to drive the heat flow towards the boiling surface, they are well isolated with an insulation material.

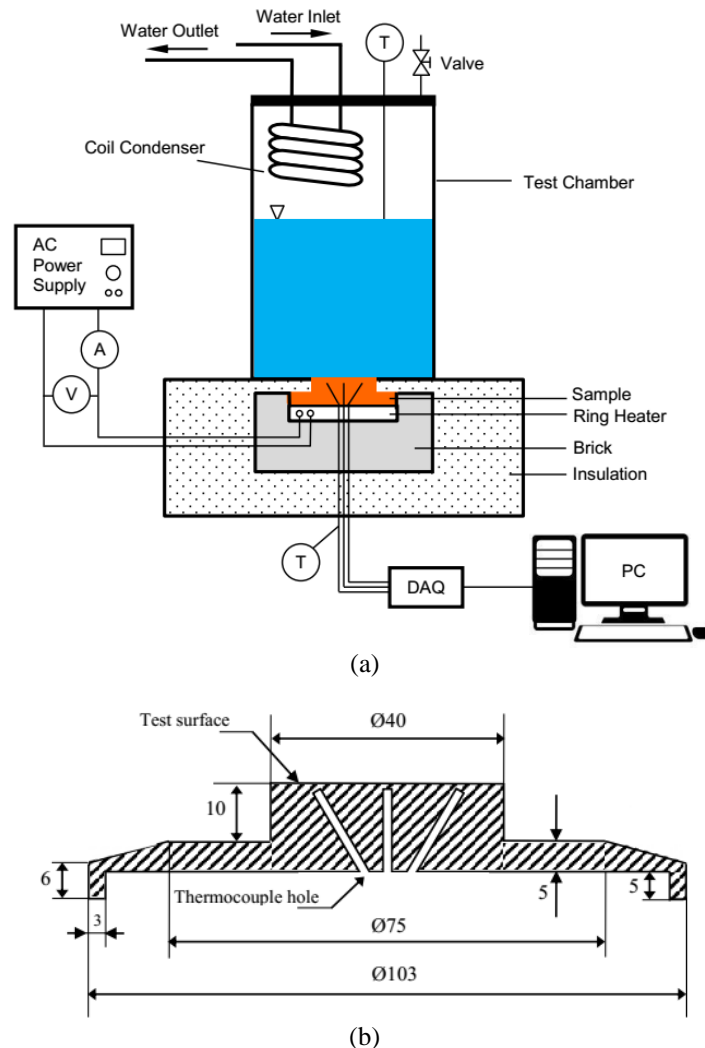


Figure 1. (a) Schematic diagram of the experimental apparatus; and (b) the details of the copper block.

Experimental Procedure

After achieving the saturation temperature of the working liquid, the power supplied to the heater was gradually enhanced up to the CHF. The readings were taken when there was no change in the temperature of the test surface to ensure the steady state condition. In the CHF point, a vapor layer is formed on the test surface and then, the surface temperature rapidly increases. At that time, the power was immediately turned off and the test was finished to prevent any equipment failure. The vessel was cleaned and filled again for the next experiment. For each test, a clean surface and the fresh fluid were used. For each step, the voltage and current supplying the heater were recorded for the plotting the boiling curves.

3.RESULTS AND DISCUSSION

The boiling experiments were performed to investigate the material effects on the pool boiling HTC and CHF of n-pentane for heater surfaces with the material of copper and 304 SS. Fig. 2 shows the heat flux vs. the surface superheat for the two surfaces. It is seen that the heat flux increases regularly with the surface superheat up to the CHF. It is found that the type of surface material has significant effects on the pool boiling HTC as well as CHF. From this figure, it can be stated that for the copper surface, lower surface superheat may cause a positive effect on the pool boiling HTC.

Fig. 3 depicts the pool boiling HTC of n-pentane for two surfaces. As expected, the experimental results showed that the pool boiling heat transfer is highly dependent on the applied heat flux. Therefore, at higher heat fluxes, the HTC significantly increases due to the intensification of bubble formation phenomenon. As can be seen in Fig.3, for the copper surface, higher pool boiling HTC is obtained. The HTC for the copper surface can be enhanced up to ~200% at highest heat flux compared to that of SS surface. This can be due to the intensification of bubble formation on the copper surface.

As seen in Fig.2, on the other hand, it is interesting to note that CHF on SS surface has been delayed until 446 kW/m^2 , which is about 20% higher than that of the copper surface. For the present test liquid, this makes the SS material more suitable for enhancing CHF compared with the copper material. In the case of the SS surface, the dry-out regions on the surface decrease and therefore, dry-out can be delayed. Moreover, the capillary wicking behavior of the surface can be improved by fouling formation, resulting in the filling more liquid into the micro-cavities on the SS surface. Thus, this can be also another determinative parameter for enhancing CHF.

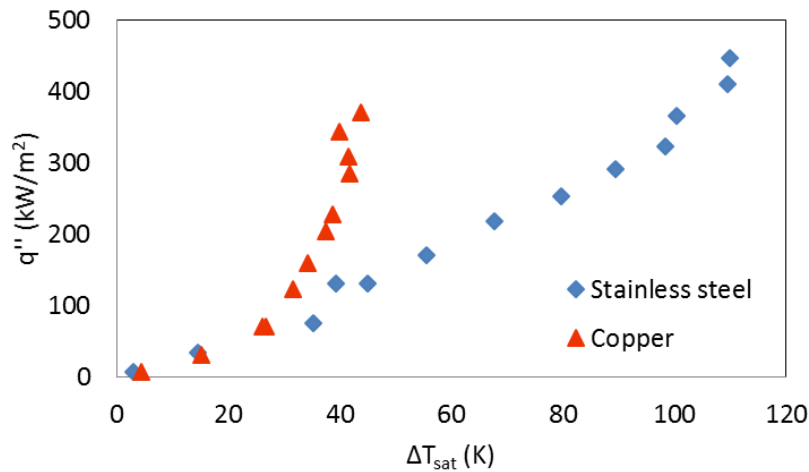


Figure 2. Heat flux vs. surface superheat both copper and SS materials.

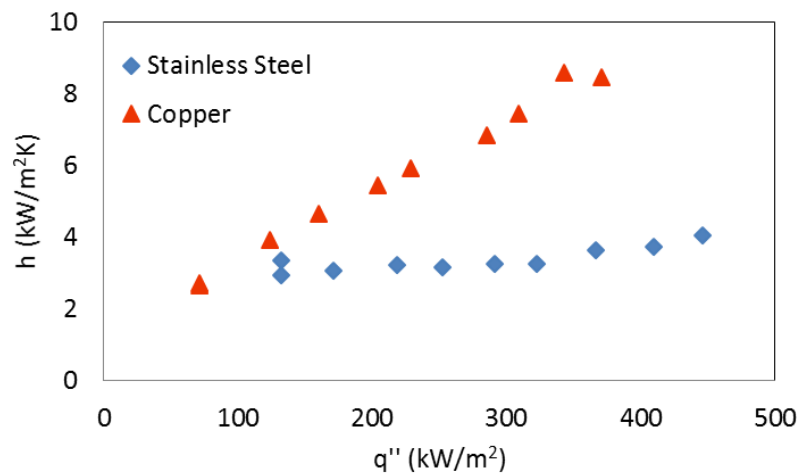


Figure 3. Pool boiling HTC of n-pentane on two surfaces at different heat fluxes up to CHF point.

Consequently, the following conclusions have been made;

- The applied heat flux significantly influence the pool boiling heat transfer performance of the material because of bubble formation.
- At a given heat flux, the copper surface exhibits lower surface superheat than that of the SS surface, resulting in higher HTC.
- The micro-cavities on the SS surface led to an increase in CHF because of the liquid spreading between micro-cavities as well as the capillary wicking action.

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The Effect of Concentration of CuO-pentane Nanofluid on Pool Boiling Heat Transfer

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Abstract: This study is tried to explain how the concentration of nanofluid will affect the boiling heat transfer. The CuO-pentane nanofluids with two different concentrations of 0.05 and 0.1 vol.% are prepared by using the two-step method and used as working fluid. To provide the fine dispersion of particles in the base fluid, sodium dodecylbenzene sulfonate (SDBS) is used as a surfactant. The boiling takes place the upper part of a copper and stainless steel sample with 40 mm diameter, which are mounted to the bottom of the Pyrex glass test vessel (Ø100x200 mm). To measure the surface temperature, three K-type thermocouples embedded 2 mm below the boiling surface are used. All experiments are performed at a saturated condition under atmospheric pressure. The boiling heat transfer coefficient and the critical heat flux are experimentally investigated in various concentrations and heat fluxes. For comparison, the experiments are conducted for pure n-pentane. The results are compared with predictions from several widely used correlations in the literature, which showed the deviation to be within $\pm 13\%$. In the case of the copper surface, it is observed that the nanofluids deteriorate the heat transfer coefficient with increasing nanoparticle concentration. Contrary to the copper surface, the heat transfer coefficient for the steel surface improves by the presence of nanoparticles in solution, while it decreases with the increasing particle concentration. On the other hand, the critical heat flux deteriorates for all test condition. These observations are related to the modifications of both surface wettability and roughness caused by nanoparticles deposition during the boiling processes.

Keywords: Pool boiling, heat transfer coefficient, critical heat flux, nanoparticle, nanofluid

1. INTRODUCTION

The nucleate boiling phenomenon is one of the most effective processes of the heat transfer. In many industrial applications that need to the ultra-high heat fluxes, the nucleate boiling mechanism is desirable by the researchers. Previous works on nucleate boiling process show that the nanofluids can be useful for improving the performance of the thermal systems. Nanofluids are colloidal suspensions having solid particles (size of 0-100 nm) dispersed in a base fluid such as water or ethylene glycol. They have been of interest for the last decade as an advanced coolant for many industrial sectors including nuclear reactors, refrigeration systems, and microelectronic device cooling systems, etc. Compared to the traditional fluids, they have enhanced thermo-physical properties and thus can exhibit better heat transfer performances.

There are some key factors on the boiling behavior of nanofluid including nanoparticle type, size, and concentration, orientation and geometry of the heating surface, the presence of dispersants and operation pressure [1-4]. Many attempts have been conducted to determine the effect of these parameters on the critical heat flux (CHF) and pool boiling heat transfer coefficient (PBHTC). You et al. [5] stated a 200% improvement in the CHF by Al_2O_3 /water nanofluid. Another work was made by Jo and Jeon [6] who also declared considerable the CHF improvement by silver/water nanofluid. In so many studies so far, since the CHF enhancement has reported using nanofluid composed of different nanoparticles and working fluids [7-12], the general acceptance is that nanofluid can increase the CHF. According to the results of the nanofluids pool boiling, the heating surface is modified with the accumulation of nanoparticles [13] which generates a porous layer on the heated surface modifying the surface wettability. This wetting improvement increases the CHF of nanofluid. Moreover, the CHF increases with the increase of deposited nanoparticles. Thus, the CHF more improves when the nanoparticles concentrations increase.

This study is aimed to explain how concentration of nanofluid will affect the boiling heat transfer. For this purpose, the several experiments were carried out to determine the pool boiling performance of nanofluids and comprehend their pool boiling heat transfer behavior. To this end, the experiments were conducted with a fluid mixture containing CuO nanoparticles and n-pentane at various concentrations (0.05 and 0.1 vol.%).

2. MATERIALS AND METHODS

Nanofluid Preparation

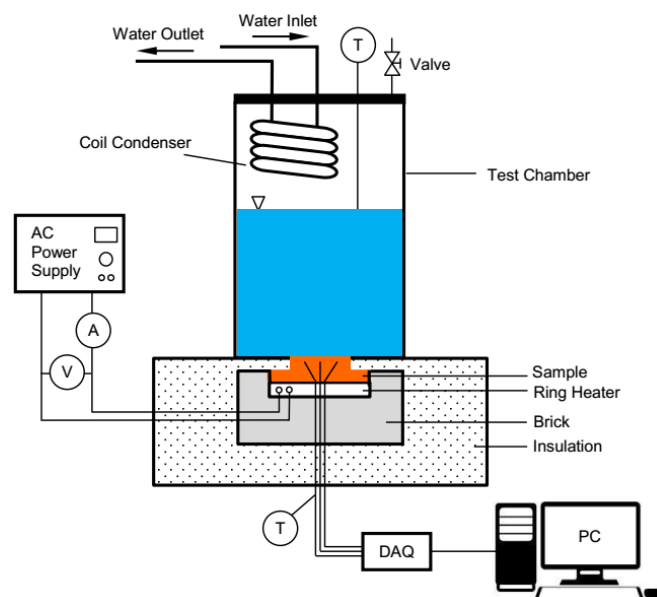
CuO/n-pentane nanofluids were prepared by using a two-step method. The CuO nanoparticles with the average diameter of 40 nm and purity 99% were purchased from NanoAmor (Nanostructured & Amorphous Materials Inc., TX, USA). CuO nanoparticles are dispersed into n-pentane (0.05 and 0.1 vol.%). To provide the fine dispersion of particles in the working fluid, sodium dodecylbenzene sulfonate (SDBS) is used as a surfactant. Then, to obtain a homogeneous suspension, a magnetic stirring was used for 10 minutes at room temperatures. In order to prevent the nanoparticles sedimentation, ultrasonication (40 kHz) was applied to suspensions about 2h before each test.

Experimental Setup and Procedure

The experimental facility was comprised of several major components such as the boiling vessel, the boiling surface which was an upper part of test samples, the coil condenser to condense the generated vapor, the power supply, and the data acquisition system. The boiling vessel containing test fluid made of Pyrex glass with dimensions Ø100x200mm. With this boiling facility, the performance parameters such as the liquid saturation temperature and the temperature of the test surface were extracted to calculate the heat flux and boiling heat transfer coefficient. The experimental facility used in this study is shown in Fig. 1a.

Fig. 1b illustrates a cross-section of the test samples which represents the orientations and placement of K-type thermocouples. These samples were machined to generate steps from 103 mm to 40 mm in diameter and this 40 mm surface acts as the boiling surface. Before each test, the boiling surface is mechanically polished by using emery paper and then with α -alumina for a mirror finish. The test surface is finally washed with deionized water. Three holes for the embedding of K-type thermocouples were drilled to measure the temperature at different orientations. Another is vertically installed into the boiling vessel to record the fluid temperature, as shown in Fig. 1a. The elapsed time, the surface and the fluid temperature are recorded using the data acquisition system (National Instruments, NI USB-6363). The sealing between the specimen and the boiling vessel is provided by a silicone seal resistant to high temperature.

The heater was powered by an AC power supply (2.5 kW power capacity), positioned to under the test sample. The heat flux was controlled by changing the voltage via 5 kW AC power supply. The test sample and AC heater are placed on a refractory brick. In order to reduce the environmental heat loss and to drive the heat flow towards the boiling surface, they are well isolated with an insulation material.



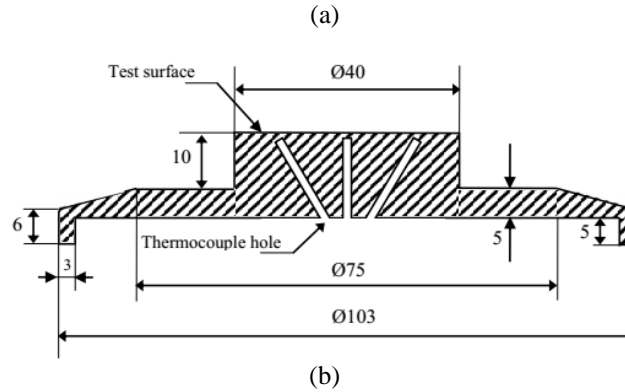


Figure 1. (a) Schematic diagram of the experimental apparatus; and (b) the details of the copper block.

After achieving the saturation temperature of the working liquid, the power supplied to the heater was gradually enhanced up to the CHF. The readings were taken when there was no change in the temperature of the test surface to ensure the steady state condition. In the CHF point, a vapor layer is formed on the test surface and then, the surface temperature rapidly increases. At that time, the power was immediately turned off and the test was finished to prevent any equipment failure. The vessel was cleaned and filled again for the next experiment. For each test, a clean surface and the fresh fluid were used. For each step, the voltage and current supplying the heater were recorded for the plotting the boiling curves.

3.RESULTS AND DISCUSSION

Fig. 2 shows the variation between the heat flux-surface superheat (Fig. 2a) and the PBHTC-heat flux (Fig. 2b) of CuO/n-pentane nanofluids with different nanoparticle concentrations. For both test samples, the PBHTC enhances with increasing the heat flux. When the stainless steel sample is examined carefully, it is observed that the presence of CuO nanoparticles increases the PBHTC compared to that of the base fluid (n-pentane), contrary to the copper sample.

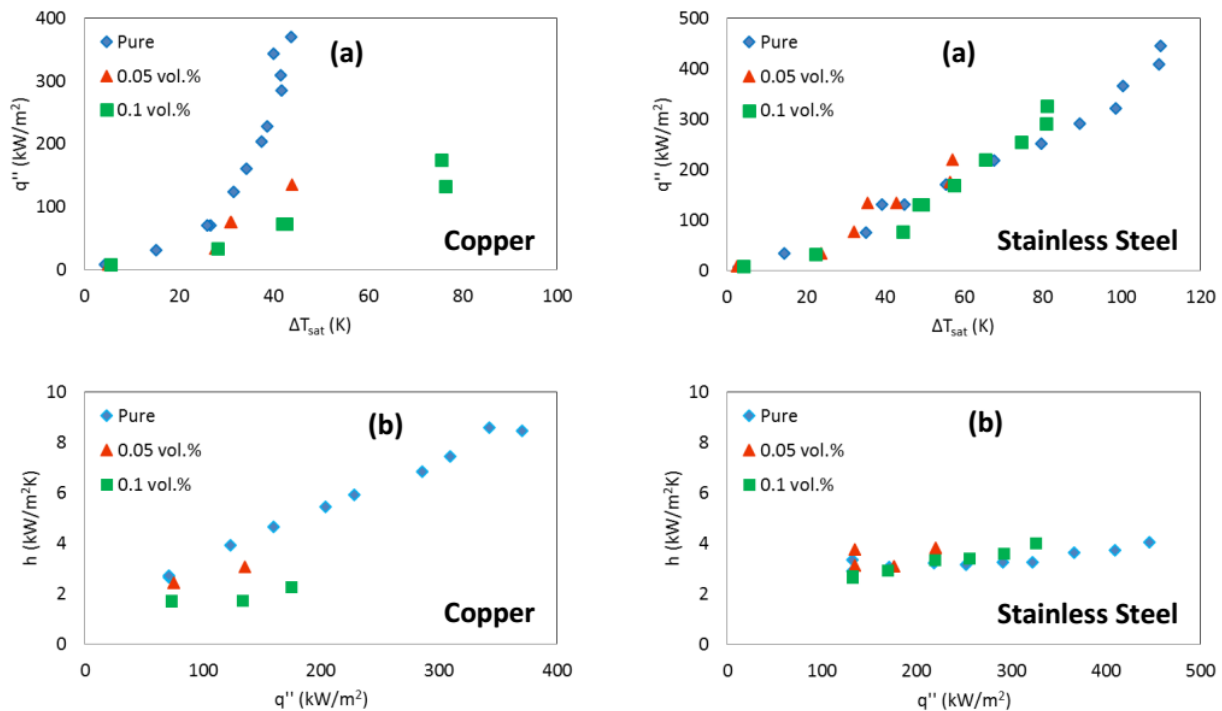


Figure 2. Boiling curves both copper and stainless steel test sample; (a) Heat flux against surface superheat and (b) PBHTC against heat flux on smooth and enhanced surfaces.

In the case of the copper surface, we have shown that accumulates of nanoparticles on the solid surface can change the surface wettability. The deterioration happens due to the increase in the wettability of surface and loss of many nucleation sites due to nanoparticle filling of microcavities, which brings about the fouling effect. In the case of the stainless steel surface, at the low nanoparticle concentration (0.05 vol%), there is an increase in the PBHTC. However, the increase of

the nanoparticle concentration decreases the nucleate PBHTC of the CuO-pentane nanofluid. At low particle volume fraction, the nanoparticles pave way for more evenly spread and loosely packed nanoparticles, which enables for chaotic movement of particles. This in turn agitates the fluid and enhances the heat transfer.

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Jet Impingement Cooling of a Hot Surface with a Facing Step Using Hybrid Nanofluids

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Abstract: Temperature oscillations occur by pressure oscillations in sound waves. The thermal interactions between these fluids and the solid surface in contact with the fluid are called thermoacoustic. Thermo-acoustic coolers are likely to be one of the cooling technologies of the future. In our work, the Hofler thermoacoustic cooler is referenced and the parameters based on the DeltaEC program are used; The effects of these parameters on the performance of the system have been observed by changing the pressure drive ratio, the stack geometry, the porosity of the stack, the distance between the stack and the loudspeaker, the batch material and the type of gas used.

Keywords: Thermoacoustics; Refrigeration

1.INTRODUCTION

Impingement jets are used in a variety of engineering and technological applications ranging from drying to turbine blade cooling and the aim was to obtain higher heat and mass heat transfer coefficients [1].

The use of nanotechnology in heat transfer fluids is growing and many thermal designs are obtained with the inclusion of metallic or non-metallic nano-sized particles to the base fluid. Also the use of two or more particles is termed the hybrid nanofluid, the name of which is called hybrid nanofluid [2].

In this study, we performed a numerical study using hybrid nanofluids for the jet impingement cooling of a hot surface with a facing step. The introduction of the step like effect adds additional complexity for the flow separation and may be more realistic for real life applications.

2.MATERIALS AND METHODS

In the present study computational fluid Dynamics (CFD) of the problem was performed. Computational Fluid Dynamics (CFD) is the science of predicting fluid flow, heat and mass transfer, chemical reactions by solving numerically the set of governing mathematical equations [3]. In the CFD, domain is discretised into a finite set of control volumes General conservation (transport) equations for mass, momentum, energy, species, etc. are solved on this set of control volumes (ANSYS-FLUENT).

Conservation Equations:

$$\text{Continuity: } \partial u / \partial x + \partial v / \partial y = 0 \quad (1)$$

$$x\text{- Momentum : } u \partial u / \partial x + v \partial u / \partial y = -1/\rho \partial p / \partial x + \nu_{nf} [\partial^2 u / \partial x^2 + \partial^2 u / \partial y^2] \quad (2)$$

$$y\text{- Momentum : } u \partial v / \partial x + v \partial v / \partial y = -1/\rho \partial p / \partial y + \nu_{nf} [\partial^2 v / \partial x^2 + \partial^2 v / \partial y^2] \quad (3)$$

$$\text{Energy : } u \partial T / \partial x + v \partial T / \partial y = \lambda_{nf} (\partial^2 T / \partial x^2 + \partial^2 T / \partial y^2) \quad (4)$$

A schematic view of the problem of jet impingement problem is shown in Figure 1. A mesh structure of the computational domain is shown in Figure 2.

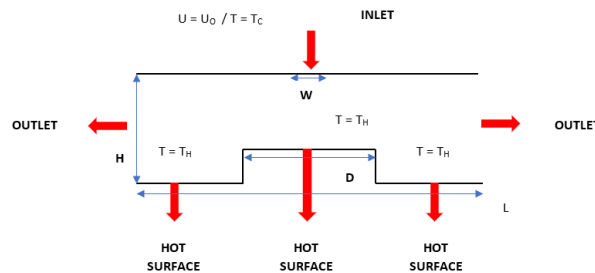


Figure 1. Schematic view of the problem

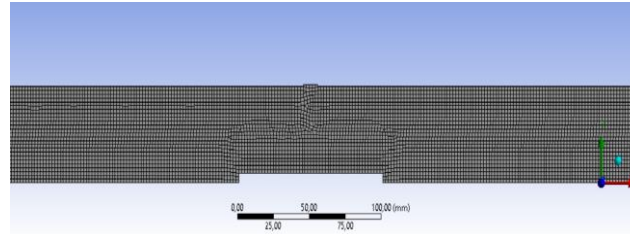


Figure 2. Mesh structure

Boundary conditions for the investigated problem is shown in Table 1.

Table 1. Boundary Conditions

INLET TEMPERATURE	298.15 (K)
HOT SURFACE TEMPERATURE	340 (K)
REYNOLDS NUMBER	100-500
OUTLET TYPE	OUT FLOW
WALL	ADIABATIC

Table 2. Thermophysical properties

MATERIALS	ρ [kg/m ³]	μ [kg/ms]	c_p [J/kg K]	λ [W/mK]
Cu	8933	-	385	401
Al ₂ O ₃	3970	-	765	46
Water	998,2	0,001003	4182	0,6

Cu-Al₂O₃ hybrid nanoparticles with different particle solid volume fraction was used in water. Thermophysical properties of base fluid nad nanoparticles are given in Table 2.

For the definition of the thermophysical properties of nanofluid following correlations were utilized:

Density:

$$\rho_{hbnf} = \phi_{Al_2O_3} \rho_{Al_2O_3} + \phi_{Cu} \rho_{Cu} + (1-\phi) \rho_{bf} \quad (5)$$

Thermal Conductivity:

$$k_{hntf}/k_{bf} = \left[\left(\phi_{Al_2O_3} \frac{k_{Al_2O_3}}{k_{bf}} \right) + \left(\phi_{Cu} \frac{k_{Cu}}{k_{bf}} \right) / \phi + 2k_{bf} + 2 \left(\phi_{Al_2O_3} \frac{k_{Al_2O_3}}{k_{bf}} + \phi_{Cu} \frac{k_{Cu}}{k_{bf}} \right) - 2\phi k_{bf} \right] / \left[\left(\phi_{Al_2O_3} \frac{k_{Al_2O_3}}{k_{bf}} \right) + \left(\phi_{Cu} \frac{k_{Cu}}{k_{bf}} \right) / \phi + 2k_{bf} - \left(\phi_{Al_2O_3} \frac{k_{Al_2O_3}}{k_{bf}} + \phi_{Cu} \frac{k_{Cu}}{k_{bf}} \right) + \phi k_{bf} \right] \quad (6)$$

Viscosity:

$$\mu_{nf} = \mu_f / [(1-\phi)^{2.5}] \quad (7)$$

Reynolds number is defined based on the hydraulic diameter as:

$$Re = \rho V D / \mu$$

(8)

Heat transfer coefficient is given in the non dimensional form with Nusselt number which is defined as:

$$Nu = (q D) / \Delta T k$$

(9)

3.RESULTS AND DISCUSSION

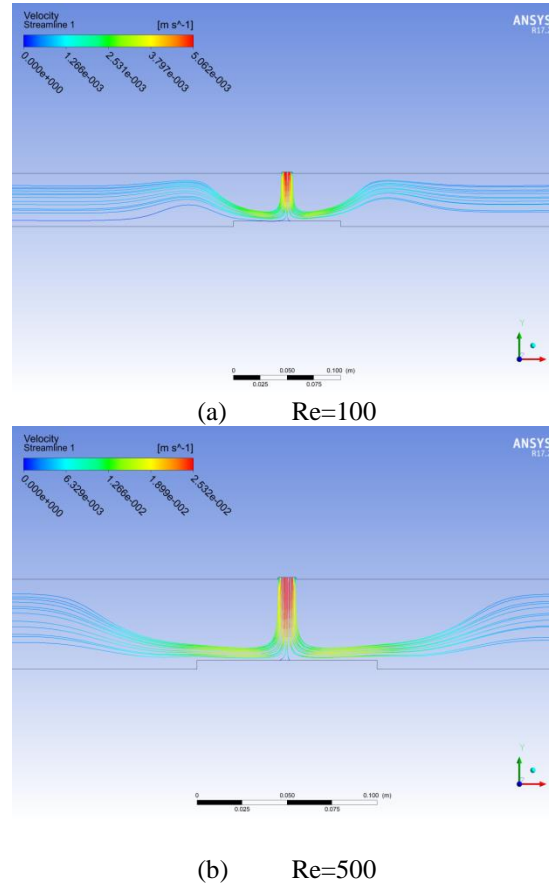


Figure 3. Streamline distributions

Streamline distributions for two values of Reynolds number are shown in Figure 3. Velocity enhances with Reynolds number. Recirculation region near the jet increases in size for higher Reynolds number. It is also observed that the wall jet region are affected with Reynolds number and step geometry. Temperature gradients become steeper for high Reynolds number. Temperature gradient is steepest around stagnation point.

Table 3 and Table 4 show the average and stagnation point Nusselt number values for various Reynolds number for water and for hybrid nanofluid. All the results show that the increase in the Reynolds number enhances local and average heat transfer. Use of hybrid nanofluid results in stagnation point and average heat transfer enhancement.

Table 3. Numerical analysis values for based water

Re	Nu _{avg}	Nu _{max}
100	1,145	14,209
200	1,600	17,214
300	2,006	17,962
400	2,409	18,283
500	5,845	18,349

Table 4. Numerical analysis values for hybrid nanofluid

Re	Ø (%)	Nu _{avg}	Nu _{max}
100	0	1,145	14,209
100	1	1,895	14,843
100	2	1,910	15,227
200	0	2,409	17,214

A numerical study of jet impingement cooling of a heated surface with a step like part was performed with finite volume method. It was observed that performance enhancements are observed with high values of Reynolds number and solid nanoparticle addition to the base fluid. Additional vortices are observed in the location of step like geometry.

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Numerical Study of a Thermoacoustic Refrigerator

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Abstract: Temperature oscillations occur by pressure oscillations in sound waves. The thermal interactions between these fluids and the solid surface in contact with the fluid are called thermoacoustic. Thermo-acoustic coolers are likely to be one of the cooling technologies of the future. In our work, the Hofler thermoacoustic cooler is referenced and the parameters based on the DeltaEC program are used; The effects of these parameters on the performance of the system have been observed by changing the pressure drive ratio, the stack geometry, the porosity of the stack, the distance between the stack and the loudspeaker, the batch material and the type of gas used.

Keywords: Thermoacoustics; Refrigeration

1. INTRODUCTION

Thermoacoustic cooling is an environmentally friendly cooling method that uses sound waves to produce cooling. The vapor compression system, which requires moving parts such as harmful refrigerant and compressor is not needed in this method therefore it is more reliable. The thermoacoustic field attracted researchers from 1816 when Pierre-Simon Laplace took into account the local change of temperature and pressure due to compression and expansion in the environment during the sound propagation. P. Rijke made significant advances which used an open glass tube and a wire mesh on both covers to heat the air locally [1].

Thermoacoustic coolers are systems that use sound to produce cooling power. They consist of a loudspeaker, usually connected to a gas-filled acoustic resonator (tube). In the resonator, as shown in Figure 1, a stack of parallel plates and two heat exchangers was installed. The loudspeaker maintains an acoustic standing wave in the gas at the basic resonance frequency of the resonator. The acoustic standing wave displaces the gas in the channels of the stack during compression and expansion. Thermal interaction between the vibrating gas and the surface of the stack causes an acoustic heat pump. The heat exchangers exchange heat with the environment on the cold and hot sides of the stack [2].

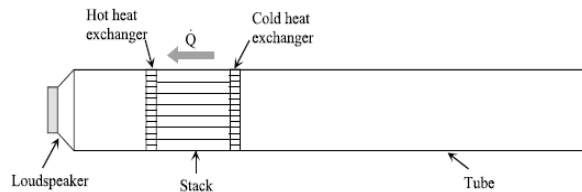


Figure 1. Schematic of thermoacoustic refrigeration system [2].

2. MATERIALS AND METHODS

System Description

Hofler: The resonator contains hot and cold exchangers and He gas (or gas mixtures) at an absolute pressure of 10 bar. The resonance frequency ranges from a maximum of 650 Hz to a minimum of 250 Hz. The electric resistance heater provides a heat load near the cold exchanger. The resonator pipe is completely made of fiberglass outside of the copper-weighted mass region. "Stack" is a plastic film spiral roll and spacers, consisting of 70 layers of 3 inches in length and 1.5 inches in diameter. Heat exchangers consist of 50 parallel copper strips. The resonator is thermally insulated with a vacuum field and a temperature-controlled radiation shield or super-insulation. Due to the higher heat capacity of the resonator, the cooling time is slow and all measurements are fixed [3]. In Figure 2, cross-sectional view of the thermoacoustic refrigeration system is seen.

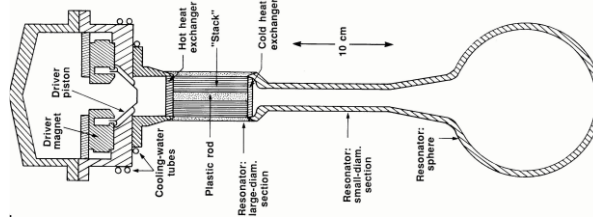


Figure 2. Hofler thermoacoustic refrigeration [4]

Basic Equations

The energy that should be supplied in the refrigeration of produced in the engine are given as:

$$W_n = \frac{\delta_{kn} L_{sn} D^2}{4\gamma} (\gamma - 1) B \cos^2 x_n \times \left(\frac{\Delta T_{mn} \tan(x_n)}{B L_{sn} (\gamma - 1) (1 + \sqrt{\sigma}) A} - 1 \right) - \frac{\delta_{kn} L_{sn} D^2}{4\gamma} \frac{\sqrt{\sigma} \sin^2 x_n}{B A} \quad (1)$$

$$A = 1 - \sqrt{\sigma} \delta_{kn} + \frac{1}{2} \sigma \delta_{kn}^2 \quad (2)$$

Coefficient of Performance) COP for refrigeration system [6];

$$COP_{SM} = \frac{\text{Elde edilmek istenen değer}}{\text{Harcanması gereken değer}} = \frac{Q_L}{W_{\text{net,giren}}} \quad (4)$$

DeltaEC Program

DeltaEC uses a low amplitude, acoustic approach and sinusoidal time dependence. Other equations, such as the wave equation and sometimes the energy equation, in a gas (or a highly compressible, thermodynamically active liquid), are given by a user in a series of segments (up to 200) in a geometry integration is performed by using ODE system [4].

3.RESULTS AND DISCUSSION

Hofler thermoacoustic refrigeration system was taken as reference. Using the DeltaEC program, the effects of different gas type, stack type, pressure ratio, bulk material on the cooling performance was investigated. Table 1 shows the reference values.

Table 1 Reference Values

Parameters	Values
Frekans	505.59 Hz
Gaz tipi	Helyum
Basınç tahrik oranı	%3
Yığın geometrisi	STKSLAB
Yığın gözeneklilik oranı	0.7240
Yığın pozisyonu	3.26 cm
Yığın malzemesi	Kapton

Pressure Drive Ratio Effects

The numerical calculations are made by changing the pressure drive ratio as 3%, 2%, 1% and keeping the other parameters as constant. The pressure drive ratio is P / P_m .

Table 2. Effects of pressure drive ratio of COP

Tahrik oranı	Q_{total} [W]	TL/TH	COP/COP _{carnot}
%3	3.8540	0.75005	0.1579
%2	3.4148	0.82126	0.16304
%1	3.1466	1.1203	- 0.15258

The drive ratio values have been changed and the results are shown in Table 2. The COP ratio increased at the rate of 2%, but the temperature ratio increased, indicating that the temperature difference between the inlet and outlet of the stack decreased. The reason for the COP ratio (-) is marked as 1% at the rate of 1% is that the cooling process does not take place at the stack output, ie the temperature is increased. The drive ratio is the ratio of the dynamic pressure amplitude to the average pressure. When performing calculations in the system, the drive ratio will be used as 3%.

Stack Type Effects

In eltaEC program; different stack types are available such as STKSLAB, STKRECT, STKCIRC Table 3 shows the stack type on the COP variation

Table 3. Stack type effects

Yığın Geometrisi	Q_{total} [W]	TL/TH	COP/COP _{carnot}
STKSLAB	3.8540	0.75005	0.1579
STKRECT	3.8597	0.75821	0.16669
STKCIRC	3.8641	0.76172	0.16643

Porosity of Porous Medium

In stack region, (A_{gap}/A) was changed and differences in COP values are added in Table 4.

Table 4. Porosity effects

A_{gap}/A	Q_{total} [W]	TL/TH	COP/COP _{carnot}
0.7240	3.8540	0.75005	0.1579
0.800	3.8840	0.73418	0.16972
0.65	3.8227	0.76729	0.14465

The area ratio is the ratio of the empty spaces in the stack to the total area. Area ratio in our system was examined in three values as 0.724, 0.80, and 0.65. COP ratio increased at 0.80 area ratio and temperature ratio decreased. If the field ratio is set to 0.80 as shown in Table 4, the efficiency in our system is increased.

Stack and Loudspeaker Distance

The size of the refrigeration does not change.

Table 5. Effects of stack distance

Speaker-Stack [cm]	Q_{total} [W]	TL/TH	COP/COP _{carnot}
4.26	3.8540	0.75005	0.1579
3.26	3.8676	0.73417	0.17685
2.26	3.8965	0.72944	0.17866

The results were observed by changing the distance of the stack in the system to the loudspeaker. The distance between the stack and the loudspeaker was examined at three different values as 4.26 cm, 3.26 cm and 2.26 cm. The ratio of the stack to the loudspeaker increased the COP rate and the temperature ratios decreased. If we set the loudspeaker distance to 2.26 cm or 3.26 cm, we increase the efficiency of the system.

Stack Material Effects

Calculations are made by changing some stack materials defined in the Delta EC program and the results are tabulated in Table 6. The used materials are Kapton, Celcor, Mylar.

Table 6. Stack Material Effects

Yığın malzemesi	Q_{total} [W]	TL/TH	COP/COP _{carnot}
Kapton	3.8540	0.75005	0.1579
Mylar	3.8551	0.75121	0.15687
Celcor	3.8607	0.75408	0.14889

Changing the stack materials did not show a significant change on the system we used.

Gas Type

Table 7. Gas type effects

Gaz	Q_{total} [W]	TL/TH	COP/COP _{carnot}
Helium	3.8540	0.75005	0.1579
Hava	3.2487	0.94412	8.5081×10^{-2}
Nitrojen	3.2533	0.94402	8.4324×10^{-2}

Helium, air and nitrogen were used. Because air and nitrogen are similar in thermophysical properties, their results are close to each other. Helium was more efficient than the others.

Thermoacoustic cooling was analyzed by using DeltaEC program. Effects of various parameters such as porosity, drive ratio, stack material, loudspeaker to stack distance and gas types on the COP were analyzed. They have some influences of the performance of the system.

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Heavy Metal and Platinum Group Elements Pottential of Yesilova-Tefenni Chromites (Burdur)

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Abstract: The study area covers two different sites located on the northwest of Tefenni (Burdur) district involving Tefenni plateau and environs with an area of 12 km² and located on Niyazlar Koyu (Yesilova-Burdur) district with an area of 50 km². The lithologic units observed in the study area from old to young are Late Jurassic–Early Creatase aged Yesilova ophiolites, Upper Cenonian aged Kızılcadag melange, Pliyo-Quaternary aged Niyazlar Formation and Quaternary aged alluvions. Yesilova ophiolite consist of tectonites, ultramafic and mafic cumulates, isotropic gabbros, plagiogranites and basalts from bottom to top. Yesilova ophiolite represents a missing row character ophiolite group because sheeted dike complex and pillow lavas are not seen. Chromite deposits of the investigation area show disseminated, nodular and massive character. Chromite deposits also observed in irregular shapes such as lens and are members of podiform type chromite deposits. 30 samples collected from the investigation area are chemically analyzed due to determine the petrographic character and rock geochemistry. 9 thin section obtained from chromite ore and lateral rock samples, and 4 pieces of polished thin section obtained from chromite samples are examined with the polarized microscopes in laboratories of Istanbul Technical University, Geological Engineering Department in order to appoint the mineral composition. Different types of diagrams are formed using the data of chromite analysis and these diagrams are correlated with the diagrams formed using the data of chromite analysis in other investigated areas in order to find geochemical similarity.

Keywords: Platinum Group Elements, Chromites, Yesilova (Burdur), Tefenni(Burdur), Ophiolites

1.INTRODUCTION

Ophiolites of Turkey mainly formed in Jura and Kretase (Figure 1). The study area covers two different sites located on the northwest of Tefenni (Burdur) district involving Tefenni plateau and environs with an area of 12 km² and located on Niyazlar Koyu (Yesilova-Burdur) district with an area of 50 km². The lithologic units observed in the study area from old to young are Late Jurassic–Early Creatase aged Yesilova ophiolites, Upper Cenonian aged Kızılcadag melange, Pliyo-Quaternary aged Niyazlar Formation and Quaternary aged alluvions (Döyen 1996). Yesilova ophiolite consist of tectonites, ultramafic and mafic cumulates, isotropic gabbros, plagiogranites and basalts from bottom to top (Stowe 1994). Yesilova ophiolite represents a missing row character ophiolite group because sheeted dike complex and pillow lavas are not seen (Kumral, 2000). Chromite deposits of the investigation area show disseminated, nodular and massive character. Chromite deposits also observed in irregular shapes such as lens and are members of podiform type chromite deposits.

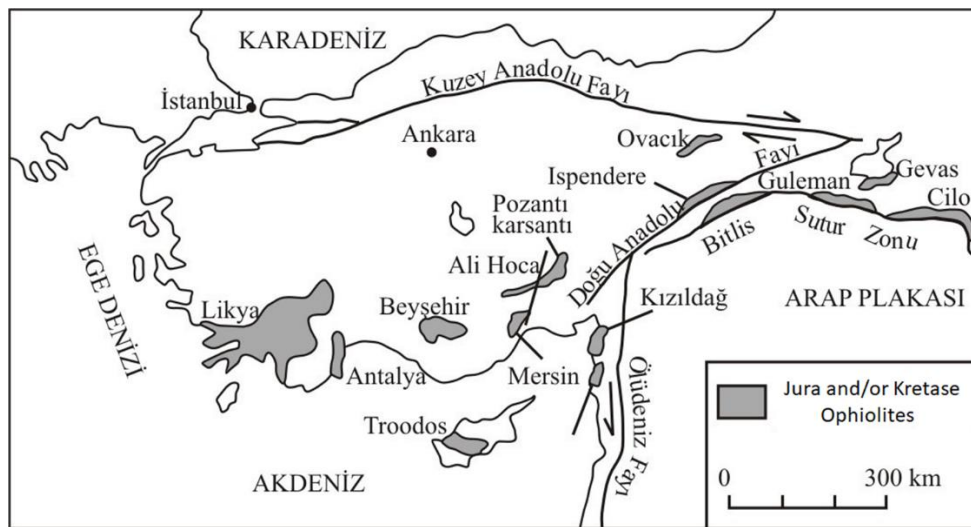


Figure 1. Jura And Kretase Ophiolites of Turkey (Parlak, 1996).

2. MATERIALS AND METHODS

30 samples collected from the investigation area are chemically analyzed due to determine the petrographic character and rock geochemistry. 9 thin section obtained from chromite ore and lateral rock samples and 4 pieces of polished thin section obtained from chromite samples are examined with the polarized microscopes in laboratories of Istanbul Technical University, Geological Engineering Department in order to appoint the mineral composition. 6 pieces of thin section obtained from chromite samples are due to microprobe analysis.

3. RESULTS AND DISCUSSION

Different types of diagrams are formed using the data of chromite analysis and these diagrams are correlated with the diagrams formed using the data of chromite analysis in other investigated areas in order to find geochemical similarity. Compared to Yesilova and Tefenni Chromites, it was determined that they showed different characteristics from these formations (Table 1). It has been determined that PGE content of Yesilova and Tefenni region Chromites do not show a regular increase or decrease in proportion to other values in the content of major oxide, some trace elements and other values of Platinum Group Element (PGE) contents (Table 2).

Table 1. Heavy Metal Content Of Samples.

Sample		NK1	NK2	NK3	TK1	TK2	TK3
Elements	Na	0,21	0,06	0,16	0,44	0,19	0,48
	Mg	8,34	9,00	9,91	10,37	10,66	9,67
	Al	10,41	10,95	11,29	8,57	7,44	6,9
	Si	1,34	1,78	2,27	3,71	6,21	4,84
	Cr	24,96	24,83	21,63	23,77	22,46	23,7
	Fe	18,78	16,91	17,88	15,91	15,32	17,33
	O	35,95	36,45	36,87	36,63	37,72	36,57
Major Oxides	Na ₂ O	0,29	0,08	0,21	0,59	0,26	0,65
	MgO	13,83	14,93	16,44	17,19	17,68	16,03
	Al ₂ O ₃	19,67	20,69	21,34	16,19	14,05	13,04
	SiO ₂	2,87	3,82	4,85	7,93	13,28	10,35
	Cr ₂ O ₃	36,48	36,29	31,61	34,74	32,82	34,64
	Fe ₂ O ₃	26,85	24,18	25,56	22,75	21,9	24,78

Table 2. PGE Elements Pottential Of Chromites.

	Au ppm	Pt ppm	Pd ppm
NK 1	0.002	0.065	0.014
NK2	<0.001	<0.005	<0.001
NK3	0.007	0.100	0.074
NK4	0.012	0.027	0.010
NK5	0.001	0.043	0.006
NK6	0.008	0.033	0.004
NK7	0.007	<0.005	<0.001
NK 8	0.003	0.056	0.018
NK 9	<0.001	<0.005	0.009
NK10	0.010	<0.005	0.008
NK 11	0.011	0.009	0.005
NK15	0.016	0.024	<0.001
TK 1-A	<0.001	<0.005	0.005
TK2	0.060	0.235	0.529
TK 3	0.004	0.038	0.004

According to the evaluation of the analysis results of Yesilova and Tefenni region Chromite Lines, it is determined that only Tefennic Chromites rich in terms of Platinum Group Elements (PGE). A total of 15 chromite minerals are found in the study area. The majority of the chromites present in the Yesilova region are operated and the operating grade is around 20-25% (Figure 2).

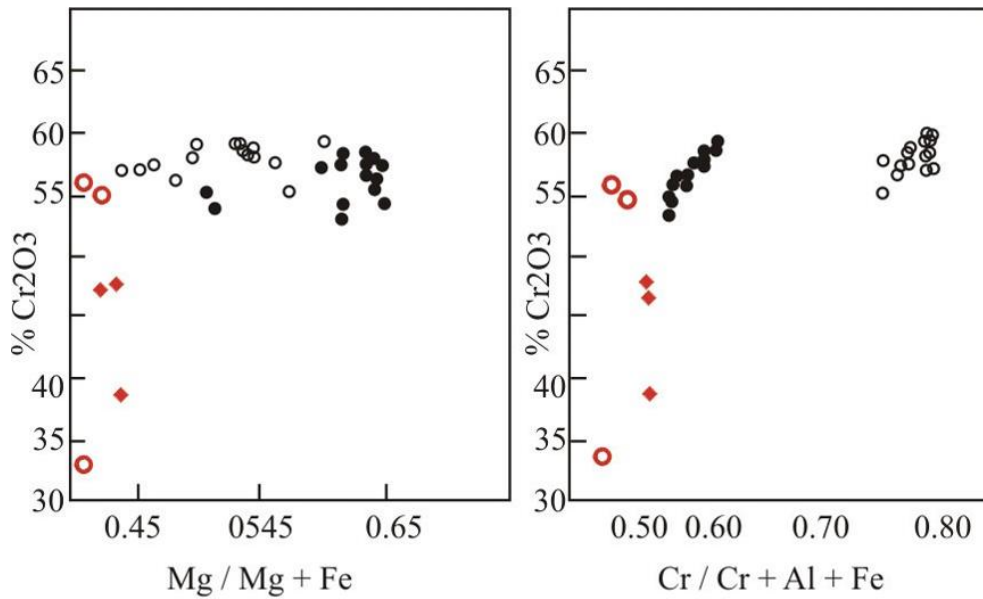


Figure 2. Heavy Metal Ratios versus Chrom Oxide Content of Different Samples.

According to the diagram showing the $\text{FeO} + \text{MgO} - \text{Cr}_2\text{O}_3 - \text{Al}_2\text{O}_3$ ratios of the samples, it was determined that the samples were rich in high Al and Fe (Figure 3).

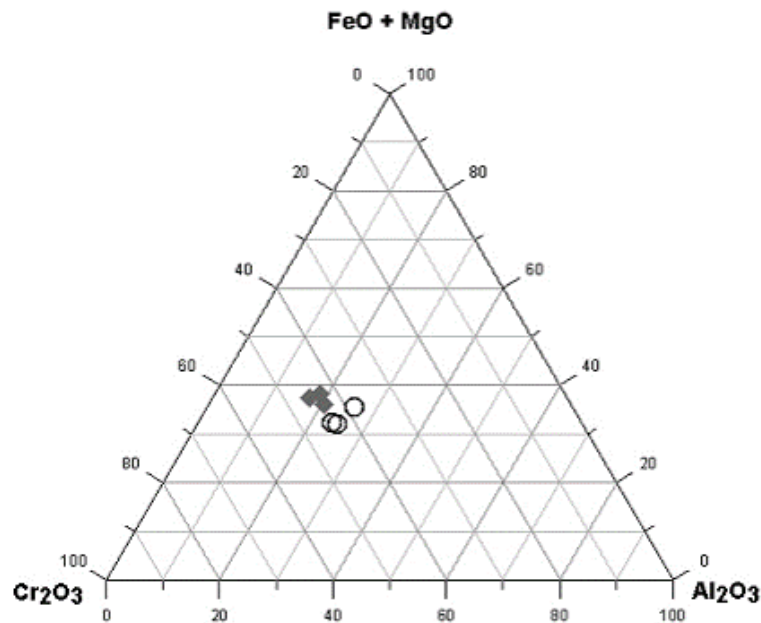


Figure 3. Equilibrium Diagram for Iron+Magnesium-Aluminium-Chrom Oxide.

The major oxide analyzes of the chromite grains revealed that SiO_2 there was a negative correlation between Fe_2O_3 value and Ni_2O_3 , negative correlation between Ni_2O_3 and Cr_2O_3 , negative correlation between Cr_2O_3 and Na_2O_3 and negative correlation between Al_2O_3 and CaO values in Fe_2O_3 and Tefenni chromites. It was found that there is no relation between SiO_2 and K_2O compared to Na_2O . Compared to Yesilova and Tefenni Chromites, it was determined that they showed different characteristics from these formations.

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Design of a Laser Scanning RangeFinder Based Feedback System for a 2DOF Robotic Balancer

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Abstract: Robotic systems have been using almost everywhere in the industrial applications. Autonomous transportation, storage area control, welding, painting, brushing, cleaning, assembling etc. tasks are today conducted by the robotic systems. They are integrated in the manufacturing lines since the planned accuracy and precision can be reached and the future manufacturing organizations can be done when the robots are in the production stages. The robotic operations like welding, brushing, painting, assembling etc. are performed via robotic arms. In such operations, the robots should access all points on the parts manufactured. This can be done either the robotic system is fixed on a turn & tilt table or the platform on which the part is placed is turned & tilted. In the industrial applications the latter, which is known as robotic balancing systems or robotic balancers, is used due to that it has some easy processes regarding to control. To be able to achieve good control for the robotic balancers, the feedback is very important. The use of cameras and efficient image processing techniques is one of the feedback solutions. Although there are number of advantages of using cameras, some of the problems, which have not been solved yet, and the disadvantages are still faced with in the real time applications. In this study, a laser scanning rangefinder solution is proposed. A laser scanner sensor is integrated to a 2DOF robotic system. The system model is constructed. The required verifications are done by the results of experiments. The details of the design stages are provided in this paper.

Keywords: Laser scanning rangefinder, 2DOF robot, feedback, balancer

1. INTRODUCTION

Robotic systems and robots have been commonly using in different industrial applications for the last two decades. Applications are ranging from welding to painting, brushing to joining tasks. Especially, in the automobile manufacturing industries, robots are almost everywhere. Starting from prototype development stage, they are in use till the ultimate product is reached. Pick and place robots are the other examples for the common use. These robotic systems are specially designed so that the base of them can be able to turnaround. In some cases, i.e. welding operations of automobile structure, the turn of the base of the robot may not be easily performed. Instead of turning the whole robotic system, the table, on which the part worked is placed on it, may be turned according to the need. This case is common in welding robotic systems due to decreasing processing time, control effort and number of feedback sources. Such robots are known as robotic balancer or balancing systems. These robots are also used in the robotics and control courses in the engineering education since the physical meaning of the feedback in a robotic system can be effectively shown to the students when a robotic balancer is used. The feedback sources of balancing robots are the integration of high resolution encoders, tachometers and high quality cameras. The control algorithm should get the data from these sensorial systems and perform required decoding processes and run the planned control loop. In this study, it is proposed that the feedback sensorial system can be created by the use of a laser scanning rangefinder sensor for a 2DOF robotic balancer. 2DOF robot's motions in two axes are achieved using two dc motors having gearheads. DC motors are suited with high resolution encoders and tachometers as well. These sensors provide the information about at which tilt angles the platform is rotated in two axes. A camera, which is placed at the top of the robotic system, is also used for getting the localization feedback for the object located on the platform. In this system, the data coming from the camera and the other sensors are replaced with the data obtaining from a laser scanning rangefinder sensor. While the balancing systems is in motion, the algorithm, which uses the laser sensor data, predicts where the object is on the platform and estimates what angles the platform rotates in two directions. At the same time, the data flowing from encoders, tachometers and camera is also collected in order to make verification about whether the robotic system follows a reference trajectory or not. In other words, their outputs are used as the ground truth. The proposed system is mathematically modeled, simulations are conducted and the results are verified with the results obtained from the experimental studies. The results highlights that laser scanning rangefinder sensors can be adapted into the robotic balancing platforms for getting fast, accurate and usable feedback. This enables to increase the performance of the control strategy and keep the object and the platform under observation during a real-time operation.

Literature Studies

There are some studies related to the robotic balancers and the clustering algorithms to detect an object placed on a platform. Wouw et al. (2005) studied the balancing performance of an automatic ball balancer. The study focused on investigating the performance of the system. Kinematic and dynamic models of a balancing system were constructed. Green et al. (2008) worked on the analytical and experimental investigation of automatic balancing systems. They

designed a dynamic balancer monitoring system. By this way, the dynamics of the system was monitored. Cui et al. (2007) proposed a laser scanner rangefinder based detection and tracking system. The objective of the system developed was to track people. The use of system in mobile robotic and intelligent surveillance applications was also investigated. Feng et al. (2014) proposed an agglomerative hierarchical clustering system to create a real-time plane extraction in point clouds. The sensor data was clustered to be able to detect the multiple planes. Lipnickas et al. (2014) developed a system including a laser scanner rangefinder and a CCD color camera. A RANSAC search engine was integrated to the system so as to segment the flat areas and detect the planes. The system proposed was able to create a 3D space scene and merge the data coming from laser sensor and camera.

Problem Description

In Figure 1, a welding operation conducted by a welding robot is demonstrated. The part which is welded by the robotic system is located on the platform. The platform is tilted in this case so that the robotic arm can able to access the desired points on the part to be welded. This increases the welding quality and reduces the time required for completing the welding process.



Figure 1. Robotic system performs a welding operation on a tilted platform. The picture is taken from the website (Web, 2018).

The process shown in Figure 1 can be converted into an intelligent system. The platform is modified and can be tilted in a desired angle. This ensures that welding torch of the robotic arm can be able to access any point on the part. According to the requirements of the welding operation, the platform may be tilted in 2, 3 or more dimensions. In such a case, the important point is the feedback. The information of the tilt angles of the table and the location of the welding part on the table gains importance. In the industrial applications, the camera solution is commonly used for obtaining the location of the part on the table and tachometer & encoder pair is used for getting the tilt angle information. Although the use of cameras has advantages, there are some challenges in real time applications.

As a solution, the adaptation of a laser scanning rangefinder sensor to a robotic platform is proposed in this study. The system developed is integrated to a 2DOF robotic balancer. Both the mathematical model and the laser scanning system developed are tested on the platform. The results verify that a laser scanning rangefinder sensor can be adapted to a robotic balancer for real time operations. Such a system does not require heavily computational efforts and is not significantly affected from the disturbances coming from the working environment.

Development of the Laser Scanning Rangefinder Based Feedback System

In this study, a 2DOF robotic balancer is used as an experimental platform. A laser scanning rangefinder sensor shown in Figure 2-a is integrated to the system. The sensor (Hokuyo URG-04LX) can be able to scan its surrounding within a 240° scanning angle range (Figure 2-b). The angular resolution in the scanning operations is about 0.36° . The sensor can measure the distances up to 4 m. The accuracy is less than 10 mm. Power consumption of the sensor is 2.5 W. It runs with 5 V DC voltage and draws 500 mA current. The communication with this sensor is achieved by the use of RS232 serial protocol.

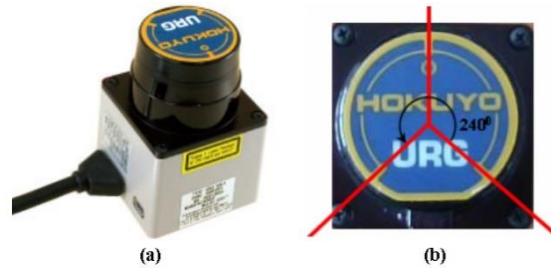


Figure 2. Laser scanning rangefinder sensor used in this study.

The integration of the laser sensor to the 2DOF robotic balancer is illustrated in Figure 3. A mechanical case is designed and the sensor is attached to it.

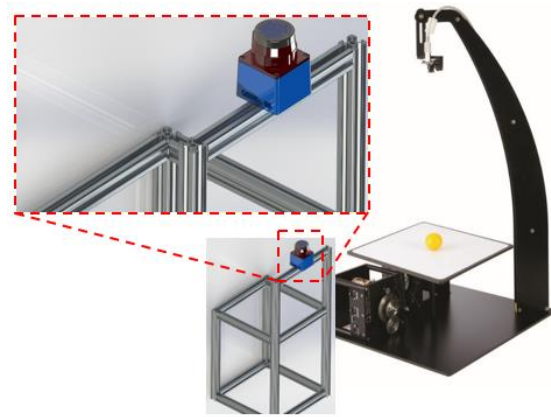


Figure 3. Integration of the laser sensor to the 2DOF robotic balancer.

Mathematical representation of the model which shows the motion of the 2DOF robotic system is shown in Figure 4. The dimensions and the forces acting on the ball are indicated in this figure. The dynamics of the motion of the ball is modeled so that the ball's motion on the tilted platform can be precisely modeled.

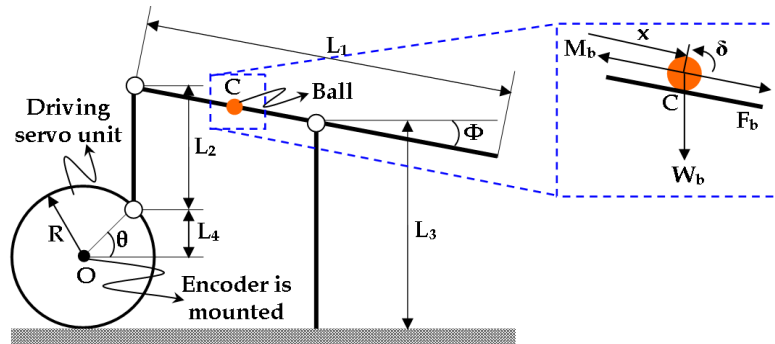


Figure 4. Mathematical modeling of the 2DOF robotic system.

2DOF robotic system is suited with high resolution encoders and a laser scanning sensor. Encoders are used to get the tilt angle information and the laser is the feedback source to obtain the location of the ball on the platform. These details are presented in Figure 4. One of the experimental results is shown in Figure 5. In this figure, the ball position on the platform is obtained by the use of modeling structure. A clustering algorithm is also adapted to this system in order to detect the ball position in an accurate way.

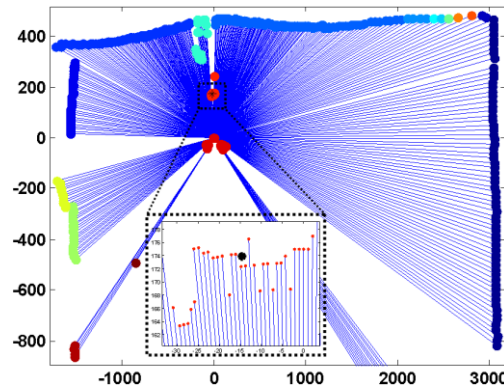


Figure 5. Detecting the object on the tilted platform.

3.RESULTS AND DISCUSSION

In this study a 2DOF robotic balancer is integrated with a laser scanning rangefinder sensor. The object location on the platform is obtained by the use of a laser sensor. 2DOF robotic platform is suited with high resolution encoders to obtain the tilt angles. Laser sensor data is fed through a data clustering algorithm developed in this study. All mathematical structures are collected into a system model to be able to detect the object location in a precise manner. The experimental results show that the object location on the table can be obtained in a couple of mm accuracy. The research provides some highlights that the system introduced in this study can be adapted to real time robotic systems. It also give some starting points to the researchers and engineers who have plans to work on this subject.

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An Investigation of Local Scour Around Bridge Piers under Gradually Decelerating Flow Conditions

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Abstract: In this study, the local scour around a cylindrical bridge pier is investigated under gradually decelerating flow conditions. The experiments were conducted in a flume that has 0.001 bottom slope, 10.0 m length, 0.5 m width and 0.5 m depth, located in the Fluid Mechanics Laboratory of Gazi University, Faculty of Engineering, Department of Civil Engineering. The experiments were carried out under non uniform flow conditions and nearly uniform sediments were used. It was observed that as the value of flow intensity (U/U_c) increases, the value of dimensionless local scour depth (y_s/h) also increases. Similarly, when the Froude number value increases, y_s/h value increases. The results obtained are compared with those obtained from the studies in the literature and it is seen that the results are consistent with these studies. In addition, the results show that gradually decelerating flow is an important parameter for local scour around bridge piers. The difference of present study from other similar studies in the literature is that the flow conditions are non-uniform flow (gradually decelerating flow). Since the non-uniform flow conditions is closer to the natural conditions, the results of this study are thought to be more suitable for the field conditions.

Keywords: Local scour, clear-water scour, bridge piers, gradually decelerating flow, non-uniform flow.

1. INTRODUCTION

Stability problems due to scouring occurring on the foundation of bridge piers are quite common problems in practice. Every year, many bridges are destroyed due to such stability problems. The scouring around the bridge piers occurs in three different ways. These are

- General scouring
- Contraction scouring
- Local scouring.

General scouring is a type of scouring that occurs along the river bed and takes place in the form of a general bottom lowering. Contraction scouring is a type of scouring formed by accelerating the flow of water and increasing the amount of sediment transported due to the narrowing of the bridge cross section on the river. Local scouring is a type of scouring that formed by changing the location, direction and speed of the stream due to a structure (e.g. bridge piers) built in the river. these three types of scouring can take place separately or in different combinations. The shape and size of the scouring not only depends on the type of scouring but also on the properties of the stream, fluid, sediment, channel geometry and bridge pier geometry (Yanmaz 2002, Melville, 2008).

In this study, only the local scouring around the bridge piers was investigated under nonuniform flow and clear water conditions using uniform sediment in a rectangular canal.

2. MATERIALS AND METHODS

A rectangular flume was used in this study (Figure 1). The experiments were conducted in a flume, which has 10.0 m length, 0.5 m width and 0.5 m depth, located in the Fluid Mechanics Laboratory of Gazi University, Faculty of Engineering, Department of Civil Engineering. The bottom of rectangular flume is made of galvanized sheet and the side walls are made of glass for direct observation of the sediment movement. The thickness of the sediment layer at the end of the flume is kept thinner than the sediment thickness at the entrance of the flume in order to obtain the desired channel bottom slope.

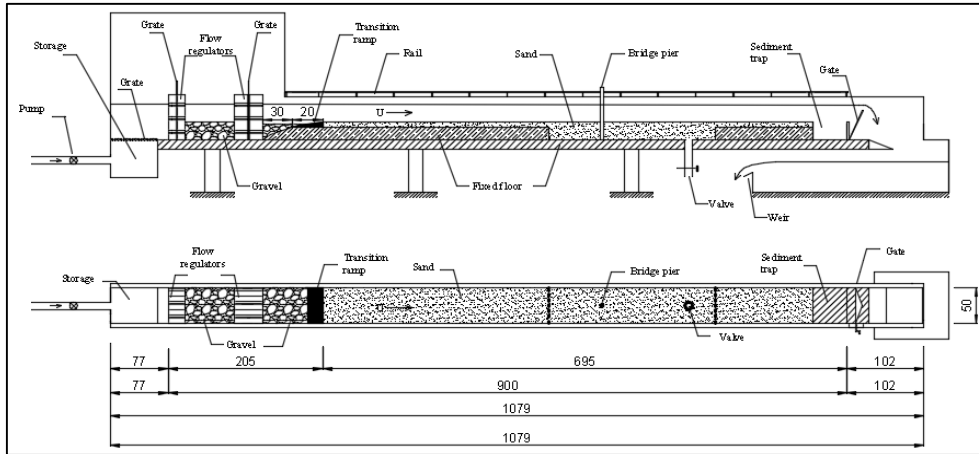


Figure 1. Schematic view of experimental setup

Cohesionless sand material nearly with an average grain diameter of 1.25 mm (Figure 2) and a geometric standard deviation of 1.17 was placed on the channel bottom from the beginning of the approach channel to the end of the channel at 0.001 slope.

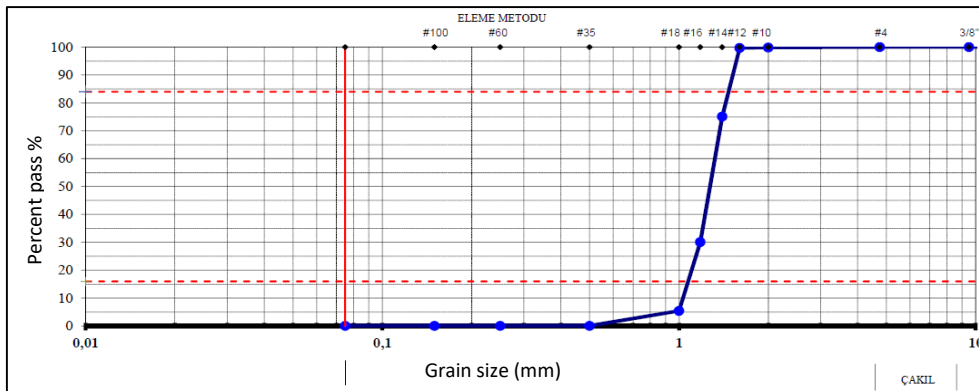


Figure 2. Grain-size distribution curve (granulometry)

The valves at the beginning of the channel are used to set the discharge, and the height adjustable gate at the end of the channel is used to obtain gradually varied flow. A total of three limnimetres were used, with the capability of ± 0.1 mm precision for measuring the water surface elevations, and one that can be moved by the wheels on one of the rail mounted on the flume.

3.RESULTS AND DISCUSSION

In preliminary tests, for each discharge value, initiation of sediment motion conditions were determined. For each U/U_c the water depths and the water surface profiles were measured. Energy grade line and water surface slopes were determined and recorded (Table 1).

Table 1. Boundary conditions for gradually decelerating flow experiments

Experiment No	Q (lt/sec)	H (m)	R (m)	Measured I_0	Measured I_w	Measured I_E	dh/dx
20SD1	20,00	0,1399	0,090	0,001	0,000616	0,000639	0,00038
20SD2	20,00	0,1336	0,087	0,001	0,000764	0,000780	0,00024
20SD3	20,00	0,1237	0,083	0,001	0,001004	0,001004	0,00000
30SD1	30,00	0,2154	0,116	0,001	0,000406	0,000427	0,00059
30SD2	30,00	0,1917	0,109	0,001	0,000568	0,000590	0,00043
30SD3	30,00	0,1752	0,103	0,001	0,000718	0,000737	0,00028
40SD1	40,00	0,2648	0,129	0,001	0,000399	0,000420	0,00060
40SD2	40,00	0,2450	0,124	0,001	0,000541	0,000562	0,00045
40SD3	40,00	0,2203	0,117	0,001	0,000692	0,000711	0,00031

An approximate duration of the experiment was attempted to be estimated using equations in literature to determine the duration of the local scouring experiments. and the duration of reaching the ultimate depth of carving was followed and recorded.

Table 2 shows the scour experiments duration at which the scour depth around the bridge piers reaches the equilibrium in the experimental conditions.

Table 2. Comparison of experiment duration results obtained from experiments and the literature

Experiment No	Computed experiment time (day) Grimaldi (2009)	Computed experiment time (day) Melville ve Chiew (1999)	Computed $\Delta y_{s,24}$ (cm) Grimaldi (2009)	Actual duration of the experiment (day)
20OD1	4,34	3,74	0,083	2,93
20OD2	4,88	3,46	0,083	3,10
20OD3	5,56	3,07	0,083	3,25
30OD1	4,15	3,92	0,083	3,00
30OD2	4,76	3,57	0,083	6,00
30OD3	5,43	3,14	0,083	5,00
40OD1	3,83	4,07	0,083	3,00
40OD2	4,46	3,67	0,083	3,35

Table 2 shows that scour depth around bridge piers, generally, reached to the equilibrium depth between 3 and 6 days. In the experiments, the variation of the local scouring over time was recorded. An example of the variation of the scour depth around bridge pier over time is as in Figure 3.

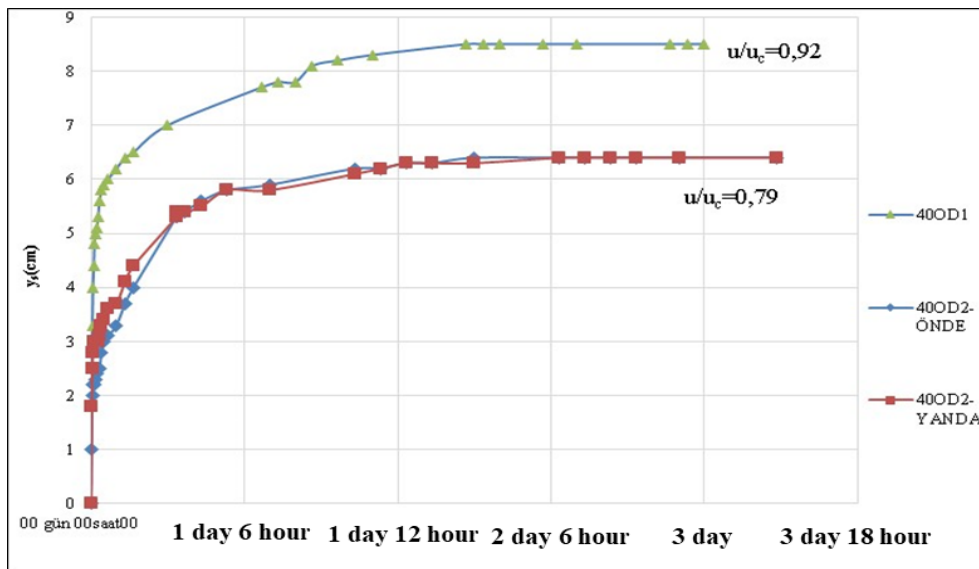


Figure 3. Scour depth development over time (from experiment 40OD1)

The experiments were carried out under clean water scouring conditions ($U/U_c < 1$). The results show that the dimensionless scour depth (y_s/h) around bridge pier is increased by the flow intensity (U/U_c) (Figure 4).

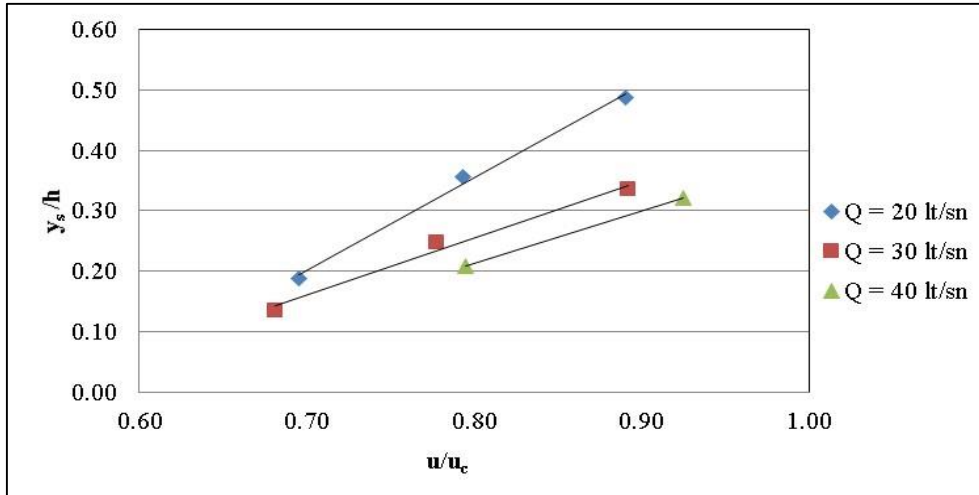


Figure 4. The relationship between dimensionless scour depth and flow intensity

When the relation between the dimensionless scour depth (y_s/h) around bridge pier and the dimensionless depth of flow (h/d_{50}) is examined, it is seen that the dimensionless scour depth decreases as the dimensionless flow depth increases (Figure 5). As seen from Figure 5, the most effective parameter on the depth of scour around bridge pier is the approach velocity.

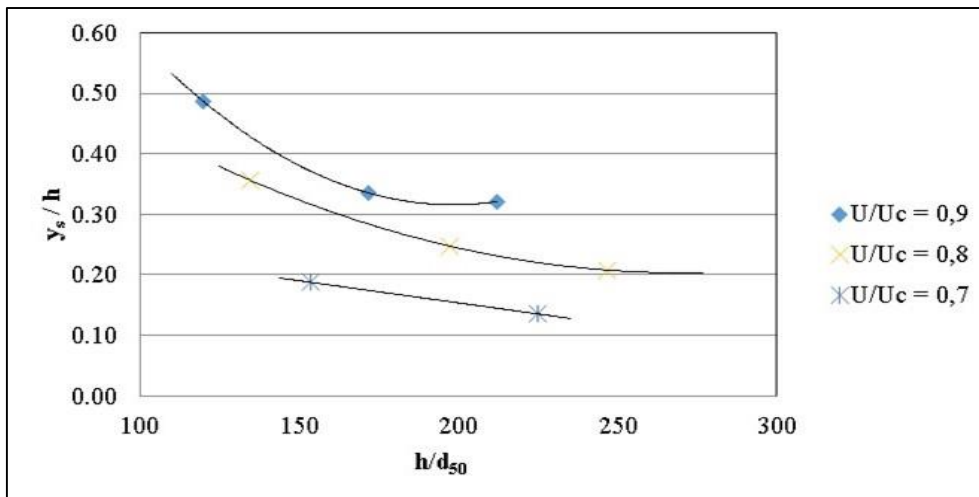


Figure 5. Variation of dimensionless scour depth with relative flow depth

Again, it is seen from experiments that there is a linear relationship between the Froude number (Fr) and the dimensionless scour depth (y_s/h) around bridge pier, and as the Froude number (Fr) increases, the dimensionless scour depth (y_s/h) is also increasing (Figure 6).

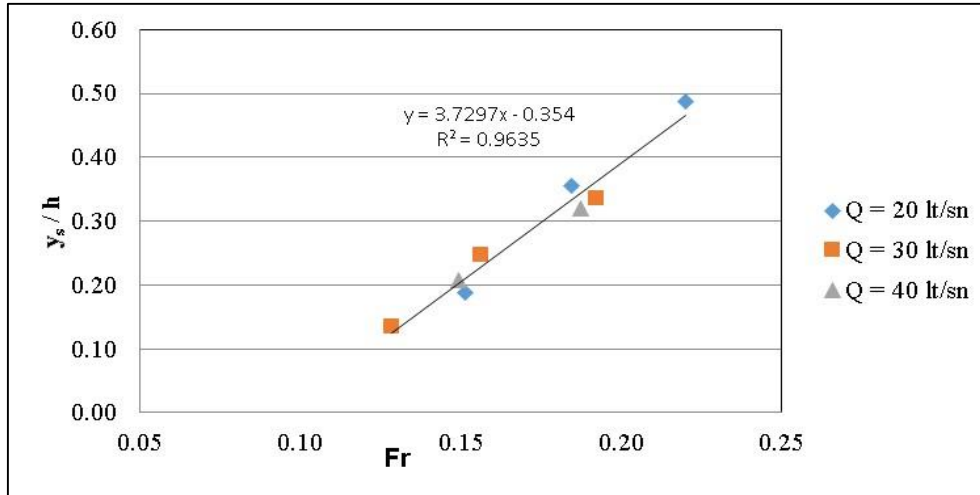


Figure 6. The relationship between dimensionless scour depth and Froude number

The ultimate scour depths obtained from the experiments were compared with the scour depths obtained from the local scour estimated formulas in the literature. The scour depths around bridge piers estimated by the formulas in the literature are usually larger than the measured scour depths (Figure 7).

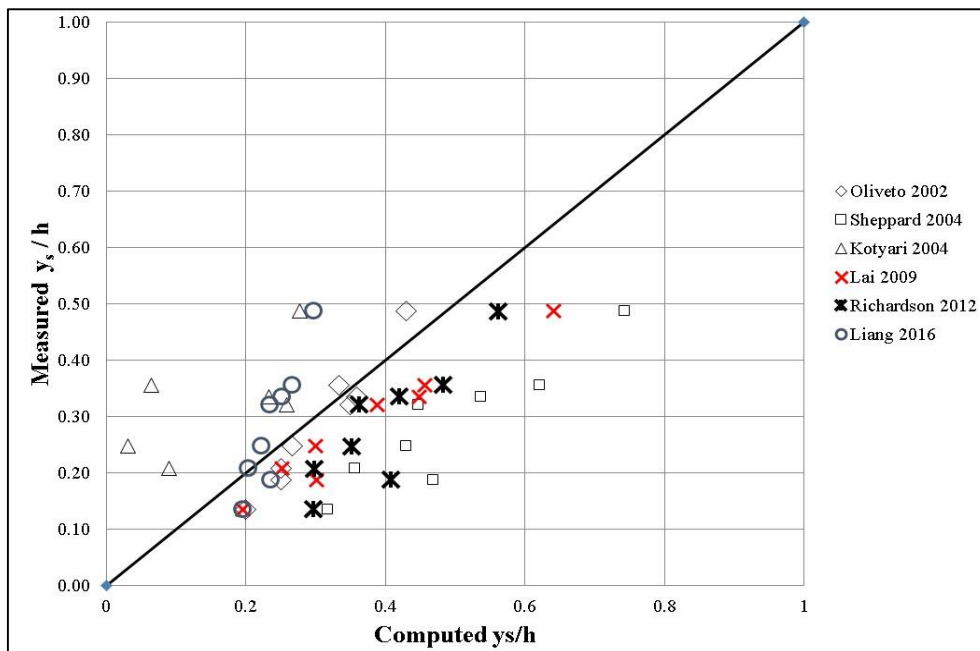


Figure 7. Comparison with estimated scour depths from the literature and measured depths

According to the results of the experiments, the following statements can be written,

- The non-uniformity of the flow affects the scour depth around bridge piers.
- Under the gradually decelerating flow conditions, the scour depth is smaller than the scour depth given by the formulas obtained from under uniform flow conditions.
- The approach velocity is the most effective parameter on the scour depth and shape.
- As the Froude number increases, the scour depth increases.
- As the U/U_c value increases, the scour depth increases.

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The Use of ROS in the Development of an Autonomous Forklift Project

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Abstract: Today, autonomous ground vehicles are in everywhere. They are being effectively used for different purposes in industrial applications. The expectations of the manufacturing lines are increased when the autonomous vehicles are adapted into the production systems. One of the main usage of the autonomous vehicles are in the storage areas of the industrial zones. The forklifts driven by operators are converted into autonomous vehicles and integrated in the manufacturing chain. This ensures that the production plans including transportation of the parts from the storage area to the manufacturing lines can be successfully followed. By this way, the manufacturing speed, which depends on the feeding the manufacturing lines with the required materials/units, is increased. Development of an autonomous forklift can be successfully completed if the computing system is accurately designed. There are many ways to develop control and communication units in the literature, however, today the mechatronics and robotics researchers wish to use engineering tools which are easy-to-use and easy-to-adapt. In order to make a contribution for this subject, the use of Robot Operating System (ROS) in the development procedure of an autonomous forklift project is focused in this study. It is aimed to show how the control architecture of an autonomous forklift is developed by using ROS tool. The communication with the sensorial units using ROS is also presented. The background of the developed system is introduced step by step in this paper.

Keywords: ROS, autonomous forklift, control, automation, mobile robot

1.INTRODUCTION

Autonomous vehicles and mobile robots have been using in different areas for different purposes especially for the last decade. In the near future it is expected that the needs for the autonomous vehicles will be dramatically increasing since the developments in computer and communication techniques directly feed the improvements in autonomy. The autonomous vehicles, nowadays, find places in industry for themselves. They are replaced with the manned vehicles in the industrial applications. The one, of which usage has been sharply increasing, is the autonomous forklifts. They almost are being in use in anywhere in the industrial tasks. Due to increasing demands, both the number of usage and the researches focused on developments of autonomous forklifts are rising up. In order to follow the researches related to autonomous forklift subject and make a contribution in this field, this study is conducted. The study focuses on design, simulation, manufacturing and assembly, control and tests of an autonomous forklift prototype. The most challenging part of a mechatronics / robotics project is the programming environment since the mathematical representations of each mechanical / electronical subsystems need to be combined using a control strategy under a smooth computational & communicational structure.

In this study, this challenging issue is overcome by the use of ROS, which is the initials of the words of “Robot Operating System”. It runs stably under Linux-Ubuntu environment and provides all its details in open-source approach. It works based on the idea of the publisher-subscriber couple. If the ROS is planned to be integrated into a system, tools, equipment, sensors, motion controllers, microprocessors and embedded computing systems, should be chosen by considering that their libraries and drivers are available in the ROS architecture.

In this study, the autonomous forklift designed has four mecanum wheels and controlled via all-wheel-drive technique. Four dc motors coupled with gearheads are commanded by the use of ROS supported motion controllers. The motors are also suited with high resolution encoders connected to a high speed encoder interface board which is also recognized by the ROS. The autonomous vehicle’s forklift part is also controlled using an actuated mechanism of which required signals are provided via a ROS supported controller. A laser scanner rangefinder used for mapping tasks and an indoor-GPS system used for localization purposes are integrated into the vehicle as well. These systems run also under ROS. The main computing unit is an embedded PC, which runs ROS under Linux-Ubuntu. In ROS, the required decoding and encoding processes of the sensors, sub-computing units and the coding strategies are performed using C++ and / or Python programming languages. In case the performance, accuracy and processing speed are the focuses, ROS provides a good engineering programming platform for the researchers. It is experienced that when the autonomous system includes sensors which require heavy computation for processing and mathematical representations which demand overload computing on computer, ROS is one of the solutions in the robotics research area. There is another advantages of using ROS that if the prototype of an autonomous system developed in the laboratory is controlled via ROS and it is intended to develop its industrial version, all computing and communicational infrastructures can be easily transferred to the industrial version by the use of ROS-Industrial Architecture.

The outline of this study is constructed as follows: the next section is about the related studies. Section 4 presents the problem statement of this study. Design procedure of the ROS based system is introduced in Section 4. The last section is related to the analysis of the system developed and conclusions.

Related Studies

Szayer et al. (2017) used ROS to develop a control system for a holonomic mobile robot. They implemented their algorithms in ROS for accessing every components online. The mathematical background of the system model was simulated and experimentally confirmed. Gracia and Tornero (2009) developed a kinematic model for mecanum wheeled mobile robots. They studied for getting zero tracking error in desired trajectory tracking tasks. They confirmed their models via simulation and experimental results. Kirsch and Rohrig (2011) studied on global localization and position tracking of an autonomous mecanum wheeled vehicle. They constructed a mathematical model and built a simulation environment. A mecanum wheeled transportation robot is used for testing the algorithms proposed. Zhang and Huang (2015) proposed a mathematical system for a mecanum wheeled forklift. The mechanical structure and trajectory tracking model of the forklift were investigated. The tracked & mecanum wheeled system was also studied. Proposed approach was experimentally tested on a tracked-omni-vehicle. Clavien et al. (2018) introduced a model for instantaneous center of rotation based motion control for an omnidirectional robot. They proposed a new kinematics based motion control approach. The algorithms were implemented to the computational environment developed by the use of ROS.

2.MATERIALS AND METHODS

In this study, the computational and communication tasks of an autonomous forklift are focused. It is aimed that these tasks are achieved by using an efficient architecture. In the literature, there are many ways to perform such objectives, however, the primary goal is to create a tool which is easy-to-use and easy-to-adapt. In an autonomous forklift, there are number of sensors, controllers and processors. They should be not only talking to each other but also passing data to the outside world. Today's researches show that this can be achieved by the use ROS, which is commonly used by the mechatronics, robotics and automation researchers and engineers. It is a general opinion that the ROS solution is compatible with the industrial applications as well. ROS is a place in which the special software libraries and tools are collected. These collections are the big helpers to the ones who devote their research life for robotics, mechatronics or automation studies. ROS gives capabilities to the researchers for building robotic applications, touching the automation lines with a great sense and converting the ideas into real autonomous systems. It includes the drivers for sensors and controllers, algorithms, mathematical models and development tools for the real robotic systems. ROS has the required capability to construct a programming architecture for an autonomous forklift system.

Design of the ROS Based System

In this study, a four-wheeled forklift is taken into consideration. The driving wheels are mecanum type. They can be able to be controlled in any direction so that a full-rotation in the mass center of the vehicle could be achieved. In addition to the vehicle's motion in backward and forward directions, the motions in right and left directions can also be performed by the use proper control strategies.

As shown in Figure 1, the forklift is driven with four DC motors suited with gearboxes. High resolution encoders are plugged into the motors so that the rotational position and velocity information can be obtained in high precision. Each motor unit is controlled by using a motion controller which has communication capabilities with both the microprocessors and the main computing unit. The forklift part of the vehicle is also driven using a DC motor and its control unit. It is a fact that the motion controllers should be controlled and at the same time the high speed encoder data should be handled via a main computing unit.

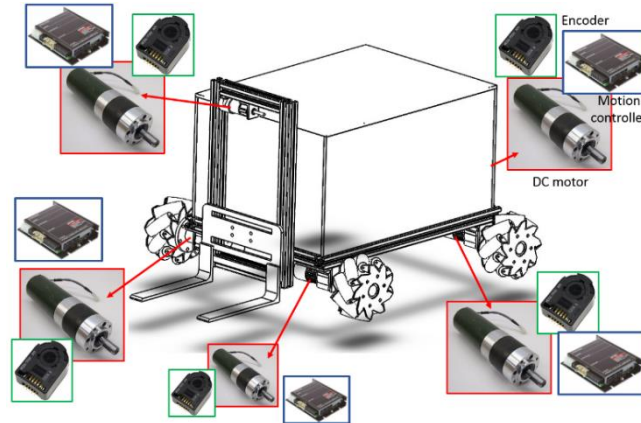


Figure 1. Forklift's traction system including DC motors, high resolution encoders and motion controllers.

In order to perform mapping of the working area, detecting the obstacles and planning the reference route, laser scanning rangefinder sensors should also be adapted to the autonomous forklift as shown in Figure 2. The decoding processes of the data which flows from the laser sensor to the main computing unit should also be performed without any interruption.

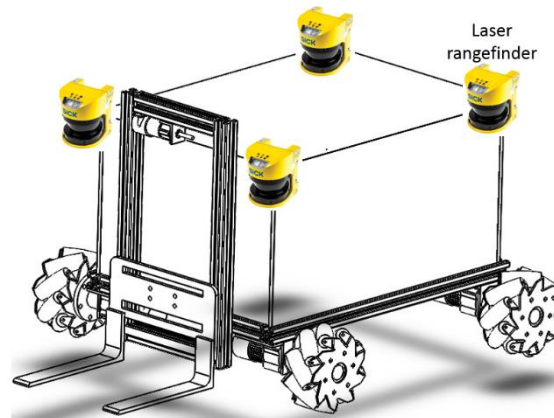


Figure 2. Forklift is suited with laser scanning rangefinder sensors.

The autonomous forklift, which the research is focused on, is to be working in a closed region. One of the challenging issue is the localization. This problem is solved by integrating an indoor GPS system to the vehicle as shown in Figure 3. The system includes at least three anchors and a tag. The data coming from these units are combined into an embedded computing system.

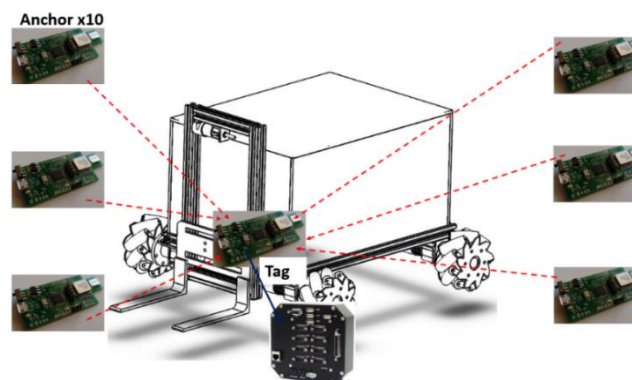


Figure 3. An indoor positioning system is integrated to the autonomous forklift to perform localization.

In addition to the laser sensors, indoor observation is also performed by the use cameras (Figure 4). They make the vehicle more intelligent and motion safer. The data coming from cameras is integrated into the system via an efficient image processing algorithm.

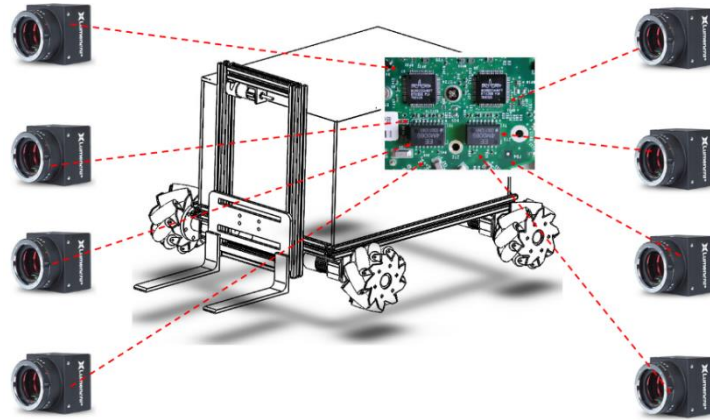


Figure 4. Cameras and an efficient image processing algorithm make the vehicle more intelligent and the motion safer.

The sensorial subunits located in the forklift are briefly summarized in Figure 1, 2, 3, and 4. These sensors should compatibly work with each other and the feedback data should be collected in a main computing unit. The solution proposed in the study is to use ROS structure. Both sensor data handling and algorithm development processes can be performed in the environment created using ROS. The working principle of ROS is presented in Figure 5. Each sensor is defined in a node unit. They publish messages. In case an information is needed, it subscribed by the topic to the related node. This infrastructure works independent of the number of sensors and actuating units. It provides data in a precise and accurate manner in the predefined working frequency. It is experienced that the frequency of facing with the real time crashes is dramatically decreased if the system works with ROS.

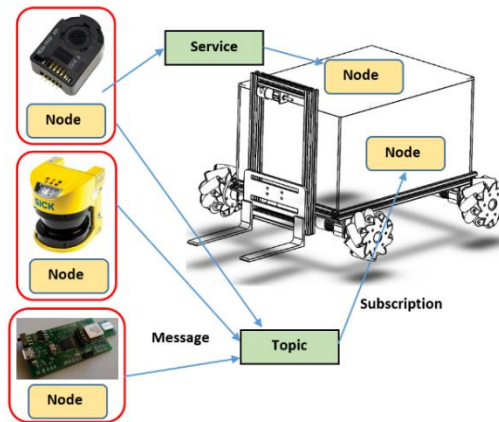


Figure 5. Representation of the ROS working procedure in the autonomous system.

3.RESULTS AND DISCUSSION

In this study, the development procedure of a control system of an autonomous forklift by the use of ROS is focused. The forklift on which the research is conducted has four mecanum wheels. A vehicle that uses mecanum wheels can be able to move any direction like a tank if the control strategy is correctly constructed. The forklift's mecanum wheels are driven via four independent dc motors. Four motion control units are coupled to the dc motors so that the position and velocity controls of the wheels can be performed. To get precise rotational motion information of the motors, each dc motor is suited with high resolution encoder. More than one laser scanning rangefinder sensors are located in the vehicle. They are the feedback sources of creating mapping of the surrounding. In order to perform the accurate localization tasks of the vehicle in the workspace, indoor GPS units are also integrated to the system. They are able to give localization information within a couple of cm accuracy. The observation of the surrounding is the major challenging issue in the autonomous forklift application. To detect obstacles and mark them in the map, create desired trajectory and make the drive safe, cameras are located in the vehicle. An efficient image/video processing algorithm is created. All these subunits are combined in the control tool developed using ROS. The stages of how to use ROS in an autonomous forklift system

to combine all sensors, algorithms, methodologies in a unique tool are presented in this study. It is also desired that the points highlighted in this study may give some foresight to the researchers who wish to work on this subject.

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Use of Particle Swarm Optimization to Determine the Optimal Transmitter in Passive Radar Systems

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Abstract: In this study, it is aimed to determine the best transmitter of opportunity in a region for a passive radar system by using particle swarm optimization algorithm. The developed algorithm utilize real terrain maps to increase the usability. In this work, the Shuttle Radar Topography Mission elevation data of the National Aeronautics and Space Administration is used to generate the terrain. The publicly available SRTM 3 version of this data set has 3 arc-seconds resolution and the elevations are calculated relative to the WGS84 ellipsoid, which is the default datum used for the Global Positioning System (GPS). Hence, the transmitters in the region are placed on the map with respect to their latitude and longitude. The search process involves an imaginary target which is placed on the intended coverage area. According to the target and the generated terrain, a line of sight test is performed to eliminate the transmitters without for the direct view. On the remaining transmitters, particle swarm optimization is applied to the radar equation to define the transmitter with the highest signal to noise ratio.

Keywords: Passive Radar, Particle Swarm Optimization, Location Determination, Terrain Maps, Radar Equation

1. INTRODUCTION

Ground-based radars are one of the most important components of the early-warning defense systems and many of the modern air and maritime surveillance systems suffer from blind zones created by the terrain features of the region. The potential coverage area gaps of the main surveillance system can be suppressed by the collaborative use of additional systems.

Passive radars can be utilized as auxiliary systems to cover the blind zones of the main surveillance systems while avoiding RF emissions. Mainly, these systems exploit feasible transmitters (such as DVB-T, GSM or DAB), called "illuminators of opportunity", in the region for their operation and make difference over the conventional radars. Especially in the last decade, investigations on the possible use of passive radar systems for surveillance purposes has received much attention from researchers because of the inherent advantages (Honda 2016). Also, the introduction of new wireless technologies and high power transmitters keep the interest in the field alive (Evers 2015).

In a typical bistatic passive radar system, high signal to noise ratio (SNR) copy of the transmitted signal is collected by the reference receiver and the surveillance receiver gathers echoes from the targets to perform detection and localization. The reference receiver can be conveniently located to a place with direct view to the transmitter. However, the direct signal, if received by the surveillance receivers, will mask weak echoes from the targets, introduce ambiguities and increase the dynamic range requirement. Thus, in passive radar systems, where the transmitter is not under the control of the radar designer, placing the surveillance receivers employing the best transmitter to be utilized is a major challenge. In this work, a particle swarm optimization based algorithm is proposed to find the best possible transmitter to be utilized in the region.

2. MATERIALS AND METHODS

Radar Equation

Passive radars utilize the commercially available transmitters for operation. Hence, these systems are bi-static where the transmitter and the receivers are placed in different locations (Skolnik 2010). A basic passive radar geometry is shown in Figure 1.

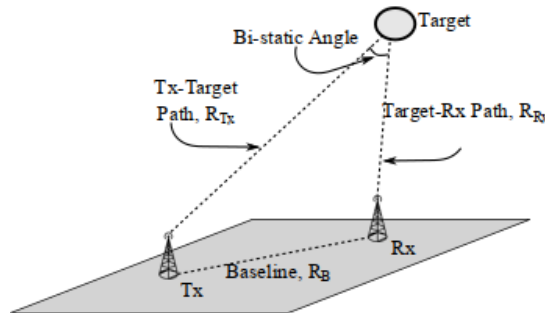


Figure 1. Bi-static passive radar geometry

In the given figure, R_{Tx} is the distance between the transmitter and the target. Similarly, R_{Rx} is the distance between the target and the echo receiver. According to the given geometry and notations, bi-static radar equation can be written as,

$$P_{Rx} = \frac{P_{Tx} G_{Tx} G_{Rx} \lambda^2 \sigma_B}{(4\pi)^3 R_{Tx}^2 R_{Rx}^2 L}$$

(1)

In this equation P_{Tx} is the transmitter power, P_{Rx} is the received power, G_{Tx} and G_{Rx} are the transmitter and receiver antenna gains, respectively. Additionally, λ is the wavelength, σ_B is the bi-static radar cross section and the L denotes the atmospheric propagation and system losses. The noise factor in the receiver can be found as

$$N = kT_e B$$

(2)

In the given equation k is the Boltzman constant, T_e is the effective system temperature and B is the bandwidth.

Terrain Generation and Coordination System

Employment of real terrain maps on the placement determination of the surveillance receivers provide opportunities to accurately test and escalate the usability of the algorithm. In this work, the Shuttle Radar Topography Mission (SRTM) elevation data of the National Aeronautics and Space Administration (NASA) is used to generate the terrain (Farr et al. 2007). The publicly available SRTM 3 version of this dataset has 3 arc-seconds resolution and the elevations are calculated relative to the WGS84 ellipsoid, which is the default datum used for the Global Positioning System (GPS). In this study, the WGS84 geodetic coordinate system is used to pinpoint the transmitters, radar receivers and the targets on the terrain. The schematic of the coordinate system and its parameters are shown in Figure 2.

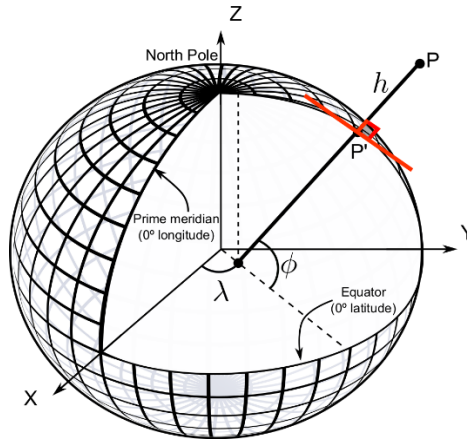


Figure 2. Geodetic Coordinate System

In the figure, X , Y and Z axis describes the Earth Centric Earth Fixed (ECEF) coordinates. At an arbitrary point P , the distance from the normal line at the point on the surface of the Earth is defined as height, h , and the intersection point is shown as P' on the figure. The term λ , geodetic latitude, is the angle between the equatorial plane and the perpendicular line that intersects P' . The term ϕ , geodetic longitude, is the angle in the equatorial plane between prime meridian and projection of the P' on the X - Y plane.

Particle Swarm Optimization Algorithm

The PSO algorithm is a social search algorithm offered for the first time in 1995 as an optimization method (Eberhart, & Kennedy 1995). The method was inspired by the collective movement of birds searching for food in groups and the classification accuracy and lengths of feature vectors are considered as an assessment criteria for particle movements. In the PSO method, particles flow in search space. A change in their position in search space is influenced by their experience and knowledge and their neighbors, so position of other swarm particles affects search of other particles.

The PSO algorithm consists of just three steps, which are repeated until some stopping condition is met:

1. Evaluate the fitness of each particle
2. Update individual and global best fitnesses and positions
3. Update velocity and position of each particle

Linear reduction of inertia weight applied version of the original algorithm can be given as

$$\begin{aligned} \mathbf{v}_{k+1}^i &= w_k \mathbf{v}_k^i + c_1 r_1 (\mathbf{p}_k^i - \mathbf{x}_k^i) + c_2 r_2 (\mathbf{p}_k^g - \mathbf{x}_k^i) \\ w_{k+1} &= \alpha w_k, \quad 0 < \alpha < 1 \end{aligned}$$

(3)

where \mathbf{x}_k^i is the particle position, \mathbf{v}_k^i is the particle velocity \mathbf{p}_k^i is the best remembered particle position, \mathbf{p}_k^g is the best remembered swarm position, c_1 and c_2 are cognitive and social parameters and r_1 and r_2 are random numbers. Additionally, w is the weight and α is the weight reduction factor. Accordingly the position rule can be updated as

$$\mathbf{x}_{k+1}^i = \mathbf{x}_k^i + \mathbf{v}_{k+1}^i$$

(4)

3.RESULTS AND DISCUSSION

In the sample scenario, for the demonstration of the proposed algorithm a single target and transmitter is used. The boundaries of the AOI is defined from 32° - 34° East in longitude to 39.5° - 41.5° North in latitude. The generated elevation map of the AOI is given Figure 3. In the figure, the FM transmitter 1 is labeled as Tx1 and located at 39.8561° N, 32.8222° E, the FM transmitter2 is labeled as Tx2 and located at 39.9463N, 32.6225E and the FM transmitter 3 is labeled as Tx3 and located at 39.8362° N,33.0321° E. The targets are arbitrarily placed at 40.85° N, 32.60° E at 6.0 km of altitude and 41.5° N, 33.45° E at 7.4 km above the mean sea level and marked as Target 1 and Target 2, respectively.

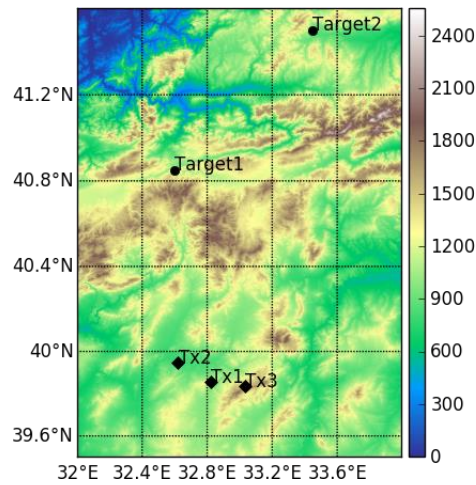


Figure 3. Elevation map of the AOI and the expected target locations.

In general line of sight must remain clear both in the illumination and in the echo paths. However, a direct line of sight in the baseline path will result in direct signal reception. Thus, additional signal processing techniques or antenna designs will be required for the cancellation of the direct path interference (DPI). In the algorithm, based on the topography of the area of interest, the visibility analysis ensures that the unobstructed line of sight in the illumination and echo paths exist and the direct signal reception at the surveillance receiver is blocked on the candidate receiver locations. The applied line of sight algorithm checks whether the line connecting the observer and the target is above the terrain. Based on steps, the visibility map of Tx1 is given in Figure 3.

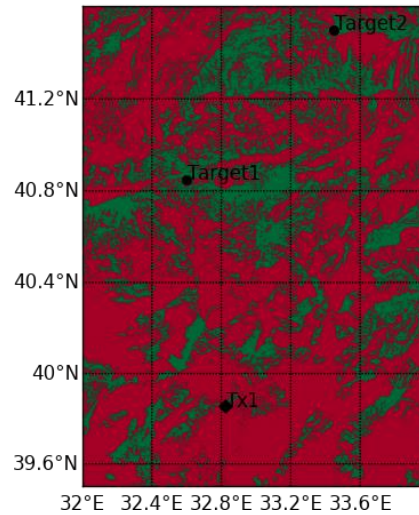


Figure 3. Visibility map for Tx1

According to the radar equation and the parameters computed, the best signal to noise ratio among three transmitters is detected as Tx1. The process of finding the optimum transmitter involves optimization of the received power based on the terrain.

It is found that the proposed particle swarm optimization based best transmitter determination algorithm, without including the effects caused by the modulation content, can successfully find the best transmitter in the region for operation. Especially on rough terrain with many transmitters, the search for the best transmitter is a time-consuming problem. The proposed algorithm can reduce the required installation time and complexity of the passive radar systems. Additionally, the algorithm ensures the best possible receiver location with the highest signal to clutter ratio by using swarm particles with less iteration and enhances the overall system performance.

Acknowledgements

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Low-Cost 3W AlGaAs Diode Pumped Compact Tm:LuAG Laser

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Abstract: In this work, we present 575 mW Tm:LuAG laser at 2014 nm pumped with a low-cost 3W multi-mode AlGaAs diode. In the experiments as low as 373 mW threshold pump power observed. Furthermore, with a birefringent filter between 1939 nm and 2096 nm laser operations obtained.

Keywords: Diode-pumped lasers, Tm:LuAG lasers, tunable lasers

1.INTRODUCTION

Tm³⁺ doped laser systems (depending on their host crystal) can operate at 2 μ m regime if they are pumped in the 770-800 nm band. Because of high water absorption in this band, Tm³⁺ doped laser systems are used in some of the medical operations that required water absorption like tissue welding or early diagnostics of urological cancer tissues [1-4]. Furthermore, these lasers can play critical roles in the laser based atmospheric communication [5,6], laser remote sensing [7] and many other fields.

In earlier studies, Tm³⁺ doped laser systems have been pumped with flash lamps [8], output of Ti:Sapphire lasers [9,10] and high-power AlGaAs multi-mode diodes [11,12]. However, these systems are typically inefficient, bulky and costly. Furthermore, in those lasers, mainly a cooling mechanism (such as water or nitrogen type) are necessary to obtain stable laser operations which increase the complexity of the lasers. Due to these reasons, the progress and improvements in the aforementioned areas have been negatively affected so far.

In this work, we report Tm:LuAG solid-state lasers effectively pumped by a standard low-cost (<250 \$) commercial compact multimode 3W AlGaAs C-mount free space laser diodes at 780 nm that can be driven with a low-cost compact electronic cards. Laser operations were achieved in an astigmatically compensated 4-mirror x-cavity containing a 7-mm long 6% Tm³⁺ ion doped LuAG crystal at room temperature without any cooling mechanism. With absorbed 2.6 W pump power, the system provide 575 mW output power at 2014 nm. Overall system could lie in a compact 60 x 30 cm table. Furthermore, by inserting birefringent filter into the system the output further tuned over 150 nm in 2 μ m band.

2.MATERIALS AND METHODS

To obtain a stable laser operation, we build a 4-mirror astigmatically compensated x-cavity (Fig. 1) consists of two curved mirror (CM1 with R=50 mm, CM2 with R=75 mm), a highly reflecting mirror (HR) and an output coupler (OC). A 6% Tm³⁺ ion doped 7-mm long LuAG crystal is placed between two curved mirrors. The arm lengths are set to 12 cm (HR) and 38 cm (OC).

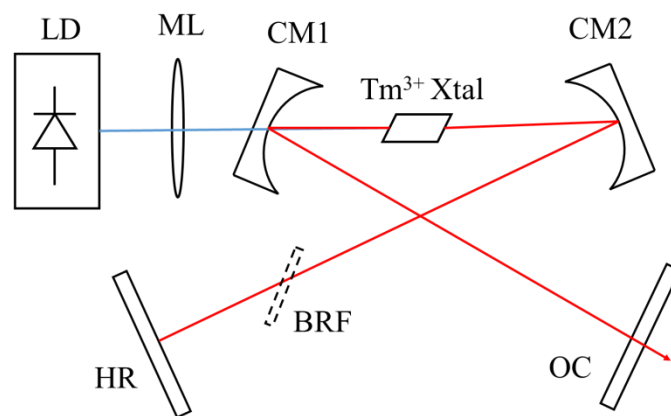


Figure 1. Tm:LuAG Laser Setup

As stated before a commercially available 3W low-cost multi-mode AlGaAs laser diode (LD) operated is used to end-pump the system. The cost of these diodes are less than 250\$. The output of the diode is arranged to be 780 nm with a thermoelectric controller to match with Tm:LuAG absorption bands. At the focus location, the beamwaist is arranged to be 125 μ m in the slow axis and 200 μ m in the fast axis with a lens system (ML) to obtain maximum laser output power.

During the experiments, we have used 1.3% output coupling level. As a gain media, we have used 7-mm long 6% Tm³⁺ ion doped LuAG crystal. The crystal is placed between two curved mirrors. Later on, we insert a birefringent filter into the HR arm at Brewster incidence to obtain tuning operations. The overall system could lie in a 30 x 60 cm table.

3.RESULTS AND DISCUSSION

In the experiments, we have obtained 575 mW output power from the laser system (Fig 2). The slope efficiency of the output is 26%. The laser operation can be obtained with as low as 373 mW pump power.

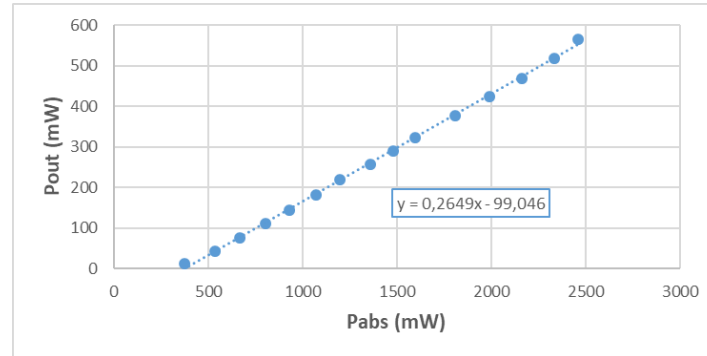


Figure 2. Power Efficiency Graph of Tm:LuAG Laser

The free-running output spectrum wavelength is 2014 nm (Fig.3). After insertion of birefringent filter into the system, the laser output can be tuned from 1939 nm to 2096 nm (Fig 4).

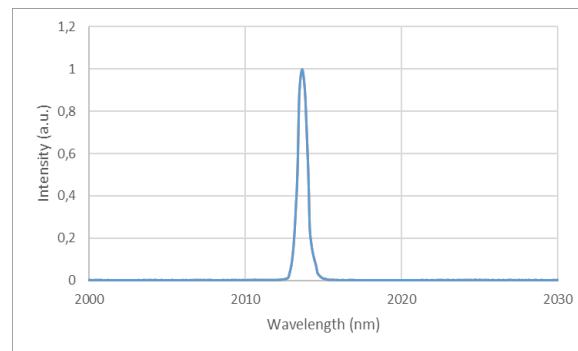


Figure 3. Output Spectrum of Tm:LuAG Laser

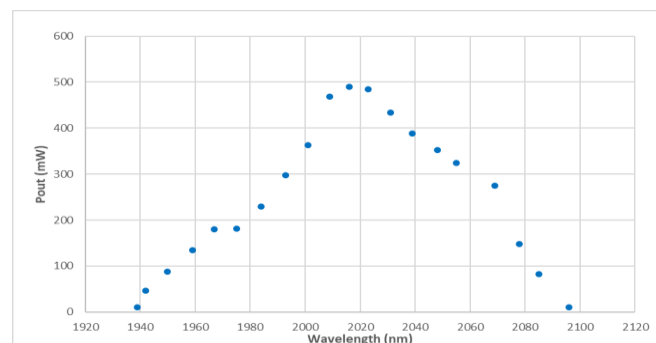


Figure 4. Tuning curve of Tm:LuAG Laser measured with 1.3% output coupler

In conclusion, a commercially available low-cost compact laser diode pumped Tm:LuAG laser obtained with 575 mW output power. The free-running wavelength of the output is 2014 nm and with a birefringent filter, the output of the system can be tuned in the 1939-2096 nm range. Since using a compact laser diode in the pumping scheme, having a compact layout, the laser can be easily integrated into the necessary fields.

Acknowledgments

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Evaluation of Expansion Strategies for Rail System Network of Ankara

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Abstract: The Ankara metropolitan municipality, where the number of automobile per capita is the highest, develops various projects in order to meet the increasing urban transportation demands. The Ankara Metropolitan Area is planning to increase the existing rail system network to 600 kilometres with 11 new lines. This paper presents a model for the expansion of urban transportation networks incorporating specific requirements about travel time, integration, demand and verity goals. Two different multicriteria decision making processes and three methods, AHP, ANP and fuzzy AHP are used in the evaluation. As a result, it is concluded which projects should be prioritized among the strategies to extend the rail system and which strategies are more important in improving urban transportation. Finally, the most suitable ranking is made for Ankara urban transport among rail systems projects and the result of three method solution are compared, are evaluated.

Keywords: Ankara, Urban Transport, Rail System Network, AHP, ANP, Fuzzy AHP

1.INTRODUCTION

Today, many cities face challenges of rapid urbanization. Many factors based on economic, social and technological reason play a role in increased urbanization. Ankara, which is central city in Turkey, has been in a rapid development and renewal especially in the aspect of population, after becoming the capital city. There have surfaced various problems, especially traffic problems due to the increasing population and urbanization. Various projects are put forward in order to overcome of the traffic problem. For this reason, there are considered to reach the aim of about 600 km of rail system with new rail system projects.

Ankara Metropolitan Municipality presents various projects to solve transportation problem. It is seen as a solution to public transportation in the solution of transportation problem. In this respect, it prioritized its due to the safe and high capacity of the metro. In this context, the Ankara Metropolitan Municipality is presenting various rail system projects in order to expand the existing rail system network and to improve the new rail system. The existing rail system lines of Ankara and planned project in next years are shown in Table 1. Urban transport is one of the most important subjects for urban planner, inhabitants of the city and environment. So, it should be paid attention to the selection of transport projects and should be given priority to projects that will provide the most benefit to liveable cities. Because of this situation, there are need multicriteria decision making process. We also used AHP, ANP and FAHP methods in this study.

Table1. Ankara rail system lines

Ankara rail system lines					
Nu	Line	Name	Opening date	Number of station	Distance(km)
1	Ankaray	Aşti-Dikimevi	1996	11	8,527
2	M1	Batıkent--Kızılay	1997	12	14,661
3	TCDD Banliyö	Sincan-Kayaş	---	28	37,5
4	M2	Kızılay-Çayyolu	2014	11	16,59
5	M3	Batıkent-Töre	2014	11	15,36
6	M4	Keçiören-AKM	2017	9	9,223
Total					101,861
Cable system line					
Nu	Line	Name	Opening date	Number of station	Distance(km)
1	T1	Yenimahalle-Şentepe	2014	4	3,257
Under the construction					
Nu	Line	Name	Opening date	Number of station	Distance(km)
1	Ankaray	Aşti-Söğütözü	2018	1	0,778
2	M4 Devam	AKM-Kızılay	2018	3	3,3
Planlanned line					
Nu	Line	Name	Opening date	Number of station	Distance(km)
1	P1	Esenboğa-Kızılay	---	17	27,5

This paper presents a model for the expansion of urban transportation networks incorporating specific requirements about population coverage, budget constraints, demand and verity goals. Two different multicriteria decision making processes, AHP, ANP and fuzzy AHP are used in the evaluation. As a result, it is concluded which projects should be prioritized among the strategies to extend the rail system and which strategies are more important in improving urban transportation.

Finally, the most suitable ranking is made for Ankara urban transport among rail systems projects and the result of three method solution are compared, are evaluated.

2. MATERIALS AND METHODS

The analytic hierarchy process (AHP) is an intuitively easy method for formulating and analyzing decisions. It was developed to solve a specific class of problems that involves prioritization of potential alternate solutions. This is achieved by evaluation of a set of criteria elements and sub-criteria elements through a series of pairwise comparisons. Numerous applications of the AHP have been made since its development and it has been applied to many types of decision problems.

Fuzzy Analytic Hierarchy Process (FAHP) embeds the fuzzy theory to basic Analytic Hierarchy Process (AHP), which was developed by Saaty. AHP is a widely used decision making tool in various multi-criteria decision making problems. It takes the pair-wise comparisons of different alternatives with respect to various criteria and provides a decision support tool for multi criteria decision problems. In a general AHP model, the objective is in the first level, the criteria and sub criteria are in the second and third levels respectively. Finally the alternatives are found in the fourth level.

Many decision problems do not have a hierarchical structure, because they involve the interaction and dependence of higher level elements and lower-level elements. Saaty suggested the use of AHP to solve the problem of independence on alternatives or criteria, and the use of ANP to solve the problem of dependence among alternatives or criteria. The ANP addresses how to determine the relative importance of a set of alternatives in a multi-criteria decision problem. The most important function of ANP is to determine the relationship of a network structure or the degree of interdependence. Analytic network process method gives a framework for describing the interactions and feedbacks among all criteria, alternatives, actors and targets. It is suitable for solving many complex real life problems because of this characteristic.

In this study we used three methods that are AHP, FAHP and ANP. Because our problem is transport planning problem that includes a very complex process. Expert opinions are used to determine the network structure relationship and comparison of pairwise. The studies performed using these methods are shown in Table 2.

Table 2. Distribution of papers based on MCDM approaches

Author(s)	Year	Technique	Summary of the paper
Hamurcu and Eren	2018	FAHP-VIKOR	Selection of transport projects
Avçılar and Yakut	2016	AHP/FAHP	Evaluation of consumer preferences
Özdemir et al.	2016	AHP/ANP	Risk rating
Mahmud et al.	2015	AHP/ANP	Location selection
Ishizaka	2014	AHP/FAHP	Supplier selection
Davraş and Karaatlı	2014	AHP/FAHP	Supplier selection
Yıldırım and Yeşilyurt	2014	AHP/FAHP	Project evaluation
Yavaş et al.	2014	AHP/ANP	Car selection
Aragones-B. et al.	2014	AHP/ANP	Project selection
Khademi et al.	2014	AHP/ANP	Method applications
Ömürlük and Tunca	2013	AHP/ANP	Selection of suppliers
Şengül et al.	2012	AHP/FAHP	Selection of public transport bus

3. RESULTS AND DISCUSSION

In this paper, three different solution methods are used for solving our hierarchical model such as AHP, ANP and FAHP with linguistic variables under fuzzy environment. The results are compared at the end of the section.

Selection Criterion for Decision Making

There are some studies in the literature about project selection; transportation planning; project selection; rail system project selection by using combine methods; technology selection and monorail route selection.

It used verity criteria in the literature for decision making in urban transport projects. The criteria that are considered in this paper are travel time, demand, accessibility, efficiency of the transport network, environmental, safety, social and integration.

Alternatives for Ankara

In this research paper, there are eleven alternative projects for Ankara. They can be submitted as follows: Dikimevi-Nato Yolu-Doğu terminal(P1), AŞTİ-Söğütözü(P2), Forum-AKM (Etlik)(P3), Esenboğa-Gar(P4), Gazino-Forum AVM (P5), Sincan-Yaşamkent (P6), Dikmen-Gar (P7), Forum AVM-Sincan(P8), Yaşamkent-TRT line (P9), Kuru-Tulumtaş (P10) and Etimesgut-Kazan (P11).

Results

We determinate the most suitable rail system projects decision that are by using AHP, ANP and FAHP methods for rail system projects which are planned in Ankara. Planned projects are weighted with these methods and select. Finally, the most suitable ranking; P4-P5-P11-P9-P2-P6-P10-P1-P3-P7-P8 for AHP And ANP methods; P4-P5-P9-P2-P11-P1-P6-P10-P7-P3-P8 for FAHP. The first and second rank for all three methods did not change, but project weights chanced. After all calculations in Table 3 results are shown which were obtained by AHP, ANP and fuzzy AHP methods.

Table 3. Weights and ranking of the alternatives

Methods	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11
Weights in AHP	0,067	0,105	0,051	0,188	0,128	0,101	0,024	0,016	0,113	0,083	0,125
Rankings in AHP	8	5	9	1	2	6	10	11	4	7	3
Weights in ANP	0,059	0,095	0,038	0,216	0,167	0,088	0,021	0,018	0,104	0,077	0,117
Rankings in ANP	8	5	9	1	2	6	10	11	4	7	3
Weights in FAHP	0,081	0,116	0,021	0,199	0,173	0,081	0,03	0,006	0,122	0,071	0,101
Rankings in FAHP	6	4	10	1	2	7	9	11	3	8	5

This study presents the ranking of eleven alternative rail system projects with eight-criteria. As a conclusion, according to the final score in all three analysis P4 is the most suitable projects in the first step for our rail systems projects in Ankara according to our application model because it has the highest priority weight for fuzzy AHP, AHP and ANP techniques. P5 projects is the next recommended rail system project.

This paper is the first study due to its solution techniques in sectoral manner such as AHP, ANP and FAHP under fuzzy environment together. Our research paper will shed light for different implementation of the selection problems in transport planning field with similar techniques in future researches. At the same time, mathematical models like goal programming can be used in addition these methods.

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Synthesis of Un-Doped Sb_2S_3 and W-Doped Sb_2S_3 Thin Films and Their Characterization

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Abstract: In present study, un-doped Sb_2S_3 and W-doped Sb_2S_3 thin films have been synthesized on glass substrates by chemical bath deposition (CBD) method at room temperature. Ammonium tungsten oxide hydrate as W source, antimony (III) chloride as Sb source and sodium thiosulphate as S source have been used during synthesis process. Un-doped Sb_2S_3 and W-doped Sb_2S_3 thin films synthesized on the glass substrates have been annealed at 350 °C for 1 hour under N_2 gas to be formed crystalline structure after synthesis process has been completed. The structural, optical, morphological, and elemental properties of un-doped Sb_2S_3 and W-doped Sb_2S_3 thin films have been investigated by x-ray diffraction (XRD), optical absorption, scanning electron microscopy (SEM) and energy dispersive x-ray (EDX) measurements.

Keywords: Characterization, chemical bath deposition, doping, Sb_2S_3 , thin film, tungsten

1. INTRODUCTION

The V-VI group semiconductors, which have their own unique optical properties, have received great interest from researchers in the last decade [1]. Antimony sulfide (Sb_2S_3), which has a direct band gap energy ranging from 1.78- 2.5 eV, is one of the important materials used in many different technological applications such as photovoltaics and optoelectronics due to its physical and chemical properties [2-3]. It has been reported in various studies that optical energy band of Sb_2S_3 thin films in the amorphous and crystalline structure are different [4-5]. It has been indicated that the indirect energy band gap of the structure in the amorphous phase is 1.5-1.75 eV, while the direct energy band gap of the same structure is changed between 1.7-2.7 eV.

The doping is an effective method for improving semiconductor based solar cell performance [6]. It has been emphasized in many studies that the photovoltaic properties of semiconductor materials doped with metals such as Co [7], Mn [8], Cu [9] and Fe [10] have been improved.

There are various methods to prepare thin films used as a sensitizer in a semiconductor thin film base solar cell structure. In many different studies [11-12], Sb_2S_3 thin films were synthesized by a chemical bath deposition method (CBD), one of the chemical techniques. The reasons for using this method have been listed as low cost, short time synthesis and no need for intensive laboratory conditions.

In present study, un-doped Sb_2S_3 and W-doped Sb_2S_3 thin films have been synthesized on glass substrates by chemical bath deposition (CBD) method at room temperature. Un-doped Sb_2S_3 and W-doped Sb_2S_3 thin films synthesized on the glass substrates have been annealed at 350 °C for 1 hour under N_2 gas to be formed crystalline structure after synthesis process has been completed. The structural, optical, morphological, and elemental properties of un-doped Sb_2S_3 and W-doped Sb_2S_3 thin films have been investigated by x-ray diffraction (XRD), optical absorption, scanning electron microscopy (SEM) and energy dispersive x-ray (EDX) measurements.

2. MATERIALS AND METHODS

To synthesize un-doped Sb_2S_3 and W-doped Sb_2S_3 thin films at room temperature using the CBD method, commercial antimony chloride (SbCl_3), ammonium tungsten[(NH_4)₆W₁₂O₃₉·xH₂O] and sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$ ·5H₂O) were used without any further purification. In a typical CBD method, 0.65g of SbCl_3 was dissolved in 10 ml of acetone. 25 mL of 1 M aqueous solution of sodium thiosulfate was added into a solution containing SbCl_3 . The total volume of mixture was made 100 mL by addition appropriate amount of de-ionized water. After obtaining a homogeneous mixture, a glass microscope slide which was cleaned well with diluted hydrochloric acid, washed by double distilled water and dried, was vertically left into the un-doped Sb_2S_3 solution for 45 minutes. Afterwards, the substrate was removed from the chemical bath, washed well with de-ionized water and dried in air. The glass substrate was annealed at 350 °C for 1 h under N_2 . To synthesize W-doped Sb_2S_3 thin film on a glass substrate with the same method, 0.0025g of (NH_4)₆W₁₂O₃₉·xH₂O was added to the above-mentioned solution and then all the steps were repeated.

X-ray diffraction (XRD) in a Rigaku x-ray diffractometer with $\text{Cu K}\alpha$ ($\lambda = 154.059$ pm) radiation was used to characterize the structural properties of thin films. UV-VIS absorption spectra were recorded using a Perkin-Elmer Lambda 2 spectrometer. Energy dispersive x-ray (EDX) (JEOL JSM 5800) was used to study the elemental analysis of un-doped PbS and La-doped PbS thin films.

3. RESULTS AND DISCUSSION

Figure 1 indicates the recorded XRD patterns for un-doped Sb_2S_3 and W-doped Sb_2S_3 thin films prepared via the CBD method at room temperature. All obtained diffraction peaks for un-doped and W- doped Sb_2S_3 thin films can be well indexed as the orthorhombic phase structure of Sb_2S_3 .

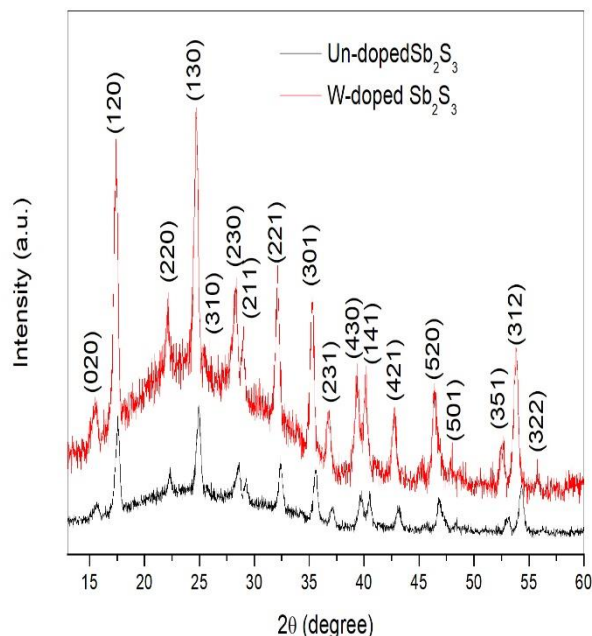


Figure 1 The recorded XRD patterns for un-doped Sb_2S_3 and W-doped Sb_2S_3 thin films prepared via the CBD method at room temperature.

The obtained result is consistent with the standard card (ICDD 00-001-0538). No extra peaks have been observed which confirm that the W- content has been substituted in Sb_2S_3 lattice and the formation of W compounds or W oxides have been ruled out in W-doped Sb_2S_3 thin film. The grain size of the thin films was estimated from the peak width of the relatively strong (130) diffraction using Scherrer's formula as given in Equation 1.

$$d = 0.9 \lambda / (\beta \cos \theta) \quad (1)$$

Where d is the mean size of the thin film, λ is the wavelength of x-ray, β is the broadening measured as the full width at half maximum (FWHM) in radians and θ is Bragg's diffraction angle. The sizes of un-doped and W-doped Sb_2S_3 thin films found from the XRD peak width, are 69.32 and 70.05 nm, respectively.

The energy dispersive x-ray (EDX) spectrum was used to confirm the elemental compositions of the W-doped Sb_2S_3 thin film. The peaks obtained from the EDX spectrums for Sb_2S_3 and $\text{Sb}_2\text{S}_3:\text{Co}(1\%)$ thin films are shown in Figure 2. The peaks obtained from the EDX spectrum are associated with Sb, S and W. Based on the EDX spectrum, the molar ratio of Sb:S:W found using the peak areas, as 40.21:57.82:1.97.

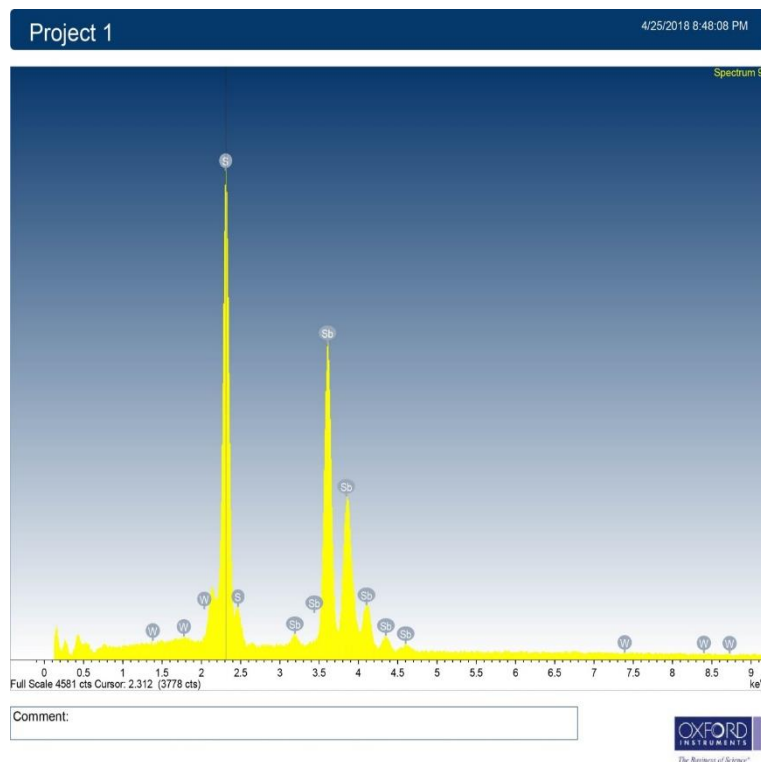


Figure 2 The recorded EDX spectrums for W-doped Sb_2S_3 thin film prepared via the CBD method at room temperature.

Optical absorption measurements were carried out to examine the optical properties of thin films and to determine their energy band gap. The absorption spectra for un-doped and W-doped Sb_2S_3 thin films are shown in Figure 3 as a result of optical measurements using UV-Vis absorption spectroscopy.

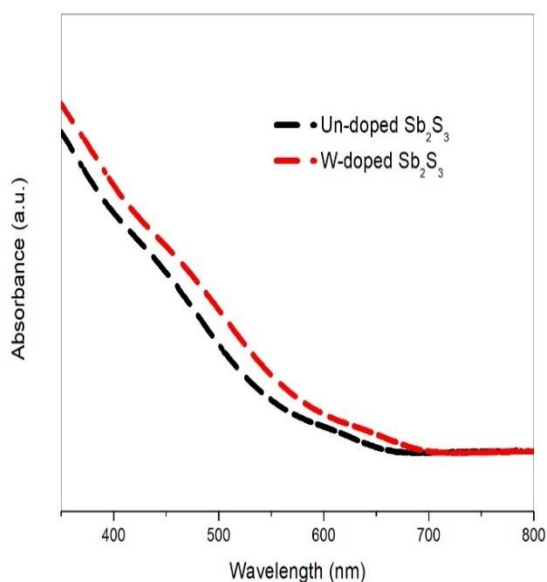


Figure 3 Optical absorption spectrum for un-doped Sb_2S_3 and W-doped Sb_2S_3 thin films prepared via the CBD method at room temperature.

It was observed that the absorption edge of W-doped Sb_2S_3 thin film shifts towards higher wavelengths (red shift). It means that the band gap of W-doped Sb_2S_3 thin film decreases due to W content. Tauc's relation is given in Equation (2) was used to determine band gap of un-doped Sb_2S_3 and W-doped Sb_2S_3 thin films.

$$\alpha h\nu = C(h\nu - E_g)^n \quad (2)$$

Where α is the absorption coefficient, $n=1/2$ or 2 for direct or indirect allowed transition, respectively, C is the characteristic parameter for respective transitions, $h\nu$ is photon energy and E_g is energy band gap. Figure 4 demonstrates $(\alpha h\nu)^2$ versus $h\nu$ for un-doped Sb_2S_3 and W-doped Sb_2S_3 thin films. Thus, the energy band gap values obtained for un-doped Sb_2S_3 and W-doped Sb_2S_3 thin films are 1.77 and 1.75 eV, respectively. Clearly, the value of W-doped Sb_2S_3 thin film is lower than that of Sb_2S_3 . This result is an indication that the energy band gap of Sb_2S_3 changes when Sb_2S_3 is doped with W.

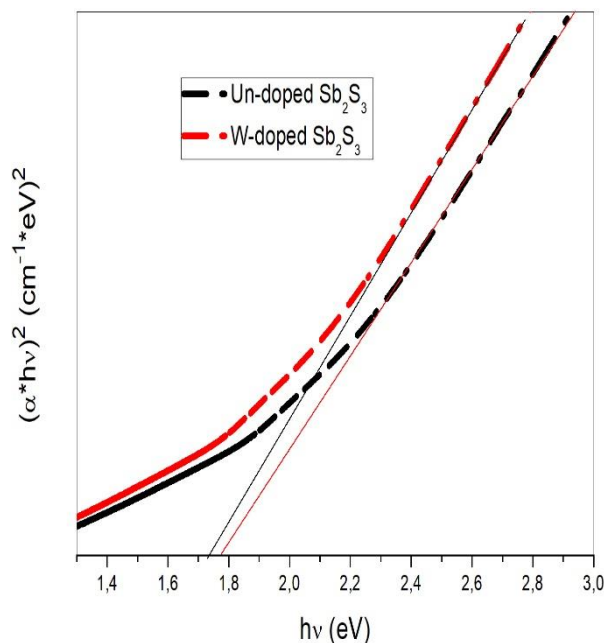


Figure 4. Graphs of $(\alpha h\nu)^2$ versus $h\nu$ for un-doped Sb_2S_3 and W-doped Sb_2S_3 thin films prepared via the CBD method at room temperature.

W-doped Sb_2S_3 TFs were synthesized at room temperature by the CBD method. Their structural, optical and elemental, properties of have been investigated for the first time. Optical study (optical absorption) revealed that the band gap of the W-doped Sb_2S_3 thin decreases in the presence of W content. Study (XRD) on the structural properties showed that all obtained diffraction peaks for un-doped and W-doped thin films prepared via the CBD method at room temperature can be well indexed as the orthorhombic phase structure of Sb_2S_3 .

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Synthesis of Un-Doped PbS and La-Doped PbS Thin Films and Their Characterization

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Abstract: In present study, un-doped PbS and La-doped PbS thin films have been synthesized on glass substrates by chemical bath deposition (CBD) method at room temperature. Lanthanum (III) nitrate hexahydrate as La source, lead nitrate as Pb source and thioacetamide as S source have been used during synthesis process. The triethanolamine (TEA) has been used as capping agent. The pH of the mixture has been controlled by NaOH. The structural, optical, morphological, and elemental properties of un-doped PbS and La -doped PbS thin films have been investigated by x-ray diffraction (XRD), optical absorption, scanning electron microscopy (SEM) and energy dispersive x-ray (EDX) measurements.

Keywords: Characterization, chemical bath deposition, doping, PbS, thin film

1.INTRODUCTION

Lead sulfide (PbS) commonly used in applications such as infrared sensors is one of the II-VI compound semiconductor group and has a narrow energy band gap of 0.4 eV [1-3]. Since PbS has large excitation Bohr radius, it is possible to see the quantum confinement effect for both electrons and holes in nano-sized PbS. Thus, the energy band gap of the PbS can be controlled by changing the particle size based on the effective mass model [4-5]. PbS semiconductor-based materials have received a great deal of attention in applications such as solar cells, photography and ion-selective sensors.

One of the most important factors affecting the optical properties of semiconductor materials is the doping of such semiconductors with metal ions. The doped metal ions result in a decrease in particle size and consequently an increase in the energy band gap [1-2]. In addition, the doping plays an active role in the use of semiconductor materials as promising sensitizers in solar cell applications owing to this feature. The observed increase in the energy band gap of a thin film in the nanocrystal structure may be related to the expected quantum confinement effect [8-10].

In present study, in present study, un-doped PbS and La-doped PbS thin films have been synthesized on glass substrates by chemical bath deposition (CBD) method at room temperature. The structural, optical and elemental properties of un-doped PbS and La -doped PbS thin films have been investigated by x-ray diffraction (XRD), optical absorption, scanning electron microscopy (SEM) and energy dispersive x-ray (EDX) measurements.

2.MATERIALS AND METHODS

The materials required to synthesize un-doped PbS and La-doped PbS thin films by CBD method are lead nitrate ($\text{Pb}(\text{NO}_3)_2$), thioacetamide ($\text{C}_2\text{H}_5\text{NS}$), lanthanum nitrate hexahydrate ($\text{La}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$) and sodium hydroxide (NaOH), respectively. 0.1 M $\text{Pb}(\text{NO}_3)_2$, 0.1 M $\text{C}_2\text{H}_5\text{NS}$ and 0.5 M NaOH were mixed in an 80 mL beaker to synthesize PbS thin film on a glass substrate at room temperature. The stirring process was continued until a homogeneous solution was obtained. Then a thoroughly cleaned glass substrate was immersed in the solution in a vertical position. The glass substrate was left in the PbS solution then removed, washed several times with distilled water, and air dried. To synthesize the La-doped PbS thin film on a glass substrate with the same method, 0.003 M ($\text{La}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$) was added to the above-mentioned solution and then all the steps were repeated. X-ray diffraction (XRD) in a Rigaku x-ray diffractometer with $\text{Cu K}\alpha$ ($\lambda = 154.059$ pm) radiation was used to characterize the structural properties of thin films. UV-VIS absorption spectra were recorded using a Perkin-Elmer Lambda 2 spectrometer. Energy dispersive x-ray (EDX) (JEOL JSM 5800) was used to study the elemental analysis of un-doped PbS and La-doped PbS thin films.

3.RESULTS AND DISCUSSION

The diffraction patterns obtained from XRD measurements for un-doped PbS and La-doped PbS thin films are shown in Figure 1(a-b).

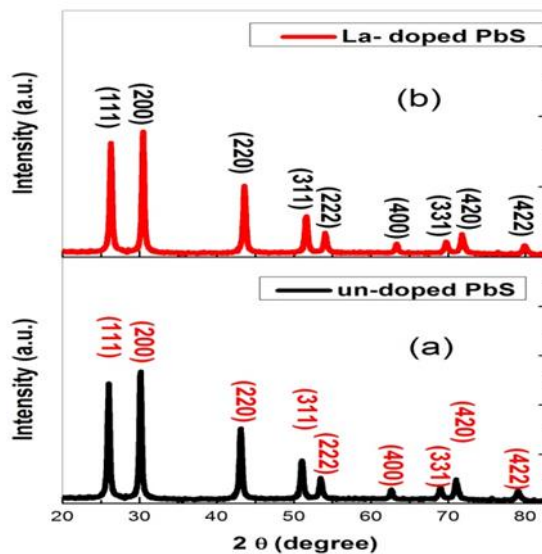


Figure 1. XRD patterns of (a) un-doped PbS thin film and (b) La-doped PbS thin film synthesized by CBD technique at room temperature.

(111), (200), (220), (311), (222), (400), (311), (420) and (422) were observed and it was determined that the two thin films shows a cubic structure using the XRD reference database of PbS. In the XRD data of the La-doped PbS thin film, no extra diffraction pattern that may be caused by undesired La compounds is observed, which can be regarded as an indication that this thin film is successfully synthesized at the desired level.

Elemental properties of La-doped PbS thin film was investigated by energy dispersive x-ray (EDX) measurement. The EDX spectra of thin film is shown in Figure 2.

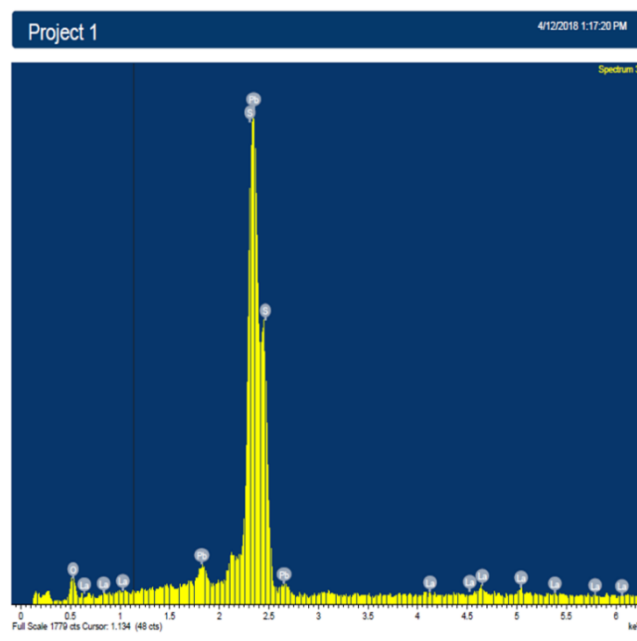


Figure 2. EDX spectrums of La-doped PbS thin film synthesized by CBD technique at room temperature.

Optical absorption measurements were carried out to examine the optical properties of thin films and to determine their energy band gap. The absorption spectra for un-doped PbS and La-doped PbS thin films are shown in Figure 3 (a-b) as a result of optical measurements using UV-Vis absorption spectroscopy.

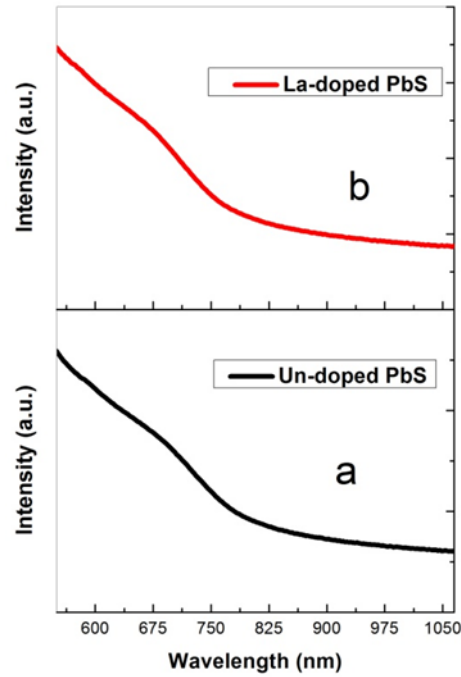


Figure 3. Optical absorption spectrum (a) un-doped PbS thin film and (b) La-doped PbS thin film synthesized by CBD technique at room temperature.

Based on the data shown in Figure 3 (a-b), graphs of $(\alpha h\nu)^2$ versus $h\nu$, indicated in Figure 4 (a-b), were obtained using the Tauc relation is given in Ref. [11].

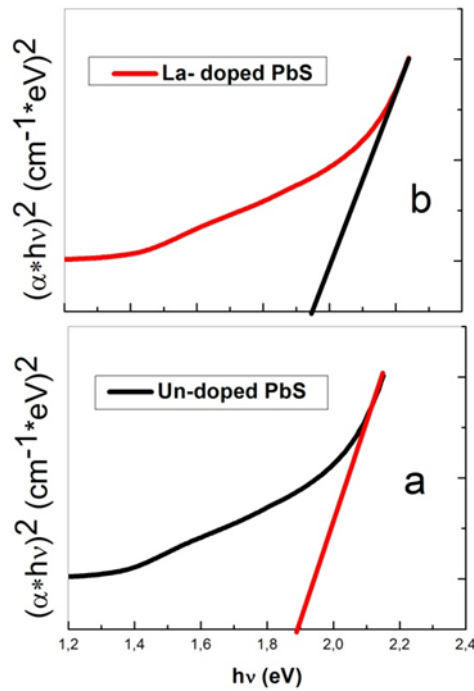


Figure 4. Graphs of $(\alpha h\nu)^2$ versus $h\nu$ for (a) un-doped PbS thin film and (b) La-doped PbS thin film synthesized by CBD technique at room temperature.

Here, α is absorption coefficient, h is Planck's constant and ν is the frequency. Thus, the energy band gap values obtained for un-doped PbS and La-doped PbS thin films are 1.89 and 1.92 eV, respectively. Clearly, the value of La-doped PbS thin film is higher than that of PbS. This result is an indication that the energy band gap of PbS changes when PbS is doped with La.

Un-doped PbS and La-doped PbS thin films were successfully synthesized on glass substrate by CBD technique at room temperature. Structural, elemental and optical properties of thin films grown on glass substrates were investigated. It was observed that the structure of both thin films is cubic. The energy dispersive x-ray (EDX) spectrum was used to confirm the elemental compositions of the La-doped PbS thin film. The peaks obtained from the EDX spectrum are associated with Pb, S and La. The expectation was confirmed as a result of the optical measurements made. Thus, the energy band gap for PbS and La-doped PbS thin films was determined as 1.89 and 1.92 eV, respectively.

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Biodiversity and Treatment Areas of Urtica

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Abstract: Urtica species have spread almost all over the country in forests, rocks, stream coasts. The family has 2,600 species of about 79 genus. The presence of burning villus on their leaves is the most prominent feature of the family. Five species are common in Turkey but two species are used for medical purposes. These are Urtica dioica and Urtica urens. Diuretic, antiulcer, antidiabetic, antihistaminic, antiallergic, antirheumatic, anti-inflammatory effects as well as anticancerogenic effects are also used in the treatment of prostate and breast cancer. Numerous biological activity studies have been investigated on Urtica dioica in recent years. Thus, it is ensured that the products are obtained and the usage of the products is increased. These products are herbal medicines as well as food supplements. The aim of this study is to investigate the therapeutic properties of Urtica genus plants on many diseases by scanning available researches. In our study, we informed about the treatment areas on diseases based on the biodiversity and pharmaceutical properties of Urtica species.

Keywords: Urtica, Urtica dioica, Medical Plant

1. INTRODUCTION

There are about 2,600 species, 79 genera in the family which are spread widely on the world. The local names of the Urtica species, known as the nettle, are Dalagan, Dalagan, dızlağan, ağdalak, ısırgı(1). Nettle grows widely in tropical and subtropical areas of both hemispheres. It grows in the forests, on the banks of rivers that do not see the sun and on the rocks (2).

In Turkey, it is a plant that grows spontaneously in open forest areas in rivers and roadsides. It is widely spreading especially in the Black Sea Region. A large part of the plants is perennial, while others show annual of development. It is usually available in the form of shrubs Although the grassy (3).

Urtica having a length of 30 cm-150 cm, showing branching, it is a plant with a plurality of stem-forming rhizomes(4). The stems are straight, four-cornered, simple or branched from the base. The leaves are stalked, oval, its edges gear, upper side is dark green, bright and are covered with feathers burning like its trunks. The plant's flowers are green and open from June to September and it creates seeds. The flowers are very small and the petals can have different colors ranging from pink to red and purple. Large leafy nettles are bisexual, small leafy nettles have unisexual flowers. The fruit formed by the pollination of the flowers is dry and single seeds. (3).

The Urtica word comes from the word "urere" which means to burn it in Latin. The Urtica plant has burning secretion substance in the stems and roots. When the plant's burning feathers are touched, acetylcholine, histamine and 5-hydroxytryptamine are released and it creates and redness and burning(5).

Although there are about 2600 species of plants Urtica (nettle) Turkey 'is available in 5 type; Urtica dioica, Urtica urens, Urtica pilulifera, Urtica membranacea ve Urtica haussknechtii(6).

Urtica Membranacea: Also known as harmful nettles. Although there are concentrations in the Mediterranean region in Turkey, it appeared to spread Portugal, North Africa and to South West Asia. It is similar to U. Dioica in that its feathers are burning and in terms of their medical properties(7).

Urtica Pilulifera: The plant, which is widely spread in the Mediterranean climate, is known as the Black nettle and Roman nettle. It is annual and monoic(7). It has the feature of lowering blood glucose in diabetes(8).

Urtica Haussknechtii: It is a perennial plant with many branches spreading. Leaves are lance-shaped, the largest leaves can grow up to 51.4 cm. There are no burning features in all the branches, only the burning feature of the hairs of the young branches(7).

Urtica Urens: Its height of 10-50 cm, It is known as Small Nettle, Dwarf Nettle. The leaves are arranged opposite, elliptical, short-pointed, serrated deep both sides slightly hairy, the light green color. It is a annual and monoecious

blooming plant. Male and female flowers are found together in the plant. It has weak, small feathers on them. The edges of the female flower perianth are hairy(9).

Urtica Dioica: It is also called the big stinging nettle. It is quite common in northern Europe and Asia. It grows in abundant quantities especially where annual precipitation is high. It is a perennial plant, that seem widely spread, in length of 30-150 cm. Specifically species that grown in Turkey is dioecious, it is rarely the monoecious. The plant is covered with burning hair. The leaves are arranged in mutually aligned, in the form of a cordate or ovate on the ground, the edges are toothed, the lower face is light green, and the upper faces are darker green. All surfaces of the fruiting perianth parts are hairy (10, 11).

Medical Properties And Uses Of Urtica Plant

Urtica is a plant species that is much more prevalent among the folk remedies from the past to the present day, and which is now usage increasingly as a result of scientific studies. Different effects were observed in the root, leaf and aboveground- piece of the plant.

Diuretic effect: The diuretic effect, which is one of the traditional and current uses of nettle grass; Tea made from the above-ground parts, ensures the evacuation of the urinary tract washing and rheumatic edema(12).

Anti-inflammatory Effect: It has been suggested that the nettle's anti-inflammatory effects, that is, the ability to stop the production and effects of the immune cells that produce inflammation in the body. Thus, the effect is proven by reducing arthritis pain and inflammation in humans (13).

Antidiabetic Effect: Nettle leaves, topsoil, roots and seeds are used in diabetes. It has been reported that the blood glucose lowering effect is demonstrated by reducing the absorption of glucose and increasing pancreatic insulin release(14).

Hypotensive effect: It has been concluded that U. dioica can produce hypotensive responses due to the release of nitric oxide in the endothelial layer of the aortic rings and an arterial relaxing effect mediated by the opening of potassium channels(4).

Antioxidant Property: The phytochemical compositions of the nettles have a strong antioxidant capacity for both elastase and collagenase. Thus, the effect of preventing aging has also emerged (4).

Use in Prostate Disease: Benign prostatic hypertrophy (benign prostate enlargement), the most common disease that affects men from the age of 40 onwards, which is a type of prostate disease, actually occurs at the hormonal level. The research on the effect of nettle and benign prostatic hypertrophy has been increasing in recent years. Nettle has been shown to reduce prostate growth by inhibiting the enzyme converting testosterone into dihydrotestosterone(13).

2.RESULTS AND DISCUSSION

Urtica is a plant species that is much more prevalent among the folk remedies from the past to the present day, and which is now increasingly used as a result of scientific studies. The reason for the increase in the importance of nettle grass is; the effects of which have been proven in studies(15).

There are different chemical compounds in the leaves of the plant, in the upper parts of the soil and in the roots. For this reason different effects can be obtained by using separately the root, leaf and upper part of the plant. Stinging nettle is best used by itself and by beating seeds or in the form of herbal teas (12).

In this study, studies on urtica are examined. As a result of the literature review, it is clear how valuable the plant is from the medical point of view.

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Development of Stand Height Curve Models on Oriental Beech (*Fagus orientalis* Lipsky) Stands of Black Sea Region, Turkey

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Abstract: Total height is less frequently used in the development of forest models than diameter, as it is hard and costly to measure, and as a result inaccurate measurements are often made. When actual height measurements are not available, height-diameter functions can also be used to indirectly predict height growth. A total of 36 models that estimate the relationship between height and diameter in terms of stand variables (basal area, quadratic mean diameter, maximum diameter, dominant diameter, dominant height, arithmetic mean height, age, number of trees per hectare and site index), were fitted to corresponding to 1015 trees, using non-linear regression procedure. The precision of the models was then evaluated by cross validation. The data were collected during 54 permanent plots of Oriental beech (*Fagus orientalis* Lipsky) stands, in the Black sea region of Turkey. Comparison of the models was carried out by studying the coefficient of determination, bias, mean square error, Akaike's information criterion and by using a F-test to compare predicted and observed values. Best results were obtained with those models that included any independent variable related to the height of the stand (mean or dominant height), although this implies a greater sampling effort for its application.

Keywords: *Fagus orientalis*, Forest Modelling, Height Model, Diameter-Height Relationship

1. INTRODUCTION

Modelling for biological systems sense is an important tool. Modelling is the process of defining a system's change with equations. It is therefore important to accurately determine the components of system during modelling and to select the correct equation to describe this system.

The relationship between tree heights and diameters is one of the most important elements of forest structure. There are for many growth and yield models require height and diameter as basic input variables, with all or part of the tree height predicted from measured diameters (Burkhart et al., 1972; Wykoff et al., 1982; Huang et al., 1992). A generalized height-diameter function estimates the specific relationship between individual tree heights and diameters using stand variables such as basal area per hectare, quadratic mean diameter, stands age, number of tree. The reason for using them is to avoid having to establish individual height-diameter relationships for every stand (Curtis, 1967). It is time consuming and expensive that is to develop a height-diameter model separately for each stands. In this cases, to reduce the error involved in estimating heights, the use of a generalized diameter-height equation is recommended, which models the changes in the height-diameter relationship over time. A wide variety of both local and generalized height-diameter models are available in the forestry literature (Huang et al., 2000; Soares and Tomé, 2002; López Sánchez et al., 2003; Temesgen and Gadow, 2004).

Oriental beech (*Fagus orientalis* Lipsky) is one of the most prevalent forest tree species in Turkey and accounts for 8,5% of the total forestland (1.889.929 ha). The species is considered good growing and shade tolerant with desirable wood characteristics (saw wood, industrial wood, plywood, firewood). Thus, it has a great potential for industrial forestry in Turkey. It is the climax tree of the Black sea region. It grows at 0-1300 m in Turkey (Anonymous, 2015).

The focuses of this study are to find an equation from selected generalized height-diameter models that can be used to predict the diameter-height relationship in natural Oriental beech stands in Sinop region (middle Black sea region in Turkey) by considering a number of stand variables (dominant diameter, dominant height, age, density, site index, etc.), which may influence the relationship and compare the models in three groups. These groups are following group models i) diameter measurements, knowledge of stand age and number of trees in per hectare (the first group models), ii) measurements of diameter and of a sample of tree heights (the second group models), and iii) addition of measurements of stand age to the second group (the third group models), respectively.

2. MATERIALS AND METHODS

In our study, it was tried to explain the change of height according to the regression models with diameter of tree in Sinop region. This research was carried out in the region of Sinop region (Ayancık, Türkeli ve Erfelek) forestland. The study area is situated different slope, predominantly north-facing aspect 0- 1300 m altitude. The soil is generally shallow or medium-deep, and stony, with a predominantly sandy-clay texture. The stands were expected to achieve a yield class of mean, good and poor site quality by Carus (1998). The total height and the diameter at breast height of each sample tree were measured.

Tree height and diameter were used from 54 sample plots were established in pure, even-aged natural *Fagus* stands in Sinop region. The sample plots were installed to give the greatest variety of combinations of stand age, stand density degree and site index. In each sample plot, diameter at breast height of all trees was crosswise measured, using Haglöl calipers, to the nearest a millimetre. Heights were measured using a Blume Leiss hypsometer. In sample plot were chosen 15-30 sample trees which were different diameter and height. The plots are square or rectangular with dimensions varying between 400-2500 m². When choosing sample trees, it's not crown or stem damaged (the fork, the hill is broken and the body shape). After this study, scatter of sample fitting model, sample validation model and all plot total height against diameter were presented in Figure 1.

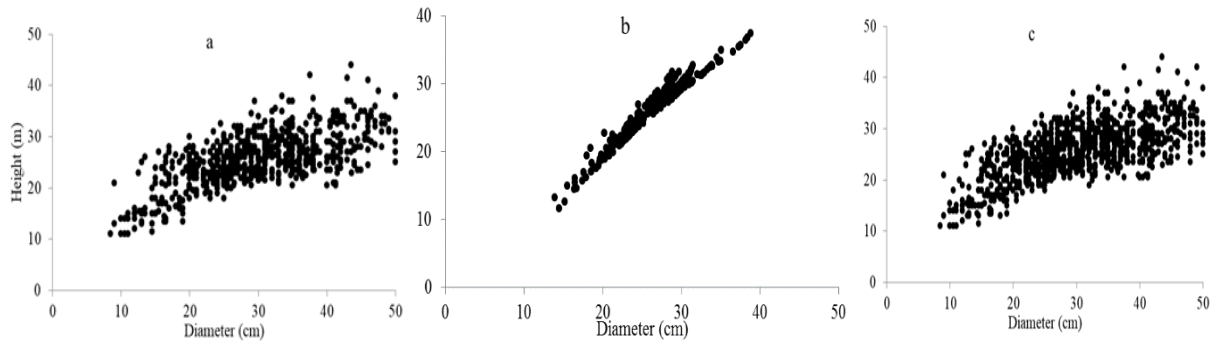


Figure 1. Scatter of sample fitting model (a), sample validation model (b) and all sample plots height against diameter (c).

Models Analysed

In the present study, we have considered the most commonly used the 36 generalized height-diameter equations given in Table 1.

Table 1. Generalized height-diameter models evaluated

The first group model (Group model 1)	Author (s)	Model
$h = 10^{(a_0 + a_1 \frac{1}{d} + a_2 \frac{1}{t} + a_3 \frac{1}{d_g t})}$	Curtis	1
$h = e^{(a_0 + a_1 \ln d_g + a_2 \ln N + a_3 \sqrt{d})}$	Cox I	2
$h = 1.30 + 10^{(a_0 + a_1 \frac{1}{d} + a_2 \frac{1}{\sqrt{t}} + a_3 \frac{1}{d \sqrt{t}} + a_4 \frac{\log N}{\sqrt{t}})}$	Clutter & Allison	3
The second group model (Group model 2)		
$h = 1.30 + \left[a_0 \left(\frac{1}{d} - \frac{1}{D_0} \right) + \left(\frac{1}{H_0 - 1.3} \right)^{1/3} \right]^{-3}$	Mónnes	4
$h = 1.30 + (H_0 - 1.3) \left(\frac{d}{D_0} \right)^{a_0}$	Canadas et al. I	5
$h = 1.30 + \frac{d}{\frac{D_0}{H_0 - 1.3} + a_0 (D_0 - d)}$	Canadas et al. II	6
$h = 1.30 + (H_0 - 1.3) \frac{1 - e^{a_0 d}}{1 - e^{a_0 D_0}}$	Canadas et al. III	7
$h = 1.30 + \left[a_0 \left(\frac{1}{d} - \frac{1}{D_0} \right) + \left(\frac{1}{H_0 - 1.3} \right)^{1/2} \right]^{-2}$	Canadas et al. IV	8
$h = 1.30 + (H_0 - 1.3) e^{a_0 (1 - \frac{d_g}{d}) + a_1 (\frac{1}{d_g} - \frac{1}{d})}$	Gaffrey	9
	Prodan	10

$h = 1.30 + (H_0 - 1.3) [1 + a_0 (H_0 - 1.3) (\frac{1}{d} - \frac{1}{D_0})]^{-1}$		
$h = 1.30 + H_0 (1 + a_0 + a_1 H_0 + a_2 d_g) e^{a_3 H_0} (1 - e^{a_4 \frac{d}{H_0}})$	Soares & Tome	11
$h = 1.30 + (H_m - 1.3) e^{a_0 (1 - \frac{d}{d_g})} e^{a_1 (\frac{d}{d_g} - \frac{1}{d})}$	Sloboda et al.	12
$h = H_0 (1 + a_0 e^{a_1 H_0}) (1 - e^{\frac{-a_2 d}{H_0}})$	Harrison et al.	13
$h = 1.30 + \frac{a_0 H_0^{a_1} (H_0 - 1.3)}{(\frac{ D_0 - d }{d})^{a_2}}$	Castedo et al.	14
$h = a_0 H_0 (1 - e^{\frac{-a_1 d}{d_g}})^{a_2}$	Piennar _a	15
$h = a_0 H_0 (1 - e^{\frac{-a_1 d}{D_0}})^{a_2}$	Piennar _b	16
$h = 1.30 + (H_m - 1.3) e^{a_0 (1 - \frac{d}{D_0})} e^{a_1 (\frac{d}{D_0} - \frac{1}{d})}$	Sloboda et al.	17
$h = 1.30 + a_0 H_0^{a_1} d^{a_2 H_0^{a_3}}$	Hui & Gadow	18
$h = 1.30 + (a_0 + a_1 H_0 - a_2 d_g) e^{(\frac{a_3}{d})}$	Mirkovich	19
$h = 1.30 + (a_0 + a_1 G + a_2 H_0) e^{(a_3 \frac{1}{d})}$	Ademe et al.	20
$h = 1.30 + (a_0 + a_1 H_0 - a_2 d_g) e^{(\frac{a_3}{\sqrt{d}})}$	Schröder & Alvarez	21
$h = H_m \left[a_0 + a_1 H_m + a_2 \frac{H_m}{d_g} + a_3 d + a_4 \frac{N}{d_g (H_m d_g)} \frac{d}{d} \right]$	Cox III _a	22
$h = 1.30 + (a_0 + a_1 H_0 - a_2 d_g + a_3 G) e^{(\frac{-a_4}{\sqrt{d}})}$	Schröder & Alvarez II	23
$h = a_0 + a_1 H_m + a_2 d_g + a_3 d_g^{0.95} + a_4 e^{-0.08d} + a_5 H_m^3 e^{-0.08d} + a_6 d_g^3 e^{-0.08d}$	Cox II _a	24
$h = a_0 + a_1 H_m + a_2 d_g + a_3 e^{a_4 d} + a_5 H_m^{a_6} e^{a_4 d} + a_7 d_g^{a_8} e^{a_4 d}$	Cox II _b	25
$h = 1.30 + a_0 G^{a_1} (1 - e^{(-a_2 N^{a_3} d)})$	Sharma & Zhang	26
$h = 1.30 + a_0 H_0^{a_1} (1 - e^{(-a_2 (\frac{N}{G})^{a_3} d)})^{a_4}$	Sharma & Parton	27
$h = 1.30 + a_0 H_0^{a_1} (1 - e^{(-a_2 D_0^{a_3} d)})^{a_4}$	Richards	28
$h = 1.30 + a_0 (H_0 - 1.30)^{a_1} e^{(-a_2 d^{-a_3} + a_4 G)}$	Budhathoki et al.	29
$h = [1.30^{a_0} + (H_0^{a_0} - 1.3^{a_0}) * [\frac{1 - e^{-a_1 d}}{1 - e^{-a_1 D_0}}]^{\frac{1}{a_0}}]$	Castedo et al.	30

The third group model (Group model 3)

$h = H_0 e^{(a_0 + a_1 H_0 + a_2 \frac{N}{1000} + a_3 t) (\frac{1}{d} - \frac{1}{D_0})}$	Tome	31
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$h = e^{(a_0 + a_1 SI + a_2 \frac{N}{1000} + a_3 \frac{1}{t} + a_4 \frac{1}{d})}$	Bennet & Clutter	32
$h = 1.30 + \frac{H_0}{e^{a_0 + (\frac{1}{d} - \frac{1}{D_{\max}})(a_1 + a_2 \ln N + a_3 \frac{1}{t} + a_4 \ln H_0)}}$	Lenhart	33
$h = a_0 H_0^{a_1} 10^{(\frac{a_2}{t} + (\frac{1}{d} - \frac{1}{D_{\max}})(a_3 + a_4 \frac{\log N}{t}))}$	Amateis et al.	34
$h = e^{(a_0 + a_1 \ln H_0 + a_2 \frac{1}{t} + a_3 \frac{\ln N}{d} + a_4 \frac{1}{dt} + a_5 \frac{1}{d})}$	Burkhart & Strub	35
$h = a_0 H_0^{a_1} G^{a_2} N^{a_3} e^{(\frac{a_4}{t} + \frac{a_5}{d})}$	Pascoa	36

In this table d=diameter at breast height over bark (cm), t=age of stand, d_g =quadratic mean diameter of stand (cm), G= basal area of stand (m^2/ha), D_{\max} = maximum diameter of stand (cm), D_o =dominant diameter of stand (cm), H_m = mean height of stand (m), H_o =dominant height of stand (m), N=number of trees in stand (stems/ha), SI= site index (m), log=common logarithm (base 10), ln=natural logarithm (base e=2,718), $a_0, a_1 \dots$ =regression coefficients.

In order to able to interpret and compare the results more easily and because of the large number of equations analysed, the models were classified in three groups according to the sampling effort. These groups: i) low sampling effort models, including those models which need diameter measurements and knowledge of stand age in same case, ii) medium sampling effort models, including models which need measurements of diameter and of a sample of tree heights, iii) high sampling effort models, including models which need the knowledge or measurements of stand age as well.

Statistical Analysis

In this study used models described above are non-linear; therefore model fitting was carried out with non-linear regression (NLIN) procedure of SPSS statistical analysis software package. The initial values of parameters were obtained for starting the iterative procedure and by other authors in similar studies were used. Comparison of estimation of models was based on graphical and numerical analysis of residuals and six goodness of fit statistics. These evaluation statistics are defined as:

Mean absolute error (MAE);

$$MAE = \frac{\sum_{i=1}^n |h_i - \hat{h}_i|}{n} \quad (1)$$

Maximum absolute error (MaxAE);

$$MaxAE = \max(|h_i - \hat{h}_i|) \quad (2)$$

Root mean square error (RMSE);

$$RMSE = \sqrt{\frac{\sum_{i=1}^n (h_i - \hat{h}_i)^2}{n - k}} \quad (3)$$

Correlation coefficients (R);

$$R = \frac{\sum_{i=1}^n (h_i - \bar{h}_i) * (\hat{h}_i - \bar{\hat{h}}_i)}{\sqrt{\sum_{i=1}^n (h_i - \bar{h}_i)^2} * \sqrt{\sum_{i=1}^n (\hat{h}_i - \bar{\hat{h}}_i)^2}} \quad (4)$$

Mean error (Bias);

$$Bias = \frac{\sum_{i=1}^n (h_i - \hat{h}_i)}{n} \quad (5)$$

Akaike's information criterion (AIC)

$$AIC = n * \ln(RMSE) + 2 * p \quad (6)$$

Where, h_i =observed height, \hat{h}_i =predicted height, \bar{h} =mean of observed heights, n =number of observations in dataset and k = number of estimated parameters.

3.RESULTS AND DISCUSSION

Data Summary

Approximately 78% (42 sample plots) of sample plots data were used to develop model and remaining 22% (12 sample plots) were used to test developed models. The parameter values for all equations were given in Table 2.

Table 2. Parameters of generalized height-diameter models

Number of model	Parameters								
	a_0	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8
1	1.608546	-4.381206	-6.890269	78.939130	-	-	-	-	-
2	-1.391593	0.620240	0.280903	0.141905	-	-	-	-	-
3	1.833934	-10.219576	-5.246647	55.916870	0.855345	-	-	-	-
4	1.032373	-	-	-	-	-	-	-	-
5	0.286137	-	-	-	-	-	-	-	-
6	-0.025047	-	-	-	-	-	-	-	-
7	-0.065849	-	-	-	-	-	-	-	-
8	0.905979	-	-	-	-	-	-	-	-
9	0.618303	-8.159438	-	-	-	-	-	-	-
10	0.170226	-	-	-	-	-	-	-	-
11	-	-	204.386580	0.006862	0.000070	-	-	-	-
12	8934.18603	204.068351	-	-	-	-	-	-	-
13	-0.393260	-0.039494	-	-	-	-	-	-	-
14	0.175095	-0.026477	1.900896	-	-	-	-	-	-
15	1.372734	-0.144975	0.082143	-	-	-	-	-	-
16	1.026002	2.955381	2.180354	-	-	-	-	-	-
17	1.044805	4.553558	1.877443	-	-	-	-	-	-
18	-0.372208	0.218547	-	-	-	-	-	-	-
19	0.802360	-0.075163	0.371643	0.721075	-	-	-	-	-
20	13.798115	1.030610	0.246119	-10.961389	-	-	-	-	-
21	10.745492	0.072841	0.776705	-10.321065	-	-	-	-	-
22	22.469180	1.550200	0.408570	-4.360314	-	-	-	-	-
23	0.674213	-0.010719	0.225910	0.011786	0.026774	-	-	-	-
24	21.557010	1.463786	0.375159	0.075132	4.388449	-	-	-	-
25	12.097170	1.263414	4.168995	-5.534056	-13.961437	-0.001281	-	-	-
26	-	-	-	-	-	-	0.000126	-	-
27	8432.49526	1.104769	-2.809462	8442.965903	0.000040	-	4.709990	0.900788	1.239042
28	10.797733	0.302462	0.073214	-0.053351	-	0.0000002	-	-	-
29	1.828492	0.820486	0.044935	-0.276618	2.067483	-	-	-	-
30	1.667129	0.849536	1.587754	-0.729372	1.979515	-	-	-	-
31	0.0000001	0.559189	-15.744331	-0.022443	0.002424	-	-	-	-
32	1.012330	0.074771	-	-	-	-	-	-	-
33	11.020633	-0.627533	-0.388891	-0.005334	-	-	-	-	-
34	2.700380	0.040806	-0.033920	-3.565409	-10.738338	-	-	-	-
35	-0.025235	-36.201965	-1.155230	80.383241	15.976433	-	-	-	-
36	2.319808	0.782363	-1.874770	-5.688270	41.742699	-	-	-	-
37	1.330541	0.697880	-4.224242	2.214786	107.898868	-	-	-	-
38	-	-	-	-	-	25.930871	-	-	-
39	2.148211	0.715757	-0.003024	0.074947	-0.407771	-	-	-	-
40	-	-	-	-	-	10.520217	-	-	-

The model parameters for all the tested models were found to be significant at the significance level of 0.05. In order to find out which model is more successful in explaining height-diameter relations, a ranking is made for all the models

according to the specified criteria and the results are given below. In this ranking method, numerical values are given starting from the smallest MAE, MaxAE, RMSE, ME, AIC values and for the R value, starting with the largest one. When the ranking values obtained for each model are collected, model with the smallest value is determined as the best model (Table 3).

Table 3. Performance criteria for generalized height-diameter models for the fitting data

Number of model	Performance criteria						Rank
	MAE	MaxAE	RMSE	R	ME	AIC	
1	3.094637(33)	13.536814(25)	3.766521(32)	0.696403(32)	0.002889(5)	953.546(32)	28
2	2.986935(31)	14.151306(30)	3.703925(31)	0.708486(30)	-0.008996(12)	941.597(31)	30
3	2.927898(29)	13.568453(26)	3.630959(28)	0.722535(28)	-0.002423(3)	929.411(29)	24
4	2.381416(19)	11.942477(21)	3.009363(18)	0.818435(18)	0.644892(26)	787.532(18)	19
5	2.587369(26)	13.053456(24)	3.117142(22)	0.778116(25)	0.757105(28)	812.621(20)	25
6	3.004964(32)	21.339261(35)	3.820186(33)	0.684072(33)	1.552040(34)	957.633(33)	33
7	2.396833(20)	12.990910(23)	3.046647(19)	0.813391(20)	0.517943(24)	796.311(19)	22
8	2.376670(18)	11.613449(19)	3.002517(17)	0.819352(17)	0.645465(27)	785.908(17)	17
9	3.286658(34)	14.084721(29)	4.178019(34)	0.603745(34)	-2.778400(35)	1023.473(34)	34
10	2.587664(27)	16.830018(34)	3.635815(29)	0.719771(29)	-0.969538(30)	922.364(28)	32
11	4.157212(35)	21.858724(36)	5.177242(36)	0.168241(36)	1.100011(32)	1182.366(35)	36
12	2.425439(21)	15.729255(32)	3.259428(25)	0.783090(24)	-1.011001(31)	846.446(25)	27
13	2.280437(12)	9.291640 (2)	2.888355(12)	0.834691(13)	-0.015520(14)	762.269(12)	11
14	2.741439(28)	15.467839(31)	3.703003(30)	0.708166(31)	-0.002976(6)	939.419(30)	26
15	2.219635(12)	10.196956(9)	2.938361(16)	0.828321(16)	0.066758(21)	774.508(16)	15
16	2.145151(5)	9.624760 (5)	2.804079(5)	0.845074(7)	0.078381(22)	741.156(5)	7
17	4.295644(36)	13.977713(28)	4.953310(35)	0.326766(35)	3.504149(36)	1184.840(36)	35
18	2.458153(23)	11.766694(20)	3.118197(23)	0.804374(22)	-0.005942(11)	818.862(23)	21
19	2.212907(9)	10.345055(11)	2.860703(10)	0.838396(11)	0.004361(9)	757.411(10)	9
20	2.298817(17)	11.176297(16)	2.929416(15)	0.829737(15)	-0.060509(20)	774.334(15)	16
21	2.263144(14)	10.389029(14)	2.903771(14)	0.833003(14)	-0.001234(2)	768.065(14)	12
22	2.504957(25)	11.225511(17)	3.209384(24)	0.791579(23)	0.0905176(29)	841.414(24)	23
23	2.257520(13)	10.355155(13)	2.890289(13)	0.834960(12)	-0.042724(19)	766.747 (13)	14
24	2.019337(2)	8.563824(1)	2.616408(1)	0.867487(1)	0.0000561(1)	699.765(2)	1
25	2.293798(16)	12.765502(22)	3.048481(20)	0.815478(19)	-0.031253(18)	812.740(21)	18
26	2.930829(30)	13.677796(27)	3.595694(27)	0.728446(27)	-0.094696(23)	920.452(27)	29
27	2.154301(7)	9.582999(4)	2.806289(6)	0.845284(5)	-0.002515(4)	745.718(6)	4
28	2.078613(3)	9.431519 (3)	2.725326(3)	0.854834(3)	0.009595(13)	724.845(3)	3
29	2.431112(22)	11.433063(18)	3.085164(21)	0.809286(21)	0.024404(17)	813.269(22)	20
30	2.494256(24)	16.051633(33)	3.357417(26)	0.768622(26)	-1.123161(33)	867.565(26)	31
31	2.218220(11)	10.596317(15)	2.840913(9)	0.840835(9)	0.527164(25)	752.461(8)	13
32	2.004096(1)	10.075994(7)	2.619238(2)	0.866773(2)	0.003190(7)	696.535(1)	2
33	2.093558(6)	10.177597(8)	2.728341(14)	0.854485(4)	-0.022200 (16)	725.633(4)	5
34	2.154109(6)	9.966377(6)	2.807569(7)	0.845130(6)	0.004682(10)	746.043(7)	6
35	2.192355(8)	10.238968(10)	2.829626(18)	0.842702(8)	0.017287(15)	753.623(9)	8
36	2.217251(10)	10.352636(12)	2.860816(11)	0.838882(10)	-0.004017(8)	761.439(11)	10

Noticeable differences were found among the predictive abilities of the height-diameter equations by species. The MAE values (m) group means were obtained 3.00316 (ranged from 2.927898 to 3.094637), 2.56608 (from 2.01937 to 4.295644) and 2.14660 (from 2.004096 to 2.218220) for model groups 1 through 3, respectively.

The MaxAE values (m) were found as group means 13.752191 (ranged from 13.536814 to 14.151306), 12.769084 (ranged from 8.563824 to 21.858724) and 10.234648 (ranged from 9.966377 to 10.596317) for model groups 1 through 3, respectively.

For models with stand-level attributes, the RMSE values (m) were found as group means 3.700468 (ranged from 3.630959 to 3.766521), 3.284445 (ranged from 2.616408 to 5.177242) and 2.781084 (ranged from 2.619238 to 2.860816) for model groups 1 through 3 respectively. The inclusion of relative position of a tree and stand-density variables improved the predictive abilities of models. On average, the addition of these variables of group 3 to the height-diameter functions reduced the RMSE by 91.9 cm.

The R values were found as group means 0.709141 (ranged from 0.696403 to 0.722535), 0.753804 (ranged from 0.168241 to 0.867487) and 0.848135 (ranged from 0.838882 to 0.866773) for model groups 1 through 3, respectively.

The ME values were found as group means -0.002843 (ranged from -0.002423 to -0.008996), 0.105786 (ranged from 0.000056 to 3.504149) and 0.087684 (range from -0.004017 to 0.527164) for model groups 1 through 3, respectively. The AIC values were found as group means 941.518 (ranged from 929.411 to 953.546), 845.483 (range from 699.765 to 1184.840) and 739.289 (range from 696.535 to 761.439) for model groups 1 through 3, respectively. In terms of group averages, the third group of equations were found to be more successful. But, the most successful model among the 36 height-diameter models used is the Cox II_a model. This model was followed by Bennet&Clutter and Richards, respectively.

The results of fitting and cross-validation for the models of group 1 are the poorest. There for, a number of studies were found that adding stand variables to the height-diameter equation and using the generalized height-diameter models increased the precision. The stand variables are reported among dominant height, stand basal area, maximum diameter, stand age, number of trees per hectare, stand density in the literature. The statistics and coefficients according to the model in the study were found to be similar to the model results of the previous studies. The inclusion of basal area and d_g into the base height-diameter function increased the accuracy of prediction.

The values of statistics of the models included in group model 2 show that the second modification of Cox II_a and Richards are the equation of this group that most accurately estimates height. The best equation was not in the second group because of much variation in stand age. When there was a lot of stand age variation, there will be more success than the third group of models.

The models of Cox II_b and Richards also fit well to the data in Table 4. The advantage of these models is that they are functions of simple equation, although the bias and MSE were slightly higher than those of the modified versions of the model of Cox II_a.

Plot of residuals versus the heights predicted in the fitting phase of the models of Cox II_a, Bennet&Clutter and Richards were shown in Figure 3. There was no reason to reject the hypotheses of normality, homogeneity of variance and independence of residuals.

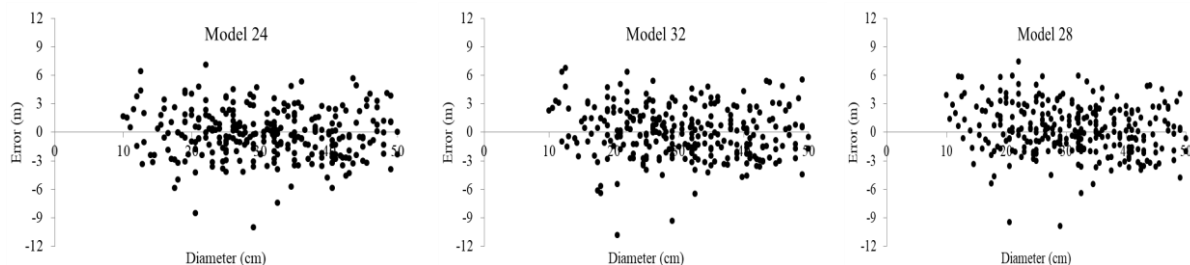


Figure 2. Plot of error versus predicted values in the fitting phase for the models of Cox II_a, Bennet&Clutter and Richards.

In general, it was found that the error amounts show an increase in successful models due to the increase in height values. The amount of error in our work did not increase, but decreased. It can be said that the variation with respect to the error distributions obtained with the generalized height-diameter models is relatively constant. In general, when it was decided whether a model is successful, it is required that the amount of error was small, and that it has a certain and constant variance in the errors were obtained.

Observed heights versus the predicted heights in the cross-validation of this model were shown in Figure 3. The performance criterion to evaluate the behaviour of model was the determination coefficient of the straight line fitted between the observed and predicted heights. Figure 4 shows no tendency toward the overestimation or underestimation of height values. Relatively similar results were obtained for same models. Here again, a situation similar to that of Figure 3 was mentioned. The overlap ratio of the predicted height values with the measured height values increases as the height value increases.

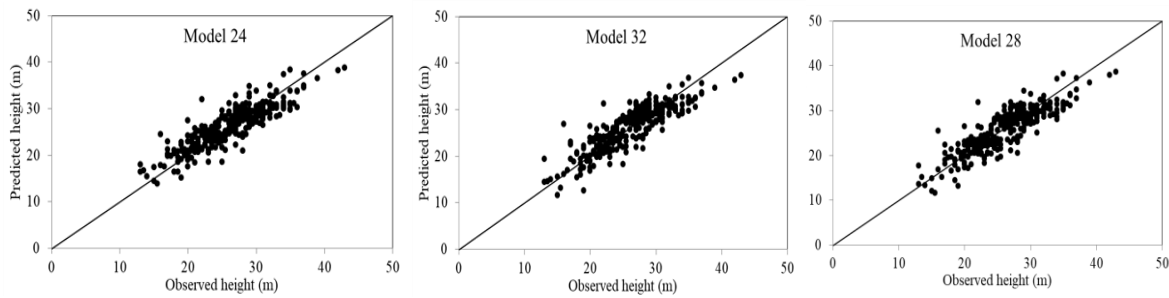


Figure 3. Plot of observed heights versus predicted heights in the cross-validation for models of Cox II_a, (M24) Bennet&Clutter (M32) and Richards (M28).

In this study, the models for the tree total height had been developed for Oriental beech stands in Sinop region (middle black sea region in Turkey). For this purpose, 54 sample plots were measured. A total of 36 models that estimate the relationship between height and diameter in terms of stand variables (basal area, quadratic mean diameter, maximum diameter, dominant diameter, dominant height, arithmetic mean height, age, number of trees per hectare and site index), were fitted to corresponding to 1015 sample trees for non-linear regression procedures. The statistics and coefficients according to the model in the study were found to be similar to the model results of the previous study.

In terms of performance criteria of group models averages, the third group models were found to be more successful. Significance of the model groups were found for predicted heights from good to poor model groups 3, model groups 2 and model groups 1, respectively (Table 3).

The most successful model among the 36 height-diameter models was found Cox II_a model. This model was followed by Bennet&Clutter and Richards, respectively. The best predictions of height were obtained by the model of Cox II_a, which uses diameter (d), quadratic mean diameter (d_g), stand mean height (H_m) as independent variables.

The inclusion of stand mean height or of stand dominant height as an independent variable in the height-diameter equations appears to be necessary in order to achieve acceptable predictions. This requires the measurement of at least one sample of heights for the practical application of the equation. The inclusion of d_g into the base height-diameter model increased the accuracy of prediction.

In general, the inclusion of new independent variables in the height-diameter model reduced bias and increased the precision of model. However, the increase in accuracy of the estimations is usually associated with a larger sampling effort due to the greater number of independent variables that must be measured in the field. But, the model proposed by Cox II_a which includes tree independent variables, given a better performance.

The obtained equation can be used safely in estimating the tree height according to diameter, d_g and H_m in various simulation models to be made with increment and growth models to be formed in local stands.

As a result, the suggested model improves the accuracy of height prediction, ensures compatibility among the various estimates in a growth and yield model, and maintains projections within reasonable biological limits.

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Modeling of Volume Increment-Crown Dimensions Relationships on *Cedrus libani* Trees, Isparta

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Abstract: Taurus cedar (*Cedrus libani* A. Rich.) is an important tree species because of the historical, cultural, aesthetic and economic perspectives and it is one of most important natural resources in Turkey. Taurus cedar has high survival, good adaption, and rapid growth when planted on good soils compared to karstic lands. In this study aim, relationships between crown diameter, crown height, crown ratio and volume increment of *Cedrus libani* trees were investigated and regression prediction models were derived in Isparta. The objective of study is to use linear and non-linear equations for estimating volume increment for Taurus cedar. For each tree, diameter, total height, crown width, crown length were measured. SPSS statistical package was used to fit the selected equations. Akaike's information criterion (AIC), adjusted coefficient of determination (R^2_{adj}), root mean squared error (RMSE), numerical and graphical analyses of the residuals were used for evaluating the models. The results showed that, all fitted equations gave acceptable results with R^2_{adj} and RMSE for Taurus cedar. The study concluded that, the volume increment could be estimated by crown dimensions as it is easy to measure for ground-based inventory and stand structure determination. This study recommended that, future research is needed with a greater variety of site and stand conditions in addition to a greater variety of tree sizes and ages. It should be noted that, the models used by this study were based on data collected from Isparta; therefore, it should be used with caution outside this area.

Keywords: Forest canopy, crown diameter, crown length, linear and non-linear equations, model evaluation

1. INTRODUCTION

Professional forest management requires precise, accurate, timely and complete forest information. Forest information can be acquired by forest inventory, which includes collection of individual tree parameters such as location, diameter at breast height (dbh), tree height, tree crown size and tree species within a sampled forest plot, and also includes the derivation of forest stand measurements such as forest density, age, mean height and crown closure, using statistical extrapolation of plot measurements (Philip, 1994).

Taurus cedar (*Cedrus libani* A. Rich.) is an important commercial species of Turkey. The species also provide a variety of end uses such as poles, pulpwood and saw logs. It grows natural and plantations in Turkey (Evcimen, 1963). The selection of species was principally based on the fact that, Taurus cedar is endangered woody plant in the forest in addition to its economic value and play a vital role in life of local communities around the forest (Boydak and Çalikoğlu, 2008). The wide uses of this in the area in the absence of proper natural regeneration, due to overgrazing, wild fires and drought, has resulted in gradual depletion of these species especially in areas close to villages. Estimation of the present growing stock in such large area using the traditional inventory system is expected to be both uneconomic and time consuming. Taking all these facts into consideration it become necessary to find out cheapest and less time consuming alternatives like a single tree volume increment-crown variables relationship as a base for using remote sensing and GIS techniques (Kazmierczak, Najrakowski, 2012).

Therefore, the objective of this study are to use i) linear and non-linear equations for estimating the single tree volume increment from crown dimensions variables for *Cedrus libani* ii) natural rules of increment and growth must be determined for single tree and stand in forest yield studies.

2. MATERIALS AND METHODS

Study Area

This study is located in Isparta region. The forest is located 10 km north of Isparta between longitudes 37° 50'13'' N and 37° 49' 57'' N and 30° 30'37'' E and 30° 29'59'' E latitude. The trees were planted with a distance of 3x2m in 1992. Study area is about 20 ha size. The study area is identified as being semi-humid.

Sampling

Selective sampling was used for data collection where each individual open grown tree was considered as a sample, and dbh, total tree height and crown diameter (CD) were recorded for all sampled trees. During the measurement process dbh (cm) was measured over bark at 1.3 m to the nearest minimeter by using tree caliper. Total tree height (m) was measured by using Silva Clinometers', while crown diameter (m) was measured in eight directions from the main bole (every 45°

beginning with magnetic north) to the vertically projected edge of the crown. Diameter increment was determined by using Pressler increment borer (mm) (Table 1).

Table 1. Descriptive statistics for some single tree variables

Variables	Model data (n=197)			
	Mean	Minimum	Maximum	Standart deviation
d (cm)	4.62	17.83	10.86	2.25
id(mm/yr)	1.60	6.40	4.20	0.83
h (m)	3.50	8.75	5.97	0.85
L (m)	2.25	7.18	4.51	0.82
D (m)	1.00	4.43	2.94	0.55
CV (m³)	1.16	39.84	13.93	6.62
CSA (m²)	6.32	60.51	29.44	9.37
CR	0.59	0.89	0.75	0.05
iv (dm³)	0.03	0.47	0.21	0.08
iv/pa (dm³/m²)	0.01	0.07	0.03	0.01

Where d=diameter (cm), id= single tree diameter increment (mm/year), h= tree height (m), L= crown length (m), D= crown diameter (m), CV= crown volume (m³), CSA= crown surface area (m²) CR= crown ratio (L/h), iv= single tree volume increment (dm³) and iv/pa = volume increment/projection area (dm³/m²).

It was used Meyer Interpolation method to increase the volume (Kalipsız, 1982 and 1984). Firstly, single entry tree volume equation was obtained (Eq., 1). Equation 2 is obtained by derived from equation 1. Finally, in equation 3 the coefficients are written. Crown volume (Eq., 4) and crown surface area (Eq., 5) are obtained from below equations.

$$v = a * d^b \quad (\text{Eq. 1})$$

$$iv = a * b * d^{b-1} * id \quad (\text{Eq. 2})$$

$$iv = 0,060995 * 2,453932 * d^{1,453932} * id \quad (\text{Eq. 3})$$

$$CV = \frac{1}{3} * \frac{\pi}{4} * D^2 * L \quad (\text{Eq. 4})$$

$$CSA = \pi * D * \left(\frac{s}{2}\right) \quad (\text{Eq. 5})$$

Where, r= crown radius (m) and s= crown side-edge length (m).

Statistical Analysis

Equations were selected for modelling the volume increment/projection area-Crown variables relationship, while Microsoft Excel 2010 was used to fit these models coefficient of determination (R²) and numerical- graphical analyses of the residuals were used for evaluating the models for Taurus cedar. For data analysis, the volume increment/projection area and crown variables were taken as independent and dependent variables, respectively.

3.RESULTS AND DISCUSSION

Optimum Crossing of Leaf Surface in Single Tree

Photosynthesis occurs in plant leaves. For this reason, vegetable production is expected to increase as the amount of leaf in the unit in the forest ecosystem increases. But this relationship is not linear. Since the leaves are shaded each other, they do not change after an optimum, even decrease. But this relationship and optimum point vary greatly depending on the genetic ability of the plants the leaves belong to, the external factors and the condition of the plant (Assmann, 1970).

Leaf amount; is measured as wet or dry matter weights or total leaf surface (leaf surface index: leaf area / soil area) of all leaves in the hectare. 5-27 times the area covered in the forest can be found in the face of a leaf.

Because the amount of leaf is difficult to measure, the number of trees in the basal area or the even aged stands stems is used instead of it in forestry applications (Figure 1 and 2).

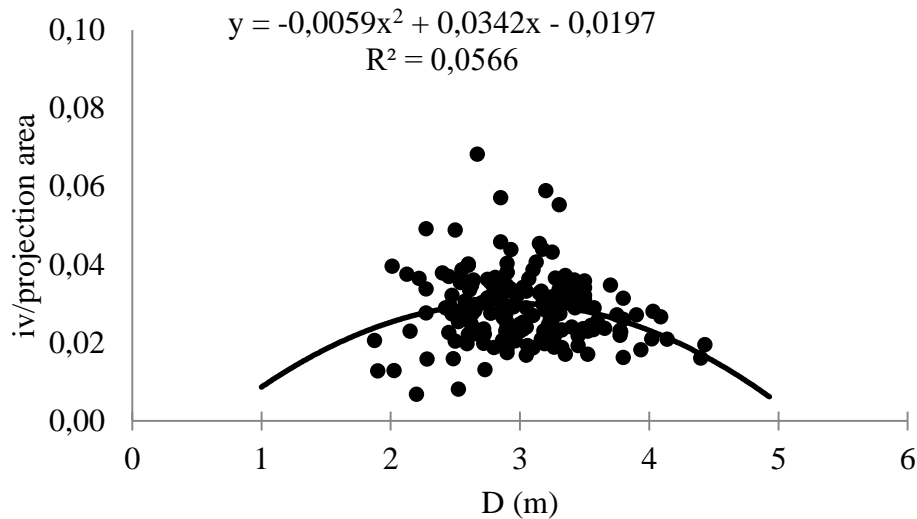


Figure 1. Crown diameter and volume increment/projection area relationship in Taurus cedar

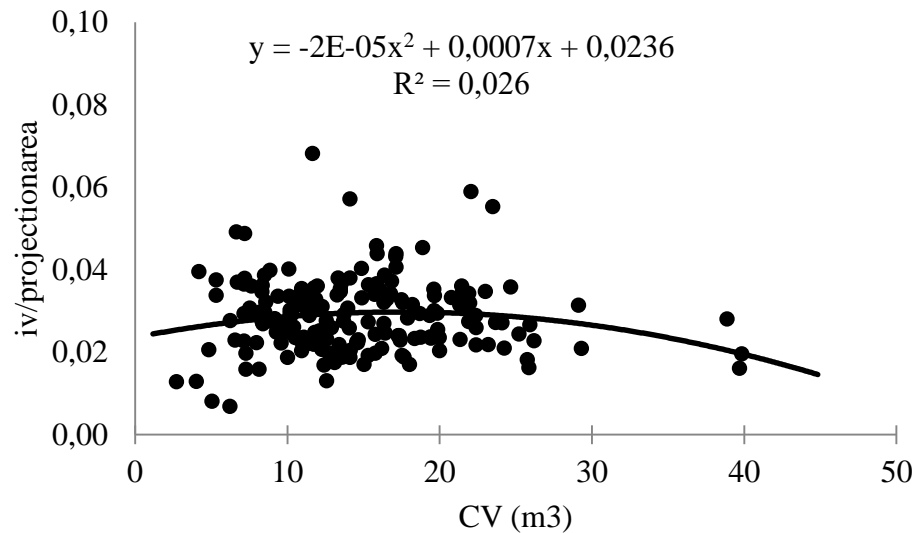


Figure 2. Crown volume and volume increment/projection area relationship in Taurus cedar

If the amount of leaf in the unit of the forest trees is higher than the amount of the leaves in the unit, there are some drawbacks due to the fact that the crop production is high, the youth is coming to the area, animal matter, seed and fruit production and forest services. Indeed, in this case there is not enough light in the forest, especially in the lower part, so seed yield is low, shrubs and annual plants cannot grow, seeds do not grow and grow, hunting and pets cannot shelter. Likewise, a significant part of the precipitation is lost through interception (Kalipsız, 1982).

Low Plant Availability of Trees Under Cover

For example, even aged in Crimean pine stands; It has been found that the tree social classes have very different ratios such as 20-160% in diameter and 3-230% in the trunk volume when the aspect ratios are between 49-120% (Assmann, 1970).

In the even aged and pure stands, the height difference between the trees is less than diameter and trunk volume proportionally. Tree height is not much affected by neighborhood relations. It gives to height to get tired to be defeated in the race and get the light. In this respect, stand height in forestry is considered as a sign of environmental and soil characteristics. Because tall trees are less affected than their neighbors and can last a long time, their top height is used

for this purpose (Hemery at. al., 2005). The trunk volume increase of defeated and crushed trees is very low (Figure 3, 4 and 5).

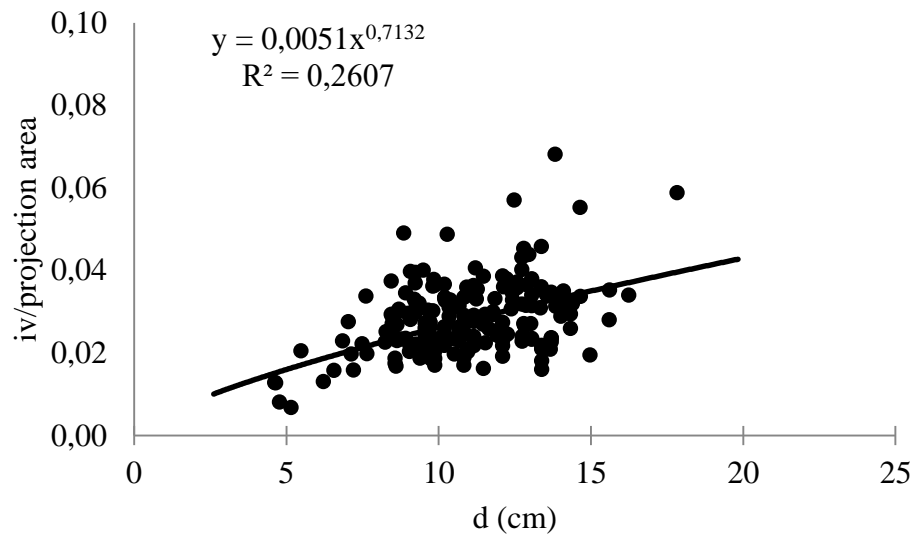


Figure 3. Diameter and volume increment/projection area relationship in Taurus cedar

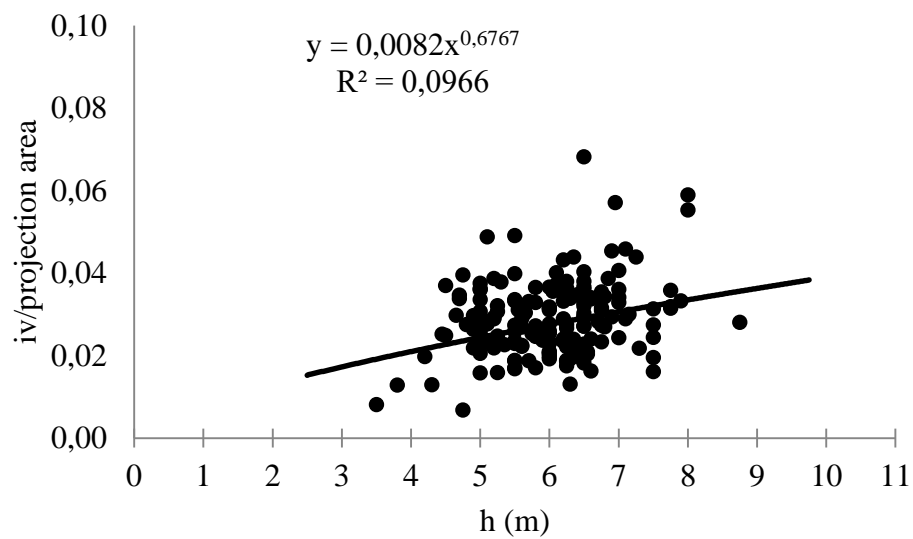


Figure 4. Tree height and volume increment/projection area relationship in Taurus cedar

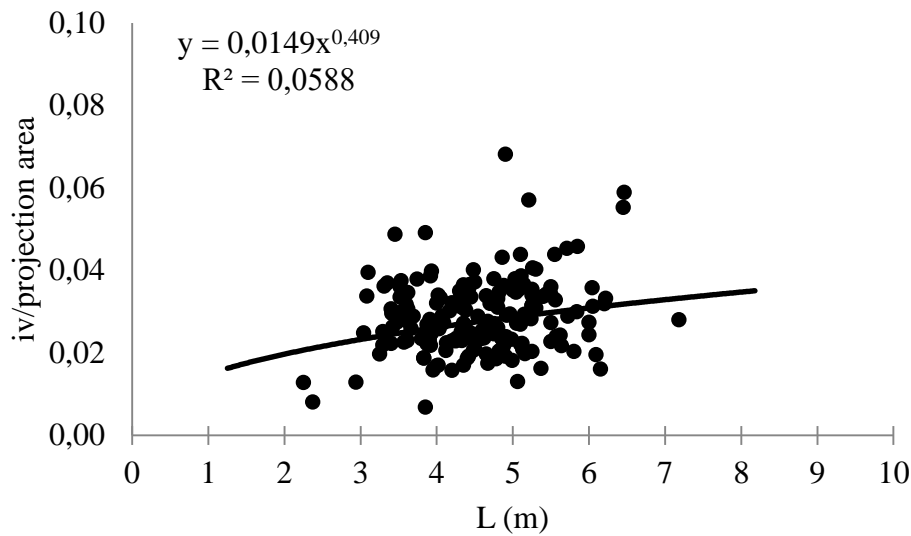


Figure 5. Crown length and volume increment/projection area relationship in Taurus cedar

Shade pressure is more effective on diameter development. In the trees under pressure, the annual ring is narrower, narrowing further towards the lower part of trunk. On the other hand, in the free-standing trees, the annual rings are much wider and are almost the same width along the trunk. This leads to the fact that the upper trees in the vertical closed stand are in a rugged, medium and lower state with plump hull (Carus at al., 2005).

Due to the Inconvenience of Crown -to-Top Surface Relationship of the Large-Topped and Large-Pitched Trees, the Increase in the Amount of Increase Compared to the Occupied Area

According to the tree branch development, the crown formed by the amount of leaves and the level of light level shows a certain volume (crown size) and occupies a space (projection area). Crown size; length, width, surface, volume, whole leaf surface, leaf weight of the hill can be measured in various forms. Projection area; air and space photographs or by location measurements (Figure 6 and 7).

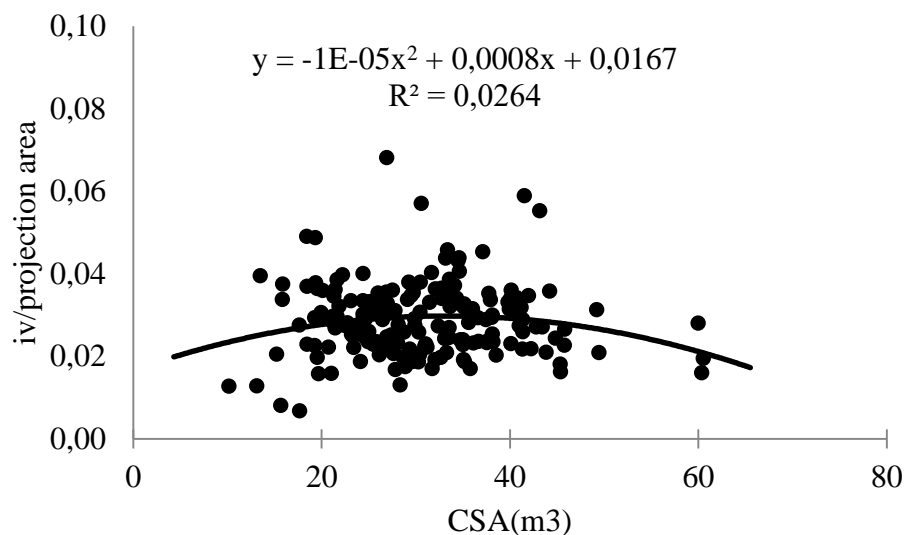


Figure 6. Crown volume and volume increment/projection area relationship in Taurus cedar

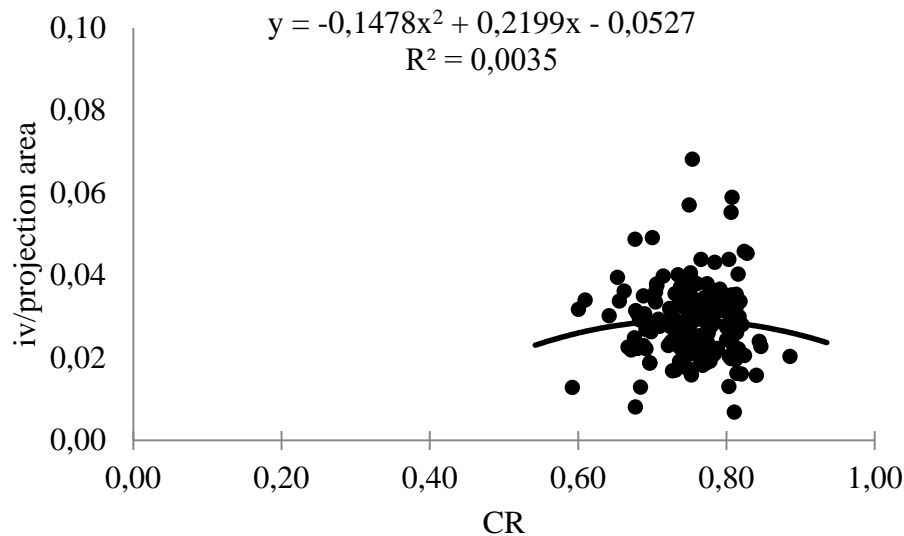


Figure 7. Crown ratio and volume increment/projection area relationship in Taurus cedar

As the size of crown is very large in leaf size, a relation is established between the size of crown and the amount of production of the tree. Since the free-growing trees are very branched and have large crowns, the share of trunk wood in the sparse stands is less (Assmann, 1970).

The size of crown and the projected area; the genetic abilities of the tree species, age, environmental conditions (neighborhood relations, nutritional status-wind and snow). Generally, broad-leaved species, light trees, low-rise growers, small trees-are broader and thicker branched than their aged trees counterparts. For example, when the young spruce stands are much shorter, smaller hills and shade leaves, the difference between thin and thick crowns is reduced because the elderly stand is separated from the lower crown, but the inner space of crown is growing. When the trees around the young tree are cut off, the top and side branches develop and the bottom branches dry up and crown size increases significantly. But since the annual shoots will be short in an old tree, there is an expansion due to the tendency of the branches (Kalipsiz, 1982).

Forest trees usually exhibit a significant relationship between their crown diameters (K) and stem diameters (d). Duchaufour (1903) was one of the first authors to identify this in a study of *Fagus*. In this study, iv/pa ratio for Taurus cedar was determined as tree diameter ($R=0.51$), tree height ($R=0.31$), crown diameter ($R=0.24$), crown height ($R=0.24$), crown volume ($R=0.16$), crown surface area ($R=0.14$) and crown ratio ($R=0.06$).

The study concluded that, the volume increment could be not too sensitive estimated by crown dimensions as it is easy to measure for ground-based inventory and stand structure determination.

This study recommended that, future research is needed with a greater variety of site and stand conditions in addition to a greater variety of tree sizes and ages.

It should be noted that, the models used by this study were based on data collected from Isparta; therefore, it should be used with caution outside this area.

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Psychophysical Effects of Changing Life Environments, Expectations and Interactions; Sample of Nevsehir Hacı Bektaş Veli University

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Abstract: Throughout history, human life has been shaped within the environment it is in, and behaves in the direction of existence or change with its components and processes. In studies on human psychophysical processes in the context of landscape-human relationships, the issues such as the effects of living environments on human psychology, the qualities of positively perceived landscapes, the preferential decisiveness of perceptions and feelings are emphasized. The natural / cultural environment and its constituents are a versatile field of work in terms of the effects of the environment on the human as well as the effects of the human on the environment. In that case, immigration and settlement from one living environment to another living environment of an individual who does have a resident living in today's society should be evaluated in terms of psychophysical processes. In this study, first-year students of Nevsehir Hacı Bektaş Veli University in the 2017-2018 school year was selected as the sampling area and the questionnaire was conducted. In the questionnaire, students who started university education and separated from the city where they lived and were settled in a new social and environmental life area were asked about their feelings, perceptions, expectations and interactions in order to analyze the process of change. Statistical analysis was applied to individual questionnaires carried out in the study, and evaluations were carried out according to these analyzes.

Keywords: Perception, landscape, living environment, university student

1.INTRODUCTION

The technological developments that took place together with industrialization and the industrial revolution have facilitated mobility and made the people more free in terms of changing their living environment. The fact that transportation is easy and fast, basically telephone and electronic communication become widespread and effective, and since even the most distant points on the world can be observed with their visuals, this makes the world smaller.

In this context, the changes in the living environment have become easier in the district, region, country and even all around the world. However, this rapid orientation brings different problems with it and the obligations and determinations of the new living environment as much as of the person carrying his life are emerging.

While the period of change is mainly for educational and business purposes, it also brings new concepts (in positive or negative directions) with it such as; sustainability-based competences (physical-social) of those new urban environments, ecological structures, anticipatory expectations shaped by individual's past social and physical conditions of life and characteristics, mutual interactions and norm of the change that is arisen as a result of those abovementioned issues. The analogy of sustainable urban development and sustainable social development can also be seen clearly in the definitions. Sustainable community development; is the ability to make developmental preferences, respecting the link between these three "E" s of economy, ecology and equality.

Economics: Economic activities should serve common interests, could renew itself and create local wealth thus creating a climate of trust.

Ecology: People are a part of nature, there are boundaries in nature, and communities are responsible for protecting and creating natural wealth.

Equality: All activity is the equal opportunity in participating to utilization and social decision making process (MACED, 2001; Atıl et al., 2005).

Every citizen, whether was born or not in the city, is a part of the healthy and developed cities that are shaped by the concepts of economy, ecology and equality, while bringing responsibilities for the individuals. When expectations of both sides come to the fore, the qualities of today's urban life should be taken into consideration.

With the developing modern life and modernization, the notion of quality of life has come to the fore (Marans 2007, Coşar 2014). Urban environment is related both to housing, to the development of the residential area, to the physical housing area components coming from the neighborhood, as well as to socio-economic (regulatory and institutional) situations (Francescato, 1998, Kellekci and Berkoz, 2006). Today, the importance of the physical environment

constituting the urban space is decreasing, while the social character of the urban space becomes more important due to technological and economic development (Castells, 1997; Ulu and Karakoç, 2004)

Within the changing urban structure; studies were made and carried out on several subjects such as satisfaction with housing and environmental quality, necessity of indoor housing, need for security and security, feelings of confidence in urban area, interaction of different types of household structures with urban environment (Kellekçi and Berköz, 2006; Tümer and Dostoğlu, 2008; Gülmez and Uraz, 2010; Özhancı et al, 2013).

The young population that is the subject of study is valuable for the future of the country and the world. When we look at population structure data; effectiveness of the figures for the young population of Turkey is seen among European countries. According to Eurostat (European Statistical Office) 2016 data; in European countries; countries Italy (22%) is the country with the greatest proportion of the population aged over 65, while Turkey (8.2%) has the least, whereas Germany is ranked as 3rd country following Greece in the sort of old age. The lowest average age was seen in Turkey with the age of 31.1, while in Germany this figure rises to 45.8. Also in the 0-14 age group, the rate was seen high in Turkey with 24%.

The purpose of this study is to evaluate the expectation, the interaction and the psychophysical consequences of the change of the living environment realized for different purposes and to examine and probe what is already presented to individuals who are young socially and physically and what have to be presented at the optimum level by urban structure.

2. MATERIALS AND METHODS

Material

The material of the work consists of students going to the first grade of Nevsehir Hacı Bektas Veli University in 2017-2018 Academic Year and Nevsehir city urban habitats.

Nevsehir city (TURKSTAT, 2016), where the population of the city center is 102.86997, is a small-scale Central Anatolian city. While the urbanization activities still continue in the city, the university and its surroundings are heavily influenced by these activities and live a continuous social and physical change and transformation.

Nevsehir Hacı Bektas Veli University, which has been giving education since 17 May 2007 and has a history of 10 years. University performs its scientific activities in 7 faculties, 7 vocational schools, 3 colleges, 3 institutes and 8 research and application centers in 6 different settlements, one of which is the main campus.

Methods

First-year students, who started university education and left the city they lived in and moved to a new social and environmental life, were asked about their feelings, perceptions, expectations and interactions in order to analyze the process of change.

There are a total of 21.518 students enrolled at the university as of the fall semester of 2017-2018. The number of first-year students in the faculties with a 4-year faculty status (Faculty of Education, Faculty of Arts and Sciences, Faculty of Economics and Administrative Sciences, Faculty of Theology, Faculty of Engineering and Architecture, Faculty of Tourism) at the main campus is 3581 among total number of students as 10.480 (Anonymous, 2018). During the spring semester of 2017-2018, a total of 190 first-year students, including 63 students from Department of Electrical and Electronic Engineering, 29 students from Department of Landscape Architecture and 98 students from Department of History were selected to conduct a survey in order to create a different profile while being chosen for the sample.

In the study, 'SPSS Statistics 22' statistical package program was used in analyzes. The distributions were given as frequency and percentage, and Chi-square analysis was applied to determine the relationship between variables.

3. RESULTS AND DISCUSSION

Distributions of gender, family income and family living information of students participated in the survey are all given in Table 1. According to this; 53.2% are male, 37.4% are in the income group between 1501-3000 TL and 52.1% live in the big city.

Table 1. The distribution of gender, family income and family living information of students participated

Factors	Participants	Total (f)	Total (%)
Gender	Male	101	53,2
	Female	89	46,8
Family income	<800 TL	12	6,3
	801-1500 TL	71	37,4
	1501-3000 TL	61	32,1
	>3000 TL	46	24,2
Family living information	Big city	99	52,1
	Medium-sized city (population between 100,000 and 300,000)	36	18,9
	Small-scale city (population less than 100,000)	3	1,6
	District	26	13,7
	Village	26	13,7

When we look at the evaluations of adaptation levels for innovations; the need for time, the problem of adaptation, and the lack of easy adaptation represent 57.4% (Table 2).

Table 2. The distribution of adaptation levels for innovations

Question	Answer	Rate (%)
Which of the following statements do you identify yourself with?	I would easily adapt to innovation	42,6
	I need time to adapt to innovations	41,6
	I am experiencing the problem of adaptation to innovations	10,0
	I can't easily adapt to innovations	5,8
	Toplam	100

Table 3 shows the distribution of information and anxiety situations that the participants get about the city before they come for education and training to Nevşehir. According to this; before choosing the city where they shall go to university, 63% never came to Nevşehir, 24.7% did not do any research, 63.2% had received information from other people more or less. Among those who asked for others' opinions, 20.0% of the participants were positively affected while 27.4% of the participants were unaffected. Besides, 22.1% of participants said they were concerned about separation from the family.

Table 3. The distribution of information and anxiety situations that the participants get about the city before they come

Question	Answer	Rate (%)
Have you ever been to this town before you choose a school?	Yes	36,8
	No	63,2
Did you do any research on this city before you came?	Yes	35,8
	No	24,7
	Partly	39,5
Are there people you talk to to get information and opinion about the city?	Yes	40,0
	No	36,8
	Partially	23,2
What motivated you to get the information and opinions you received?	Positive	20,0
	Neither positive nor negative	27,4
	Negative	4,7
	I am confused	11,1
What was the greatest hesitation about your new life before you came?	I did not talk	36,8
	Leave my family	22,1
	Failure to get used to	21,6
	A boring environment.	20,0
	Feeling loneliness.	14,2
	I did not hesitate	22,1

54.7% of the students who participated in the survey, stayed in the dormitory of Credit and Dormitories agency (KYK) while 51.1% of them expressed their satisfaction with their life and they were very satisfied. In addition, while participants were mostly suffered the difficulties of being strangers about the general environmental structure (39.5%) and social facilities (34.2%); 48.9% rated the adequacy of street standards, surrounding facilities and services in terms of daily necessities as partially sufficient (Table 4).

Table 4. The distribution of assessment situations regarding the place and the environment where the participants stay here

Question	Answer	Rate (%)
Where are you staying?	Credit and Dormitories agency	54,7
	Apart	15,8
	Apartment	20,5
	Private dormitory	8,9
Which one do you express your satisfaction with living here?	I am very pleased	10,0
	satisfied	41,1
	I am not satisfied	20,5
	I am not happy at all	13,7
What is the most unfamiliar thing about life around here?	Undecided	14,7
	Climate and natural conditions	17,4
	Social facilities	34,2
	The conditions where I stay	8,9
Are street standards, environmental uses and services adequate for your daily needs?	General environmental structure	39,5
	Yes, enough	17,4
	Partially enough	48,9
	Not enough	22,1
	No very unsatisfactory	11,6

41.1% of the participants think that the city of Nevsehir is partly sufficient city to live. While 39.5% of them see the city as natural and environmentally beautiful, whereas urban and buildings are found inadequate (32,1) and very inadequate (16,3%) (Table 5).

Table 5. The distribution of the participants' evaluations on the urban structure of the city of Nevsehir.

Question	Answer	Rate (%)
In your opinion, is Nevsehir an ideal city to live in?	Yes	20,0
	No	38,9
	Partially	41,1
In your opinion, is Nevsehir a beautiful natural and environmental city?	Yes	39,5
	No	22,1
	Partly	38,4
Which of the following statements is appropriate for you to describe the urban physical structure and possibilities of Nevsehir?	Urban structure and facilities are sufficient	7,4
	Urban structure and facilities are partially sufficient	44,2
	Urban structure and facilities are inadequate	32,1
	Urban structure and facilities are very inadequate	16,3

49.5% of the participants stated that their approach to the city would not change if they came with their family (Table 6).

Table 6. The distribution of emotional states in the case of if participants come with their families.

Question	Answer	Rate (%)
Whether you come to live with your family, does it change your approach to the city in a positive or negative way?	Positive	20,5
	Immortal	15,8
	It does not affect	49,5
	No idea	14,2

The students who participated in the survey stated that they miss (39,5%) the city where they live because they are more familiar / accustomed to the place they live in, and 27,9% of them stated that they miss social facilities (Table 7).

Table 7. The distribution of the participants longing for where they live

Question	Answer	Rate (%)
What is the thing that you miss much about the place where you live with your family?	There's nothing I long for	11,1
	Nature	15,8
	Climate structure	5,8
	Social facilities	27,9
	It is an environment that I am accustomed to	39,5

Chi-square analysis was performed to determine the relationships between variables. Table 8 shows the statistical relationships between gender variables and responses to the questions.

Table 8. The results of chi-square analysis showing the relationship between gender and responses to questions

Compared variables	X ²	p	N
What was the greatest hesitation about your new life before you came?	27,604	0,000**	190
Which one do you express your satisfaction with living here?	16,708	0,002**	190
What is the most unfamiliar thing about life around here?	1,188	0,756	190
Are street standards, environmental uses and services adequate for your daily needs?	6,753	0,080	190
In your opinion, is Nevsehir an ideal city to live in?	15,840	0,000**	190
In your opinion, is Nevsehir a beautiful natural and environmental city?	9,281	0,010**	190
Which of the following statements is appropriate for you to describe the urban physical structure and possibilities of Nevsehir?	4,884	0,181	190
Whether you come to live with your family, does it change your approach to the city in a positive or negative way?	3,601	0,308	190
What is the thing that you miss much about the place where you live with your family?	1,345	0,854	190

**p<0,01(Significant at 1% level)

According to this; it is resulted that there is a very significant relation between gender and the responses given to the question of "what is your greatest hesitation about your new life?" (p: 0,000, p <0,01), the majority of men responded that they were not hesitant and the ladies had more anxiety about not being able to get accustomed.

It is occurred that there is a very significant relation between gender and the responses given to the question that "which of the following that you shall use in order to express your satisfaction with your life here?"(p: 0,002, p <0,01). The figures of satisfaction in different genders are close to each other, but apart from this, agglomeration in men tend to be dissatisfied, while in women, it tends to ambiguity.

It is resulted that there is a statistically very significant relation between the answers given to the question "Is Nevsehir an ideal city for you to live?" and the gender (p: 0,000, p <0,01), the majority of the men responded negatively while the ladies found it more livable.

It is resulted that there is a statistically very significant relation between the answers given to the question "Do you think Nevsehir is a beautiful city in terms of nature and environment?" and the gender (p: 0,010, p <0,01), the majority of the men responded positively while the ladies found it partially beautiful.

The statistical relations between the answers given to the questionnaire and the variable about the place where they live with their family are given in Table 9.

Table 9. The results of chi-square analysis showing the relationship between the place where they live with their family and responses to questions

Compared variables	X ²	p	N
What was the greatest hesitation about your new life before you came?	13,100	0,108	190
Which one do you express your satisfaction with living here?	16,397	0,037*	190
What is the most unfamiliar thing about life around here?	12,740	0,047*	190
Are street standards, environmental uses and services adequate for your daily needs?	7,511	0,276	190
In your opinion, is Nevsehir an ideal city to live in?	14,525	0,006**	190
In your opinion, is Nevsehir a beautiful natural and environmental city?	7,177	0,127	190
Which of the following statements is appropriate for you to describe the urban physical structure and possibilities of Nevsehir?	6,489	0,371	190
Whether you come to live with your family, does it change your approach to the city in a positive or negative way?	8,568	0,199	190
What is the thing that you miss much about the place where you live with your family?	24,638	0,000**	190

*p<0,05 (Significant at 5% level)

**p<0,01(Significant at 1% level)

In accordance with this; it is resulted that there is a statistically significant relation between "the place where you live with your family" and answers to the question "Which of the following that you shall use in order to state your satisfaction from living here?" (p:0,037, p<0,05). While there is an accumulation tends to be not satisfied by those who come from metropolitan municipalities, an accumulation tends to be satisfied by those who come from small and middle-scale cities, towns and villages was observed.

It is resulted that there is a statistically significant relation between “the place where you live with your family” and answers to the question “What is the most difficult issue that you feel stranger about your living environment here?” ($p:0,047$, $p<0,05$). While there is an accumulation tends to the fact that there are insufficient number of social facilities for those who come from metropolitan municipalities, an accumulation in tends to negativity in terms of general environmental structure by those who come from small and middle-scale cities, towns and villages was observed.

It is resulted that there is a statistically very significant relation between “the place where you live with your family” and answers to the question “Is Nevsehir an ideal city to live or not?” ($p:0,006$, $p<0,01$). While there is an accumulation tends to negativity for those who come from metropolitan municipalities, an accumulation tends to positivity or partial positivity in terms of general environmental structure by those who come from small and middle-scale cities, towns and villages was observed. It is resulted that there is a statistically very significant relation between “the place where you live with your family” and answers to the question “What is the thing that you miss much about the place where you live with your family?” ($p:0,000$, $p<0,01$). While there is an accumulation tends to social facilities for those who come from metropolitan municipalities, an accumulation tends to the environment to which they are familiar by those who come from small and middle-scale cities, towns and villages was observed.

Statistical relations between the variable of family income and answers given to questions are shown in Table 10.

Table 10. The results of chi-square analysis showing the relationship between family income and responses to questions

Compared variables	X^2	p	N
What was the greatest hesitation about your new life before you came?	22,556	0,004**	190
Which one do you express your satisfaction with living here?	25,058	0,002**	190
What is the most unfamiliar thing about life around here?	5,147	0,525	190
Are street standards, environmental uses and services adequate for your daily needs?	6,375	0,383	190
In your opinion, is Nevsehir an ideal city to live in?	2,706	0,608	190
In your opinion, is Nevsehir a beautiful natural and environmental city?	6,444	0,168	190
Which of the following statements is appropriate for you to describe the urban physical structure and possibilities of Nevsehir?	2,273	0,893	190
Whether you come to live with your family, does it change your approach to the city in a positive or negative way?	5,664	0,462	190
What is the thing that you miss much about the place where you live with your family?	6,447	0,375	190

** $p<0,01$ (Significant at 1% level)

In accordance with this; it is resulted that there is a statistically very significant relation between family income and answers to the question “What is your biggest hesitation about your new life before you came here?” ($p:0,004$, $p<0,01$). It is observed that there is an accumulation tends to not able to be adopted by those whose family income is less than 1500 TL, while an accumulation tends to not having any hesitation by those whose family income is between 1501-3000 TL and an accumulation tends to having a hesitation about the fact that there could be a boring environment by those whose family income is 3000 TL and more.

In accordance with this; it is resulted that there is a statistically very significant relation between family income and answers to the question “What is the issue with which you have the biggest problem and which you feel like a stranger?” ($p:0,002$, $p<0,01$). It is observed that there is an accumulation tends to positivity and satisfaction in all participants from all income groups.

There are significant relations between the place where they stay and whether Nevsehir is an ideal city to live or not and street standards of where they stay and the sufficiency of that place in terms of usage by participants (Table 11).

Table 11. The results of chi-square analysis showing the relationship between the place where they stay and responses to some questions

Compared variables	X ²	p	N
Which one do you express your satisfaction with living here?	25,0158	0,000**	190
In your opinion, is Nevsehir an ideal city to live in?	23,755	0,001**	190
Are street standards, environmental uses and services adequate for your daily needs?	23,526	0,001**	190

**p<0,01 (Significant at 1% level)

While the case of being satisfied of not satisfied of living in Nevsehir shows equal distribution in participants who stay in dormitories of Credit and Dormitories Agency(KYK); those who stay in apartments shows an accumulation tends to satisfaction.

While the opinion that Nevsehir is an ideal city to live takes precedence over generally (totally or partially), the ratio of being satisfied is higher in those who stay in apartments (77,0%).

Distribution of those who think that street standards and sufficiency in terms of usage partially or totally of the place where they stay is respectively (82,1%) in apartments, (76,6%) in aparts and (56,7%) in dormitories of Credit and Dormitories Agency (KYK).

If briefly stated in light with the findings;

- It is also seen in this study that people could not adapt the same pace in terms of adaptation to innovations despite fast-consuming sense of life of today's world, easiness to access to information and sufficiency of visual resources and adaptation problem and not being able to adapt easily come to fore.
- Before making a choice for university, 63% of the students never came to Nevsehir while students at the same rate asked for others' opinions more or less. The majority of those who are not affected among those who asked for others' opinions. In other words, the experiences of others do not turn into our acceptance. Undoubtedly, what we have to do is to judge by experiencing and to individualize our expectations.
- In general, the view that the city of Nevsehir is inadequate and very inadequate in terms of urban structures and social facilities has taken the precedence over. The students express themselves as satisfied and very satisfied with their current life. Moreover, the majority of them also consider street standards as adequate and partly sufficient in terms of the daily needs of the surrounding usage and services. As mentioned before, Nevsehir city is a small city. However, this has a positive or negative feedback in proportion to your expectation.
- Those results were obtained from the students who came from the metropolitan cities that they were not satisfied with their current lives and there is a lack of social opportunities and Nevsehir was not an ideal city to live in. In those students who came from middle and small-sized cities, districts and villages, the tendency has arisen in the opposite direction. In addition, the students who came from the big cities longed for the social facilities where they came from, whereas the middle and small sized cities, the towns and the villages were more familiar. The social structure and alternatives of the metropolitan cities are becoming a necessity for young people who have grown up in these conditions. However, when there is no habit, expectation does not occur.
- About the question "What was your greatest hesitation about your new life before you came?", the results were observed in those students from low income level as "not being familiar" while it is "not having any hesitation" in those students from middle income level; the results from those students from high income level are accumulated on the fact that "there shall be a boring environment". It is understood that our expectations are determined by our environmental habits and economic opportunities we have brought from the past.
- A significant part of participants stated that their approach toward the city would have not been changed if they shall come with their families. In the life of young people, there has been no major result of family dependence. There are different kinds of disruptions and problems.
- It is observed that the majority of male participants had no hesitations about their new life before they came to Nevsehir, while they responded that Nevsehir is a beautiful city in terms of natural and environment, but it is not an ideal city to live in. It is occurred that ladies mostly has hesitations about not being able to be adopted, while they think Nevsehir is partly beautiful and livable city. For women, getting used to the new living environment and feeling safe is a priority and more important than social opportunities.
- The rate of considering Nevsehir as an ideal city to live and being satisfied to live there is higher in those students who live in apartments. Similarly; the distribution of those who think that the residence is sufficient and partly adequate in terms of street standards and surrounding usage is higher in those who live in the apartments. That is to say, to interpret a city and to give it a positive or negative value is in accordance with the standards of your field.

Especially if your ability of mobility is lower than that of adults, it is difficult for you to discover the different aspects of the city and its immediate surroundings, so your assessments take place to the extent of your experience.

- Moreover, since those students who live in their own houses are more satisfied with the situation, it leads to the result that the conditions of apart and dormitory affect the motivation negatively. Undoubtedly, these conditions, which are determined by a number of factors, need to be considered.

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Perceptions of University Students towards Nevşehir Urban Identity

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Abstract: Cities are shaped by interaction of natural conditions such as topography, climate, water, vegetation, geographical location with culture and socioeconomic structure, and create different identity. The main elements that bring the urban pattern are the building blocks, the open-green spaces around the building masses and the ways that connect them together. Their features create the visual character of the city and form the city identity based on people's perceptions. Perceptions of people about their surroundings can show differences according to many factors such as the socio-cultural characteristics of the people, their experiences and environmental awareness. This study aimed to reveal the identity of Nevşehir city from university students' perspectives. Face to face surveys were applied to students who are in the main campus of Nevşehir Hacı Bektaş Veli University. Within the scope of the research, questions were asked which identify the students' individual characteristics, districts where they frequently used in the city, their views about the environmental structure and urban images. As a result, because of being located in the Cappadocia Region, importance of studies about Nevşehir city image and urban identity has been emphasized and it has been revealed how the city is perceived by foreigners.

Keywords: Nevşehir, urban identity, urban image, student, perception

1. INTRODUCTION

Cities are accommodation units where the interaction between people and the environment can be observed intensively and actively (Karadağ and Turut, 2013). Human-space relations begin with the perception of environment by an individual. In the mind of the person who perceives the environment, an image of that environment occurs. When this situation is evaluated in urban scale, urban identity is formed by collective perception and adoption of physical, social or natural objects forming the city (Bayramoğlu, 2010).

The identity of the city is an entirety that is formed by urban elements that belong to the city, which makes it different from the others and adds value to that city (Oğurlu, 2014). In order to define the environment according to the formal approach of environmental perception, the environment must be comprehended deeply as a whole and evaluated as a whole. Each of the parts forming the entirety has a distinctive characteristics and identity (Önem and Kılınçaslan, 2005).

Kevin Lynch (1960), who laid the foundations for his work on the perception of the city, called the elements that define the settlements as 'urban image elements / urban imagery' (Erkan and Yenen, 2010). Lynch sees the legibility of the space as a visual cognitive act in which urban images are perceived by the individual and classifies those urban images by dividing into five elements. Those elements are paths, edges, districts, nodes, and landmarks.

Paths: could be defined as a circulation network that perpetuates the transportation which links the city elements to each other. Edges: Items that draw attention with respect to their linear features and usually frame other physical places of the city with natural limitations such as mountains, seas and lakes. Districts: Spaces and areas of large cities where individuals shape their physical boundaries in their minds and feel the area where they are inside when they are located within. Nodes: The focal strategic points of the city where the paths or intersections intersect. Landmarks: Differentiated objects and structures in the city that gains a distinctive character by separating themselves from the urban fabric (Ülkeryıldız et al., 2009). In this study, the city identity of Nevşehir was analyzed by evaluating the elements forming the city from the perspective of the university students.

2. MATERIALS AND METHODS

The main material of this research which was made in order to determine how university students perceive the city of Nevşehir as environmental is the students who are studying in Nevşehir urban fabric and the main campus of Nevşehir Hacı Bektaş Veli University in 2017-2018 academic year. A face-to-face survey was conducted with a total of 10,480 undergraduate students studying at the main campus with 210 students selected randomly from social facilities and open spaces where students were heavily involved. Twenty open-ended and multiple-choice questions were asked to identify students' individual characteristics and urban environmental perceptions.

Survey questions were generated based on Lynch(1960)'s main types of urban images (paths, edges, districts, nodes / focal points, and landmarks) in determining urban environmental perception. As a result of the survey, it was tried to

determine the environmental factors, reasons, city architecture, green areas and the aesthetic and functional qualities of the roads, urban image, city focal points and landmarks of the students who have been to the city for the first time. The SPSS 22 statistical program was used to evaluate the data. In multiple choice questions, percentage distributions and frequencies of answers are determined and the average scores of the options were determined by questions in which sorting as per importance is required.

3.RESULTS AND DISCUSSION

Findings related to the demographic characteristics of the students participating in the survey are presented in Table 1.

Table 1. Demographic characteristics of students participating in the survey

Demographic characteristics		Frequency	Percentage
Gender	Woman	124	59,0
	Man	86	41,0
Class	1.	76	36,1
	2.	23	11,0
	3.	43	20,5
	4.	68	32,4
The income status of their families	<1000 TL	15	7,1
	1001-2000 TL	74	35,2
	2001-3000 TL	53	25,2
	3001-4000 TL	37	17,6
	>4001 TL	31	14,8
Geographic regions where they come	Mediterranean	34	16,2
	Eastern Anatolia	5	2,4
	Aegean	14	6,7
	Southeastern Anatolia	9	4,3
	Central Anatolia	106	50,5
	Black Sea	18	8,6
	Marmara	24	11,4
The region they live in the Nevşehir city	The neighborhoods around the university	170	81,0
	Different neighborhoods of the city	34	16,1
	District	6	2,9

59% of the students who participated in the survey consist of girls and 41% of them are boys. 36,1% of them are in the first grade, 32,4% in the fourth grade, 20,5% in the third grade and 11% in the second grade. The income status of their families is mostly (60,4%) between 1000-3000 TL. Looking at the cities where the students live with their families, most of them are located in the Central Anatolian Region (50,5%) in parallel with Nevşehir's position; it is determined that the number of students coming from coastal areas is also very high (42,9%). A large majority of university students in Nevşehir meet their housing needs with state dormitories and apartments around the university. Therefore, it was determined that 81% of the students who participated in the survey were resident in the district of 2000 Evler when they were asked about the region they live in.

When the Nevşehir settlement texture is examined in the context of the edges among the urban elements revealed by Lynch (1960), the Nar-Sulusaray valley constitutes the eastern-northern edges, hills at the eastern and southern edges and the Aksaray-Nevşehir highway from the west-north direction at the western edge of the city constitute the edges of Nevşehir (Figure 1).

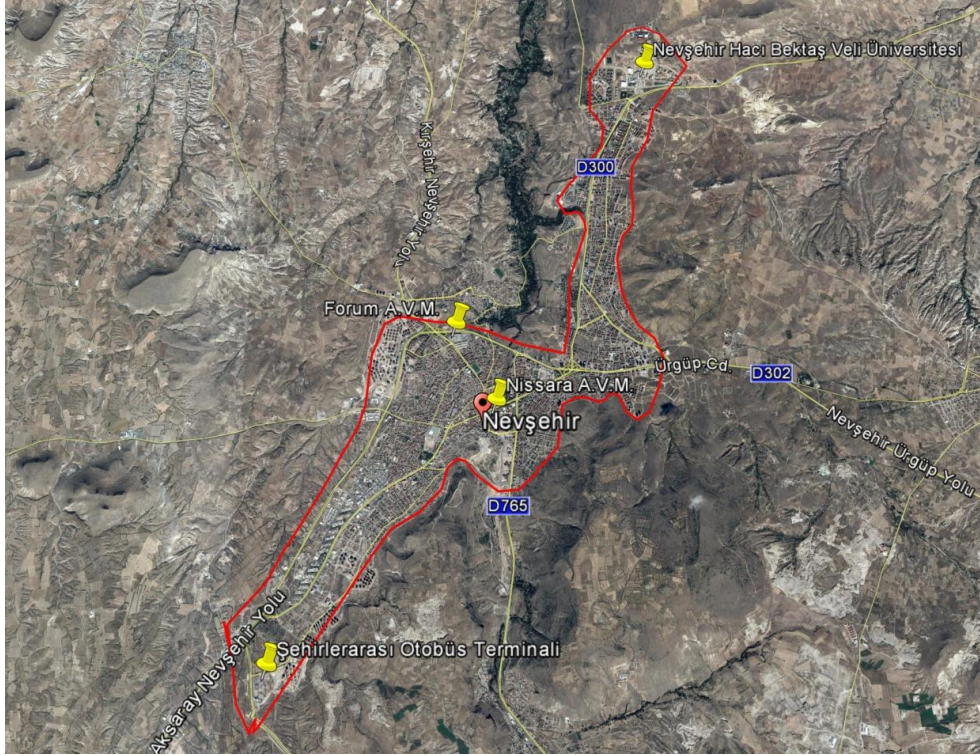


Figure 1. Urban fabric and edges of Nevşehir

When the most used districts by the students in the city were questioned, the first ranked district was university and its immediate surroundings ($M=4,7$) according to the average score in the priority order; followed by the district where they lived and the immediate surroundings ($M=3,5$), the shopping centers ($M=2,1$) and the city center ($M=1,9$), respectively. In the other open-ended option in the questionnaire, it was determined that the students spent time in the touristic districts ($M=0,24$). Students spend most of their day in university campus; they usually prefer to go to cafes and shopping centers during their free time. Depending on the fact that living environment of the students within the urban fabric is around university; cafes, patisseries, etc. places are mostly located in the same district. Therefore, the most used routes and districts by the students in the city are university-city center (Nissara Shopping Mall) university-bus station (Forum Shopping Mall).

When students first came to Nevşehir in order to receive education in the university, the places they visited mostly were also the bazaar (city center), university and immediate surroundings and shopping centers. In addition, almost all of them visited the touristic sites (Avanos, Göreme, Ürgüp). When asked what is the first thing to draw attention to the elements that make up the urban fabric, first ranked element is geological formations (39,5%), second one is paths (25,1%), third one is green areas (22%) and fourth one is buildings (13,4%).

Although the typical surface formations of the Cappadocia Region are not found in the city center; the students identified the province with these since those districts that come to fore with these characteristics are very close to the city center (Uçhisar: 8 km, Göreme: 12 km, Avanos: 17 km, Ürgüp: 20 km). Therefore, most of the attention within the urban fabric has drawn to paths. When the reasons are asked, they have generally emphasized on the order of paths, quality and landscaping. Over the last year, infrastructure renovation work has been continuing in the main arterial roads of the city. For this reason, the first graders stated that the roads are mostly rough and damaged. Students have generally expressed their discomfort from ongoing road work, insufficient road arrangements despite the fact that they are within the tourist area, and insufficient pavements. Nevertheless, senior students who have seen those paths before their infrastructure work have indicated stated that they found it impressive with the route, the width and the order of the bus station -university route.

The green texture of urban components is the second element that draws attention when students first arrive in the city. Due to the climate, students in the city stated that in the city with steppe vegetation cover, they found out that there are few green areas, parks and trees; the city was surprisingly arid.

In the structural fabric, the rock carvings unique to the region, and the natural stones of the region, Nevşehir stone covered buildings and flat roofs draws the attention of students. Although there are few examples in the city today, the town of Nar and the other districts in the city conserve traditional architecture. Therefore, the students evaluated not only city center but also city as a whole in terms of buildings. In the new residential areas, it was found attractive that the buildings are built very close to each other and have few storeys.

After determining the first impressions of a foreign person at the first time she/he sees Nevşehir, the answers to the questions about how to evaluate the urban fabric of Nevşehir in terms aesthetic and functionality are given in Table 2.

Table 2. Percent distribution of responses to questions about aesthetic and functional characteristics of constructions, green areas and paths

	Yes (%)	Partially (%)	No (%)
Do the buildings reflect traditional architecture in the city?	31,9	46,7	21,4
Are the outlines of the structures in comply with each other?	21,9	42,9	35,2
Does the city have a regular and perceptible settlement pattern?	11,4	37,1	51,4
Is the amount of green areas in the city enough?	2,4	12,4	85,2
Are green areas qualified to meet your recreational needs?	4,8	26,2	69,0
Are the green areas generally well-maintained?	6,2	33,8	60,0
Do you find the green area layouts visually sufficient?	4,8	31,0	64,3
Are the streets of Nevşehir city aesthetic?	5,7	24,8	69,5
Is the Nevşehir city road layout functional?	7,6	27,6	64,8
Can the urban transport network be easily perceived?	39,5	35,7	24,8

The urban texture constitutes constructions, open-green areas and paths connecting them together. The qualities of these three elements in Nevşehir city are revealed by the percentage distribution of the choices which students answer in the form as "yes, no and partially". According to the students, the buildings in the city reflect traditional architecture. As mentioned earlier, this view was the settlement of traditional architecture, which surrounds the city and is intertwined with the city. In today's restoration style, it is stated that buildings are relatively compatible (42,9%) with each other in terms of the number of storeys, architectural structure, etc. Half of the students who say that the buildings are quite frequent in the city think that the city does not have a regular and perceptible settlement texture (51,4%).

The vast majority of the students (85,2%) stated that there is not enough green areas in the city and that they cannot meet the recreational needs of the existing green areas (69%). It has been stated that green areas are neglected (60%) and arrangements are inadequate (64,3%) in terms of visual perspective.

Since Nevşehir is a small-scale city, the intra-city transportation network is generally easily recognizable. When students were asked their ideas about path layouts, 69,5% were not aesthetically pleasing; 64,8% stated that they are not functional for safety and quality for pedestrians and vehicles.

Among the options given in the question "Which are the highlighted squares and junctions in the city that take the most attraction" directed to the students in order to determine the focal points of the city, the most marked (52,4%) is the Borsa Junction. Although the other junctions are not remarkable by the majority, the junction of the university (48,1%), the hospital junction (48,1%), Yavuz Sultan Selim Bridge Interchange (30,5%), Fatih Sultan Mehmet Bridge Interchange (21,4%), the junction in front of the Provincial Gendarmerie Command (17,1%), the square / junction in front of Governorship Building (16,2%) and Fire Bridge (7,6%) junction follows the Borsa junction.

According to the students; the city's landmarks are university (73,8%), Nissara shopping center (71,4%), Forum shopping center (43,8%), Nevşehir Castle (25,7%), Nevşehir Governorate (25,2%), Gülbahçe Park (19,5%), Damat İbrahim Pasha Complex (13,8%) and Nevşehir Cappadocia Culture and Art Center (12,9%).

Creating well-designed, living urban spaces is directly or indirectly the task of the designer. Creating good spaces is based on aesthetics and visibility, as well as creating areas where users can socialize, where feelings such as trust, innovation, and integration can be felt. In order to do this, the identity of the space needs to be well defined (Bayramoğlu, 2010). In this study, effective components on Nevşehir urban identity were investigated.

According to the research result, the most important items affecting the urban image and urban identity of Nevşehir are roads and green areas. It is important to improve the road layouts and increase the green texture for an urban development.

Considering the regions that students frequently use, it seems that the university environment and the city center have taken an active role in environmental perceptions.

The region's traditional architecture is the foreground as a positive and remarkable element in urban identity. Preservation of traditional texture of settlements such as Nar, Göre and Avanos, which draw attention with their silhouettes on the interurban and intercity transportation routes, will also affect the urban identity of Nevşehir city.

Although the city has a legible settlement texture in terms of urban layout with buildings' exterior views and number of storeys, it has not been described as a city that can be perceived by most of the students due to adjacent and frequent restructuring. Therefore, increasing the open and green areas around the building will make the city more legible. It is seen that the number of storeys in the buildings have increased considerably in new structures in the city. It should also be kept in mind that the alignment of building structures must be maintained for the prevention of visual complexity and for urbanization with identity.

The Borsa junction is the most important node of the city. The Hospital junction and the bridged junctions in the city are again important node points in the urban identity. The designs to be made in these areas will affect the image of the city positively. It was determined in the survey conducted that although the city center in front of the governorship building which was visited most frequently by the people who came to the city, was an important node, it could not play an active role on the identity of the city. Especially shopping malls could be called as landmarks and are the symbol of the city. Therefore, the visual quality of the surrounding area has an important place in urban aesthetics. Considering its historical and topographical characteristics, it is expected that the Nevşehir castle with a characteristic silhouette and the underground city beneath it will be the most important symbol of the city. This area is not well known by the students. Planning and design works should be carried out in order to define the city center with original values rather than shopping centers and to bring these values to the foreground.

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The Effects of Active Organisms on the Physiological Characteristics of Taurus Cedar (*Cedrus libani* A. Rich.) Seedlings

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Abstract: Owing to ecological changes related to global climate changes and environmental pollution, plants, like any other living organism, are exposed to stressors and require extrinsic biochemical support to continue developing. Plant growth regulators such as arbuscular mycorrhizas and effective microorganisms are used for this purpose. All such elements required for support are synthesized using material available in the natural environment and used to promote plant growth and development. Effective microorganisms are the newest addition to this bunch. In this study, the effects of the biohumus effective organisms EM-A, EM-1, EM-5 and EM-Gold on the variation of chlorophyll-a, chlorophyll-b, and total chlorophyll contents, transpiration rates, relative humidity levels and photosynthesis rates in Taurus Cedar seedlings were examined. Taurus Cedar (*Cedrus libani* Rich.) is a forest tree of great value in terms of the ecological, silvicultural and economical dimensions and can adapt to different conditions in Turkey given its wide geographical distribution. As part of the study, one-way analysis of variance (ANOVA) was used to compare the data on physiological parameters and Duncan test was used for grouping. According to the statistical analysis, a significant difference at the confidence level of $P < 0.01$ with regard to the chlorophyll-a, chlorophyll-b and total chlorophyll contents was observed among effective organisms. According to Duncan test, for the abovementioned physiological variables, EM-A and EM-1 together comprised the first group, EM-5 comprised the second group and EM-5 and EM-Gold together comprised in the third group. According to one-way ANOVA, for photosynthesis rates showed a difference at the confidence level of $P < 0.01$ among the different effective organism types. For this variable, according to Duncan test, at the confidence level of $P < 0.05$, EM-A comprised the first group, EM-1 the second group, followed by EM-5 and EM-Gold in that order. Next, statistical analysis for relative humidity levels and transpiration rates, a statistically significant difference at the confidence level of $P < 0.01$ was observed. Further, according to Duncan test, with regard to relative humidity levels, EM-A comprised the first group, EM-1 comprised the second group and EM-5 and EM-Gold together comprised the third group, and with regard to transpiration rates, EM-A comprised the first group, followed by EM-1, EM-5 and EM-Gold in that order. According to these results, all the physiological variants examined in Taurus Cedar seedlings showed a significant difference owing to the effect of biohumus.

Keywords: Effective Organisms, Physiology, Taurus Cedar, Seedling Quality, Adaptation

1. INTRODUCTION

Taurus Cedar is a type of tree known since ancient times. The earliest known use of cedar in history is before the common era, when cedar wood was transported from Phoenicia to Egypt. Again, before the common era, in Palestine, which was a province of Egypt then, workers at the service of local overlords were clearing the cedar forests in Lebanon to obtain cedar wood. Interest in cedar trees and wood continued to develop after the disintegration of Egypt (Mayer and Sevim, 1959). Cedar wood was a commodity utilized widely, but no attempt was made to protect the cedar forests, leading to the destruction of most of the forest area (Mayer and Sevim, 1959). Interest in cedar trees since the ancient times caused destruction of cedar areas, which are dispersed in disorderly forest stands today; thus, it is important to rehabilitate and reforest these cedar areas (Odabaşı, 1967).

Regarding the selection of the species to be used for reforestation, obtaining plants with a high breeding value, i.e., plant species that are better in increment, output and the consequent economic value compared with local indigenous species in that area, is an important issue. Taurus Cedar is a tree important to Turkey and can easily be grown outside its natural habitat (Boydak, 1990; Yahyaoğlu, 1992; Ürgenç, 1998; Ayan et al., 2017). For the purpose of forestation, selection of appropriate tree species for specific habitats and high quality seedlings are the foremost concerns.

Although there are many recent studies on the effects of fertilization on seedling quality, studies on the effects of effective microorganisms [(EMs, (effective, active, efficient or beneficial microorganism)] on seedling quality are almost non-existent, despite the fact that they are used in many different areas, particularly for agriculture in Europe, and considered to be a part of the advanced technology with respect to fertilization.

EMs comprise a new technology set forth by Prof. Dr. Teruo Higa in the Ryukyus University in the city of Okinawa, Japan. EM technology, which is preferred and used in many areas such as agriculture, animal husbandry, environmental

sciences and medicine, can have beneficial and healthy effects on humans, nature and animals. EMs are a combination of 5 different microorganisms: photosynthetic and lactic acid bacteria, yeasts, actinomycetes and fungi (URL-1, 2018). These microorganisms make use of sunlight and produce beneficial organisms that support the nutrition and development of plants and also suppress the harmful bacteria in the soil, which would otherwise obstruct the development of plants. In this study, it was aimed to examine the physiological characteristics of EMs that have a significant effect on the quality of 2+0-year-old Taurus Cedar seedlings.

2. MATERIALS AND METHODS

In this research, 4 different EM products were used: EM-1, EM-5, EM-A and EM-Gold. Four different products were prepared in 1.5-liter plastic bottles. For the administration, the solutions in the plastic bottles were transferred into containers that facilitated spraying and then sprayed on the above-ground sections of the seedlings and the surface of polyethylene tubes.

For this study on Taurus Cedar, EM administration was performed by pulverization on the above-ground sections of the seedlings and on the soil mixture at the surface of the tubes in the month of April before the 2+0 containerised seedlings entered the vegetation season and in the first week of June when seedling growth was most active. A trial was set up to have each procedure represented with 10 seedlings in 3 replications of each transaction. After the administration, before the plant starting the 3rd vegetation period, 5 seedlings from each plot were brought into the laboratory for the physiological measurement tests.

Determination of Chlorophyll –a -b and Total Amount

The chlorophyll content in Taurus Cedar needles was determined using a photo electro calorimeter (FEK-M) device (Dmitriyeva and Kefeli, 1991).

Determination of Photosynthesis Rate

Photosynthesis rate was analyzed using the LICOR-6200 portable photosynthesis measurement device. Photosynthesis rate was calculated from the exposed and developed leaves of 5 sample seedlings taken from each plot. The measurements were recorded between 9:00 and 12:00 a.m. Results obtained were recorded in $\mu\text{mol m}^{-2} \text{s}^{-1}$.

Determination of Transpiration Contents

A total of 120 seedlings (5 seedlings from each replication) were brought to the laboratory. Seedlings brought to the laboratory were washed with distilled water, cleaned and then dried. Cleaned seedlings were kept at +4°C distilled water for 24 h until fully saturated. The wet weight of saturated seedlings was recorded. Following this process, seedlings were kept in a drying oven at 105°C for 24 h, and their dry weight was recorded.

The transpiration rate of the measured seedlings was obtained by means of the following formula (Dmitriyeva and Kefeli, 1991; Semerci, 2002).

$$S = (FSS - WOC) / DW \times 100 \text{ g H}_2\text{O} / 100 \text{ g Dry Weight} \quad (1)$$

FSS: Fully Saturated State

WOC: Weight Outside Cabinet (weight after being taken out of the climate cabinet)

DW: Dry Weight (weight after being taken out of the drying oven)

Determination of Relative Humidity Contents

For determining the relative humidity level, needle leaves obtained from seedlings were cut in equal-sized pieces and weighed on precision scales to determine the wet weight. After the wet weights were recorded, leaves were kept in distilled water for 4 h until they attained a state of turgor. When turgor pressure was saturated, the needle leaves were weighed and fresh weight was obtained. Then they were kept at 105°C for 24 h and measured again to determine the dry weight. After obtaining these values, the formula $RH (\%) = [(WW - DW) / (TW - DW)] \times 100$ was used to determine the relative humidity level.

Statistical Evaluation

For the evaluation of physiological measurements performed on Taurus Cedar, which is the subject of this study, SPSS Statistics 17.0 programme was used. Statistical parameters such as arithmetic mean, standard deviation, maximum and minimum were calculated and used for analysis of variance (ANOVA) to determine the effects of the process on seedling characteristics. In case statistically significant ($P \leq 0.05$ / $P \leq 0.01$) differences were found in ANOVA, Duncan test was used to create homogeneous groups.

3.RESULTS AND DISCUSSION

Following ANOVA for the physiological characteristics of seedlings, the results showed a significant deviance with regards to administration Duncan test was performed for administration.

Chlorophyll-a (mg/g) Amount

The administration types were categorized in 5 different groups depending on their effects on chlorophyll-a content. The highest chlorophyll content was found in seedlings with EM-A administration, followed by those with EM-1, EM-5 and EM-Gold administrations in that order. The lowest chlorophyll-a content was found in the control seedlings (Table 1, Table 2).

Table 1. Statistical Information of Chlorophyll-a (mg/g) Measurement

Treatment	Number of Seedlings	Mean chlorophyll-a (mg/g)	Standard Deviation	Minimum	Maximum	R
Control	10	1,9400	,1049	1,79	2,08	0,29
EM 1	30	2,6600	,2534	2,25	3,14	0,89
EM A	30	2,9040	,2432	2,51	3,29	0,78
EM 5	30	2,5663	,2362	2,20	2,97	0,77
EM gold	30	2,2670	,20763	1,93	2,61	0,68

Table 2. Duncan Test Results according to Treatment for Chlorophyll-a

Characteristics	Treatment	Number of Seedlings	Mean	P	Homogeneous Groups
Chlorophyll-a	Control	10	1,94	0,000	a
	EM-1	30	2,66		d
	EM-A	30	2,90		e
	EM-5	30	2,56		c
	EM-Gold	10	2,27		b

Chlorophyll-b (mg/g) Amount

The treatment types were categorized in 5 different groups with regards to their effects on chlorophyll-b content. The highest chlorophyll-b content was found in seedlings with EM-A administration, followed by those with EM-1, EM-5 and EM-Gold administrations in that order. The lowest content was found in the control seedlings (Table 3, Table 4).

Table 3. Statistical Information of Chlorophyll-b (mg/g) Amount

Treatment	Number of Seedlings	Mean chlorophyll-b (mg/g)	Standard Deviation	Minimum	Maximum	R
Control	10	1,7950	,1383	1,62	1,97	0,35
EM 1	30	2,4530	,2290	2,09	2,88	0,79
EM A	30	2,6690	,2248	2,32	3,03	0,71
EM 5	30	2,3633	,2131	2,03	2,74	0,71
EM gold	30	2,1270	,2395	1,79	2,89	1,10

Table 4. Duncan Test Results according to Treatment for Chlorophyll-b

Characteristics	Treatment	Number of Seedlings	Mean	P	Homogeneous Groups
Chlorophyll-b	Control	30	1,80	0,000	a
	EM-1	30	2,45		d
	EM-A	30	2,67		e
	EM-5	10	2,36		c
	EM-Gold	30	2,13		b

Total Chlorophyll Measurement

With regard to their effects on total chlorophyll content, the administration types were categorized in 5 different groups. The highest total chlorophyll content was found in seedlings with EM-A administration, followed by those with EM-1, EM-5 and EM-Gold administrations in that order. The lowest content was found in the control seedlings (Table 5, Table 6).

Table 5. Statistical Information of Total Chlorophyll Measurement

Treatment	Number of Seedlings	Mean chlorophyll	Total	Standard Deviation	Minimum	Maximum	R
Control	10	3,7350		,2359	3,44	3,98	0,54
EM 1	30	5,1130		,4814	4,36	6,02	1,66
EM A	30	5,5730		,4674	4,83	6,31	1,488
EM 5	30	4,9297		,4458	4,23	5,71	1,48
EM gold	30	4,3940		,4253	3,72	5,37	1,65

Table 6. Duncan Test Results according to Administration for Total Chlorophyll

Characteristics	Treatment	Number of Seedlings	Mean	P	Homogeneous Groups
Total Chlorophyll	Control	30	3,74	0,000	a
	EM-1	30	5,11		d
	EM-A	10	5,57		e
	EM-5	30	4,93		c
	EM-Gold	30	4,39		b

Photosynthesis Rate Measurement

With regard to their effects on photosynthesis rate, the treatment types were categorized in 5 different groups. The highest photosynthesis rate was in the seedlings subjected to EM-A administration and the lowest rate was found in control seedlings (Table 7, Table 8).

Table 7. Statistical Information of Photosynthesis Rate Measurement

Treatment	Number of Seedlings	Mean Photosynthesis rate	Standard Deviation	Minimum	Maximum	R
Control	10	670,500	10,9367	656,00	685,00	29,0
EM 1	30	777,233	21,5370	745,00	823,00	78,0
EM A	30	838,833	21,0796	804,00	884,00	80,0
EM 5	30	722,067	16,5882	697,00	759,00	62,0
EM gold	30	709,733	13,9381	684,00	736,00	52,0

Table 8. Duncan Test Results according to Administration for Photosynthesis Rate

Characteristics	Treatment	Number of Seedlings	Mean	P	Homogeneous Groups
Photosynthesis rate	Control	30	670,50	0,000	a
	EM-1	10	777,23		d
	EM-A	30	838,83		e
	EM-5	30	722,07		c
	EM-Gold	30	709,73		b

Transpiration Rate Measurement

With regard to their effects on the transpiration rate, the administration types were categorized in 5 different groups. The lowest transpiration rate was found in the control seedlings in the first group, whereas the highest rate was found in the seedlings subjected to EM-A administration in the 5th group (Table 9, Table 10).

Table 9. Statistical Information of Transpiration Rate Measurement

Treatment	Number of Seedlings	Mean Transpiration rate	Standard Deviation	Minimum	Maximum	R
Control	10	83,6800	3,1013	79,10	88,26	9,16
EM 1	30	106,0550	9,2044	92,12	123,35	31,23
EM A	30	115,3467	9,7857	100,35	134,53	34,18
EM 5	30	105,0400	5,3878	96,42	115,54	19,12
EM gold	30	99,0400	8,4258	88,23	116,60	28,37

Table 10. Duncan Test Results according to Treatment for Transpiration Rate

Characteristics	Treatment	Number of Seedlings	Mean	P	Homogeneous Groups
Transpiration rate	Control	10	83,68	0,000	a
	EM-1	30	106,05		d
	EM-A	30	115,34		e
	EM-5	30	105,04		c
	EM-Gold	10	99,04		b

Relative Humidity Measurement

With regard to their effects on relative humidity, the administration types were categorized in 4 different groups. The lowest value was found in the control seedlings, which comprised the 1st group, whereas the highest value was found in the seedlings subjected to EM-A administration, which comprised in the last group. The values for seedlings administered EM-5 and EM-Gold were similar, and these seedlings were categorized in the 2nd group (Table 11, Table 12).

Table 11. Statistical Information of Transpiration Relative Humidity

Treatment	Number of Seedlings	Mean Relative Humidity	Standart Deviation	Minimum	Maximum	R
Control	10	38,0650	2,5520	34,10	42,03	7,93
EM 1	30	46,6533	3,2421	40,43	53,42	12,99
EM A	30	47,9600	3,5210	41,13	55,12	13,99
EM 5	30	43,7967	3,3180	37,66	50,85	13,99
EM gold	30	44,2283	3,0116	38,06	50,16	12,1

Table 12. Duncan Test Results according to Treatment for Relative Humidity

Characteristics	Treatment	Number of Seedlings	Mean	P	Homogeneous Groups
Relative humidity	Control	30	38,06	0,000	a
	EM-1	30	46,65		c
	EM-A	30	47,96		d
	EM-5	10	43,80		b
	EM-Gold	30	44,22		b

According to the chlorophyll-a results obtained from seedlings treated with EMs, the highest chlorophyll content on average was found in seedlings treated with EM-A (2.90 mg/g), followed by seedlings treated with EM-1 (2.66 mg/g), EM-5 (2.56) and EM-Gold (2.27) in that order. The lowest chlorophyll-a content (1.94 mg/g) was found in the control seedlings.

With regard to chlorophyll-b content, the highest content was found in seedlings treated with EM-A (2.67 mg/g), followed by seedlings treated with EM-1 (2.45 mg/g), EM-5 (2.36 mg/g) and EM-Gold (2.13 mg/g) in that order. The lowest chlorophyll-b content (1.80 mg/g) was found in the control seedlings.

The examination of total chlorophyll (a+b) content revealed that the highest total chlorophyll a+b content on average was found in seedlings treated with EM-A (5.57 mg/g), followed by seedlings treated with EM-1 (5.11 mg/g), EM-5 (4.93 mg/g) and EM-Gold (4.39 mg/g) in that order. The lowest value (3.74 mg/g) was found in the control seedlings.

In the study by Odabaşı (1967) on the effects of nitrogen hummus and Kober 5 BB rootstock on chlorophyll content in *Vitis vinifera* L. plant, different amounts of calcium ammonium nitrate fertilizer (60/120/180 kg N/ha) were used, and at the end of the study, the highest chlorophyll-a and -b contents were found in plants treated with 120 kg of N/ha fertilizer. In addition, it was found that Kober 5 BB rootstock increased the chlorophyll content in leaves.

In a study by Atik (2008), the change in chlorophyll content in oriental beech leaves in the Baykal EM-1, biohumus and Baykal EM-1 + biohumus procedure groups during different months (July, August and September) was examined. The results showed that during these three months, the highest chlorophyll content was observed in seedlings treated with Baykal EM-1, followed by seedlings treated with Baykal EM-1 + biohumus and those treated with biohumus. Regarding chlorophyll-b content, in July and August, the highest chlorophyll-b content was found in seedlings treated with Baykal EM-1, followed by seedlings treated with Baykal EM-1 + biohumus and those treated with biohumus. The lowest chlorophyll-b content was found in the control seedlings. In the examination of chlorophyll-b content in September, the

highest chlorophyll-b content was found in plants treated with Baykal EM-1 + biohumus and the lowest in the control seedlings. Regarding total chlorophyll content, based on the months, the highest values were in seedlings treated with Baykal EM-1, followed by those treated with Baykal EM-1 + biohumus and biohumus. The lowest total chlorophyll values were found in the control seedlings.

As part of this study, in the seedlings treated with EM, the highest photosynthesis rates were in seedlings treated with EM-A (838.83 μmol), followed by those treated with EM-1 (777.23 μmol), EM-5 (722.7 μmol) and EM-Gold (709.73 μmol) in that order. The lowest photosynthesis rate (670.50 μmol) was in the control seedlings.

In the examination of transpiration rates, the highest value (115.34) among EM types was in seedlings treated with EM-A, followed by those treated with EM-1, EM-5 (105.04) and EM-Gold (99.04) in that order. The lowest transpiration rate (83.68) was found in the control seedlings.

Plants use $\text{CO}_2 + \text{H}_2\text{O}$ and sunlight for photosynthetic conversion and produce the nutrients and O_2 needed for their vitality and development. Photosynthesis rate is calculated by measuring the uptake of CO_2 or production of O_2 during this process. Water shortage in plants decreases the photosynthesis rate. Plants are exposed to stress conditions caused by water shortage that occurs in plant cells due to drought, and the duration and severity of water shortage have adverse effects on plant growth and decrease the photosynthesis rate (Yüksel and Aksoy 2017). In these conditions, the plant has to minimize water loss by synthesizing some of the much needed organic compounds from the soil. Some structures that play a role in protecting the turgor balance synthesize a group of solvents. These may consist of different groups such as amino acids, organic acids and carbohydrates. Because these equalize the water pressure leaves, they ensure photosynthesis continuity and help the plant grow by increasing stomatal conductance (Örs and Ekinci, 2015).

In this regard, it can be said that amino acids produced by photosynthesis bacteria in EMs maintain the turgor balance in plants, ensure photosynthesis continuity and promote plant growth.

According to the relative humidity levels obtained from seedlings treated with EM, the highest value (47.96%) was found in seedlings treated with EM-A, followed by those treated with EM-1 (46.65%), EM-Gold (44.22%) and EM-5 (43.80%) in this order. The lowest relative humidity value (38.06%) was found in the control seedlings.

Because EMs have a positive effect on physiological variables such as chlorophyll-a/b and total chlorophyll contents, photosynthesis rates, transpiration rates and relative humidity levels, EMs are recommended in improving physiological characteristics that have significant impact on seedling quality in similar species and cultivation conditions. They are also recommended for improving plant growth in unfavorable environmental conditions caused by global climate changes.

Overall, it was found that chlorophyll a/b and total chlorophyll contents, photosynthesis rates, transpiration rates and relative humidity levels were higher in all EM variants compared with control seedlings, and among EM types, EM-A yielded the highest values. In general, EM treatments have more significant and positive effects on seedling physiological characteristics compared with morphological characteristics.

In conclusion, it can be stated that EM treatments have a positive effect on physiological characteristics of seedlings, and EM treatments, which have become popular and have been widely used in agriculture, livestock industry, environmental sciences and medicine in Europe, can also be used in forestry to cultivate high quality seedlings and achieve high plantation as well as serve as a tool to increase the performance of forestation areas.

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Solid Waste Management and Public Awareness on Solid Waste Management in Libya – Benghazi

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Abstract: Libya like most developing countries is faced with problems of solid waste management. In Benghazi, the Municipal Solid Waste is ultimately disposed of in both authorized and unauthorized waste dumps. All kinds of wastes, regardless of their nature, are being dumped indiscriminately into depressions, sand pits, old quarries, beaches, drains and even in certain areas, along streets, without due regards to the nuisance and harm caused to the environment. In order to solve the problems related to Solid Waste Management (SWM) in Benghazi in this study and to select the best method, some questionnaires were made by interviewing public to determine the restrictions on solid waste management authorities and sustainable solid waste management in Libya. Survey number one was Sample of Questionnaire for Members of the Public. Survey number two was Sample of Semi-Structured Questionnaire for Interview Sections Questionnaire (Semi-Structured). Survey number three was Sample of Questionnaire for Members of Benghazi Municipal Council. While data generated from the questionnaire survey were analyzed using the Statistical Package for the Social Sciences (SPSS). According to the results of the surveys; where it is important to note that 43.3% of the participants reported that they are dissatisfied or very dissatisfied with waste management. On the other hand, 39.7% of the participants reported that they are satisfied or very satisfied with waste management. This suggests that most of the participants are not satisfied with waste management in the country. While the survey number two 65% of the participants reported that they are neither Satisfied nor Dissatisfied about waste management. In survey number three for Sample of Questionnaire for Members of Benghazi Municipal Council. they are asked: which would you say is your level of Satisfaction or Dissatisfaction about solid waste management in this country? Almost half of the participant was neutral according to satisfaction and dissatisfaction.

Keywords: Solid Waste, Solid Waste Management, Survey, Benghazi, Libya

1.INTRODUCTION

Municipal Solid Waste: Every unwanted or non-useful solid substance generated in any human population is referred to as solid waste (Kaseva & Mbuligwe, 2003). Over time, consumption practices and activities of economic nature have resulted in the generation of MSW (Cointreau, 2006). which is basically waste that is generated from different sectors of a society such as households, educational, health and commercial institutions, public places, etc., and which is taken care of either directly or indirectly by the municipal or local authorities (Williams, 2005). EEA (2009) defines MSW as: "...waste from households and other waste which because of its nature or composition is similar to waste from households (cf. the Land Directive). Some of this waste is biodegradable, e.g. paper and cardboard, food waste and garden waste. Biodegradable waste means any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food and garden waste, and paper and paperboard (cf. Landfill directive)" (EEA, 2009). The components of such waste, often an assorted mix, are seldom the same for different areas due to factors ranging from the standard of living and habits of residents to resources and climatic conditions found in each geographical location. MSW is often generated in urban areas and has contents that are organic and inorganic nature; the former being often found more in developing countries than the latter. The reverse is mostly the case in the developed part of the world and this is regarded as a significantly distinctive feature from the waste generated in their developing counterpart (Oteng- Ababio, 2011; UNEP, 2005 a).

Waste and Waste Management: Waste can be generally described as any item or material that is generated and disposed of or intended to be disposed of by a person that has custody of it. However, in addition to considerations of legal nature and geographical location of generation, different definitions of waste exist based on conditions under which they occur (Williams, 2005). A process whereby the strategic combination of methods are employed to efficiently regulate waste from the source of generation up to the final disposal point is referred to as waste management, and the aim is to maintain a perpetually safe and healthy environment at minimal cost (Igbinomwanhia, 2011). Waste management has been identified as a challenge in many countries all over the world, much more so in developing countries, and a correlation has been identified between accelerated urbanization, population explosion, industrial development and rate of waste generation in cities found in such countries (Narayana, 2009; UNEP, 2005b).

Though the Municipal Solid Waste management technologies working effectively in the developed countries (waste collecting containers adapted for mechanical waste collection; waste compactor vehicles; sanitary landfills) can be adopted and adapted to various local conditions in the developing countries, these have not been very successful. Almost all developing countries have serious problems with solid waste management with the urban centers characterized by

poor sanitary conditions. While various reasons can be advanced for these developments, central to these is the absence of a policy framework capable of eliciting the participation of the general public for the attaining of sustainable Municipal Solid Waste management objectives and goals through the cultivation of proper waste disposal habits and the creation of a policy environment that encourages the general public to contribute in monetary terms towards the disposal of waste they generate. In developing such a policy framework, environmental, economic and social considerations should be integrated into each phase of the policy development cycle.

Libya like most developing countries is faced with problems of solid waste management. In Benghazi, the Municipal Solid Waste is ultimately disposed of in both authorized and unauthorized waste dumps. All kinds of wastes, regardless of their nature, are being dumped indiscriminately into depressions, sand pits, old quarries, beaches, drains and even in certain areas, along streets, without due regards to the nuisance and harm caused to the environment.

In order to solve these problems related to Solid Waste Management (SWM) in Benghazi in this study and to select the best method, some questionnaires were made by interviewing public to determine the restrictions on solid waste management authorities and sustainable solid waste management in Libya.

2. MATERIALS AND METHODS

Benghazi is located $32^{\circ} 7' 0''$ N, $20^{\circ} 4' 0''$ E, it is the second largest city in Libya after Tripoli (Figure 1). And spread over an area of about 11372 km² with population 674,591.



Figure 1. Location of the study area

In designing the questionnaires for this research, a great deal of caution was taken to ensure validity, reliability, and objectivity of the measuring instruments. Measures taken in the design of questionnaire include the expert rating of the various questions included in the questionnaire. This involves sending the questionnaire to individuals who have insight into the issue under study. These people were asked to criticize the questions and give suggestions as well. Minor problems identified including seemingly ambiguous questions were addressed before the questionnaires were sent to the actual respondents.

Babbie (1990) and Creswell (2003) have exhaustively discussed key issues affecting postal questionnaire surveys and response rates. It is their opinion that, for most studies, a response rate of between 20-30% is normal even in the context of developed countries, with very good postal infrastructure. Given that postal services in Libya at the time of this study are not as reliable as in those developed countries, a decision was made to use the direct door stepping questionnaire administration approach after the method adopted by Phillips et al., (2002) and Read et al. (2009). An obvious advantage of this strategy is to enhance the rate of return since the questionnaires were normally delivered directly by hand to the respondents and taken back immediately on completion. In their study, Phillips et al., (2002) reported a return rate of about 98%. An important drawback of this approach is that it is laborious, time-consuming and expensive.

Data Analysis

Two sets of data were obtained from the waste compositional analysis and the questionnaire survey. Analysis of data from the waste composition study was carried out using Microsoft Excel for Windows while data generated from the questionnaire survey were analyzed using the Statistical Package for the Social Sciences (SPSS).

3.RESULTS AND DISCUSSION

Summary of Result Survey One

Survey number one was Sample of Questionnaire for Members of the Public. The results suggest that the participants noticed the unconcerned waste disposal mainly negative effects on the public health (%33.6) and environmental pollution (%32).The participants reported the waste is disposed of in landfills with treatment or without treatment (%72.3).The results suggest that most of the participants will be more satisfied when governmental institutions to carry out the functions of waste collection and disposal (%55.2).The participants mostly agree that if waste disposal was collected by the authorities properly they would be compelled to dispose of waste properly (%76.8).The participants recognized that improper disposal of waste collected by waste collecting authorities (%53.2) discourage them from participating in a Solid Waste Management scheme to keep the city clean. The participants reported that the government officials, chiefs, and religious leaders are the main sources of information about public awareness on proper waste disposal respectively. The participants who are aware of any tax (money contribution) that they pay purposely for keeping the city clean reported that it has caused them to be more concerned/careful about the way I dispose of waste (%79.2). However, most of the participants desired to be informed in advance or made aware before a new policy is introduced by the government (%96.4).

Summary of Result Survey Two

Survey number two was Sample of Semi-Structured Questionnaire for Interview Sections Questionnaire (Semi-Structured). And the first question is does the Environmental Protection Agency (EPA) play any role with respect to solid waste management in the country? the survey shows 42.4% of the participants said that policy formulation should play the role with respect to solid waste management in the country, and 34.3% said answered with Advisory. And 78.4 % of the participants have some constraints with respect to playing this role. To develop sanitary landfills charge waste collectors per number of tips? Was three-quarters of the participants said that it is possible for private enterprises to develop sanitary landfills and charge waste collectors per number of tips. Almost the half of majority said that waste collected is finally disposed of by the waste collecting Authorities through Dumping in the isolated area and waste dump. Landfill as means of ultimate disposal cannot be avoided, would you support a policy that requires the establishment of the sanitary landfill in all metropolis. The result was 75.8% of the participants support a policy that requires the establishment of the sanitary landfill in all metropolis.

Summary of Result Survey Three

Survey number three was Sample of Questionnaire for Members of Benghazi Municipal Council. As shown from the survey three, 44.8% of the participant proposes that waste is treated and disposed of in landfills. On the other side, 55.2% of the participant suggested that waste is disposed of without treatment in landfills.56.8% of the participant suggested that private enterprises should carry out the functions of waste collection and disposal. Most of the participant disagree with the statement that there is sufficient public awareness on proper waste disposal and 96% of the participants favors the introduction of a program in our educational system that aims at inculcating in students/pupil's proper waste disposal habits. Constraints to sustainable Solid Waste Management in this country 43.2% of the participants gave lack of finance as a constraint to sustainable Solid Waste Management in this country. About question Government will equip all municipalities to process bio waste prior to disposal by the year which Most of the participants said that government will equip all municipalities to process bio waste prior to disposal by the year 2021.While 43.2% of the participants gave lack of finance as a constraint to sustainable Solid Waste Management in this country. And 48.6% of the participants answered with Regulatory measures that compel people to behave in prescribed ways. Whereas, 46% answered with Awareness creation to raise the consciousness of the general public about the benefits and need for proper waste disposal.48.6% of the participants said that Regulatory measures that compel people to behave in prescribed ways are Sustainable Solid Waste Management, in your opinion, with respect to the difficulty with which they can be implemented.

The satisfaction or dissatisfaction about solid waste management in this country. that shows figure 2 Where It is important to note that 43.3% of the participants reported that they are dissatisfied or very dissatisfied with waste management. On the other hand, 39.7% of the participants reported that they are satisfied or very satisfied with waste management. This suggests that most of the participants are not satisfied with waste management in the country. While the survey number two 65% of the participants reported that they are neither Satisfied nor Dissatisfied about waste management. In survey number three for Sample of Questionnaire for Members of Benghazi Municipal Council. they are asked: which would

you say is your level of Satisfaction or Dissatisfaction about solid waste management in this country? Almost half of the participant was neutral according to satisfaction and dissatisfaction.

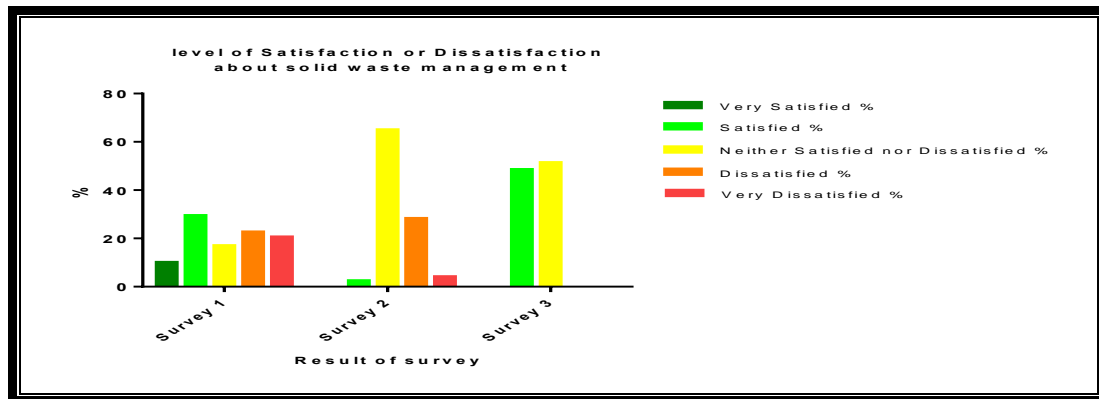


Figure 2. Explain the result of the question for three survey level of Satisfaction or Dissatisfaction about solid waste management in this country.

About the ownership of such waste processing facilities shows that question for interview Sections Questionnaire Type: Semi-Structured. is in your estimation what should be the ownership of such waste processing facilities Sample of Semi-Structured Questionnaire. Anywise, Figure 3 explain the result of this question. 45.8% of the participants said that the ownership of such waste processing facilities should be the government, while 43.3% of them chose Both private and government.

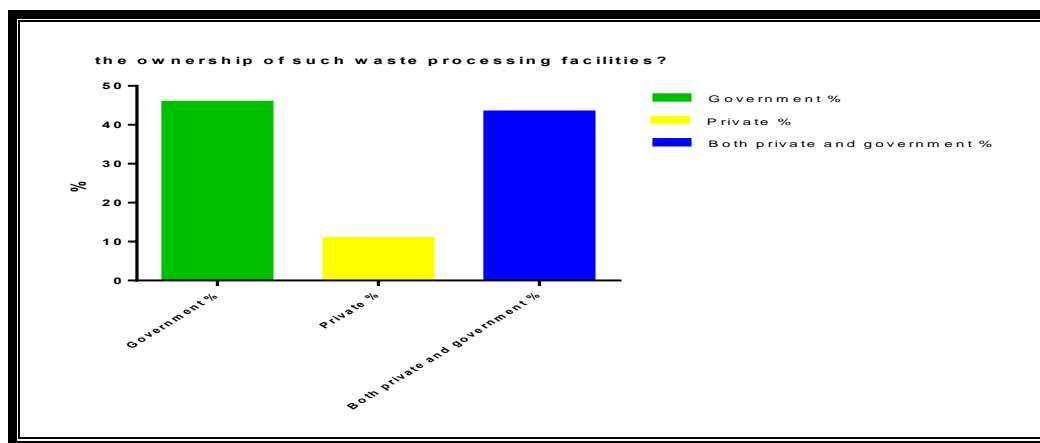


Figure 3. explain the result of question what should be the owner of such waste processing facilities.

According to the participants reported in figure 4, that bio-waste (food leftover, plant and animal parts and any other such waste materials that will decay/get rotten easily when left in the environment) and plastics (to polythene bags and any other such waste materials) are amongst the most problematic waste disposals. While the survey two for Sample of Semi-Structured Questionnaire for Interview Sections Questionnaire Type: Semi-Structured 52.5% of the participants considered Scrap metals as a waste type. And survey three for Sample of Questionnaire for Members of Benghazi Municipal Council. most the participant (81.1%) said that carrying out the functions of waste collection and disposal by bio-waste.

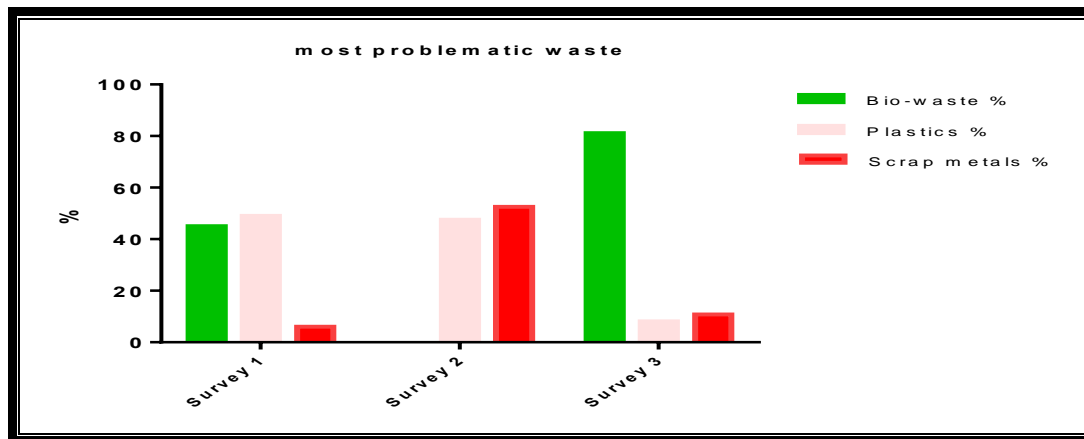


Figure 4. Explain the result of question which of the following waste type according to your understanding do you consider to be the most problematic waste.

Are you aware of any regulation/laws that punish indiscriminate waste disposal habit? And Public Perception of Penalties for Indiscriminate Waste Disposal. According to figure 5 the survey number 1 for Sample of Questionnaire for Members of the General Public. which the results indicated that most of the participants are not aware of any laws/regulations that punish people who make the city dirty by throwing waste in open drains/gutters, on the streets and open spaces (%74.4).and The participants who are aware of a law/regulation that punishes people who dispose of waste in an unconcerned manner/indiscriminately reported that the law/regulation has contributed to compelling most of them to dispose of the waste properly (%60.8). while survey two they are asked: Which do you prescribe as punishment for people who throw waste indiscriminately on the street, most of the participants answered with fine.94.0% of the participants are aware of any tax (money contribution) imposed purposely for keeping our country clean. The survey three the participants who are aware of a law/regulation that punishes people who dispose of waste in an unconcerned manner/indiscriminately reported that the law/regulation has contributed to compelling most of them to dispose of the waste properly (%97.0).

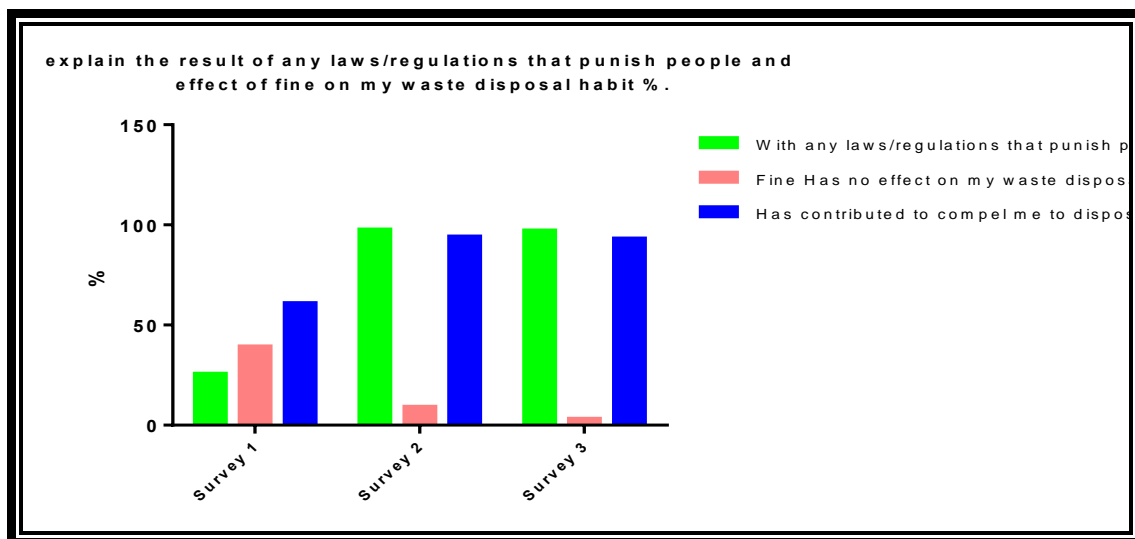


Figure 5. explain the result of any laws/regulations that punish people and effect of fine on my waste disposal habit %.

The figure 6 most of the participants reported the time they would like to know/be made aware of a new policy prior to its implementation more than 6 months (%70.4).The results suggested the television is the most important media for receiving public information about proper waste disposal (%64.1). while survey three 75.7% of the participants indicated that 6-9 months is the time they think appropriate for the populace to be informed/made aware of a new policy prior to its implementation.

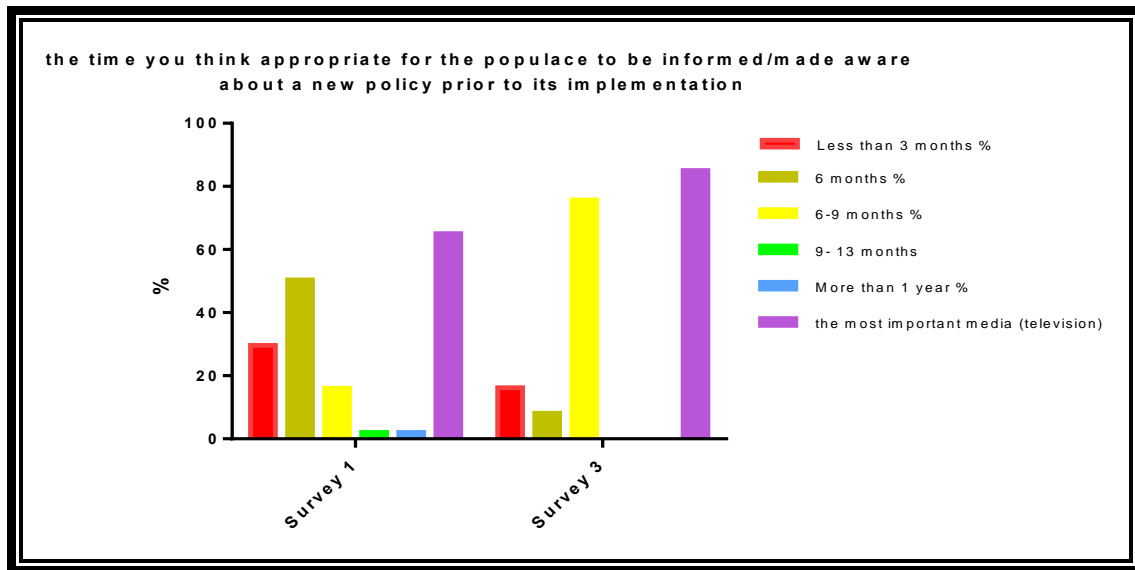


Figure 6. Explain the suitable time for the populace to be informed/made aware of a new policy prior to its implementation.

In survey one about equation what should be the distance between waste bins (receptacles) located in the city center and other public places that figure 7 show The participants reported that the distance between waste bins (receptacles) located in the city center and other public places should be more than 100 m (%84).while survey two 78.3% of the participants suggested the distance between waste bins (receptacles) located in the city Centre and other public places should be 100-150m.

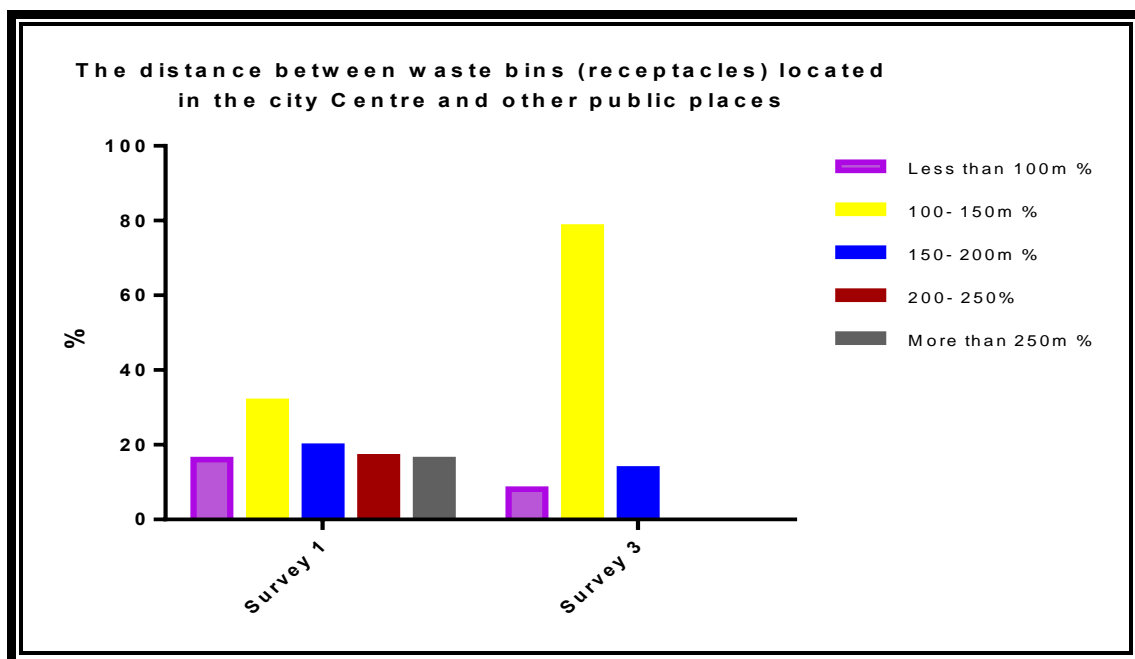


Figure 7. Shows answer equation what should be the distance between waste bins (receptacles) located in the city Centre and other public places?

Policy Package for Sustainable Solid Waste Management in Libya:

1. Provision of litter bins at all public places.
2. Introduction of waste separation at the source.
3. Provision of guidelines for medical waste management.
4. Provision of sector specific waste minimisation guidelines.
5. Support for the development of plastic recycling industries.

6. Promotion of the use of locally produced cotton shopping bags.
7. Specification of time for policy dissemination and policy review.
8. Development of sanitary landfills and material recovery facilities.
9. Support for the development of systems for processing bio-waste.
10. Promulgation of national laws and regulations related to sanitation.
11. The institution of a program for the disposal of old and unserviceable vehicles.
12. The institution of a program for waste management officials to meet periodically.
13. Incorporation of solid waste management into regional development planning.
14. Support for the development of waste related Information Management System.
15. Promotion of active anti-littering campaign and awareness on proper waste disposal.
16. The institution of levy on sources of plastic related waste (plastic bags and sachets for water).
17. Incorporation of graduate programs related to waste management into the education system.
18. Capacity building and re-defining the responsibilities of some solid waste related agencies.
19. The institution of the deposit-refund system for household batteries and another household hazardous waste.
20. The institution of programs for cost recovery for waste collection and disposal in low-income communities.
21. Incorporation of programs into the educational system that inculcates proper waste disposal habits in pupils and students.

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Coating of Wood Materials with *Cotinus coggygria* and SiO₂ Mixes and Its Effects On Combustion Properties

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Abstract: This study aimed to protect wood materials with natural plant colorant of smoke tree (*Cotinus coggygria*) and liquid glass (SiO₂) against fire. According to that, natural colorant was extracted from smoke tree by boiling method and added as mordant in ratios 3% oak ash, and 10% vinegar (CH₃COOH). Liquid glass added to obtained mixtures in ratio 20% and applied to the wood samples scots pine (*Pinus sylvestris* L.) and beech (*Fagus orientalis*) by classic dipping and vacuum method. Combustion tests were performed on coated wood materials according to ASTM E-69 standard and weight loss (%), temperature (°C), gasses (CO, O₂) were measured during the combustion. The results showed that; smoke tree has well potential to color the wood material, but unfortunately test performances are not enough to retard the fire effect on the wood materials. Eco-friendly smoke tree colorant maybe uses in places where protection against fire is not desired, instead of synthetic paints.

Keywords: Smoke tree, Liquid glass, Combustion, natural colorant, fire retardant.

1. INTRODUCTION

Wood material has many unique properties from the point of view of environmental and health aspects, aesthetic, physical and mechanical properties and processing. Wood continues to play an important role as a structural material in today's high-tech society. In the all-around the world wood is widely used as a decoration material building material in some areas as the main construction and (Toker *et al.*, 2012). Alongside these perfect features, unfortunately there are undesirable properties such as decay, color change, water relation, change of shape, and burning. Today, a variety of chemicals are used to protect wood materials against these undesirable properties. These chemicals are preserve the wood material but on the other side damage the environment and human health. Recently international awareness of environment, ecology and pollution control created an upsurge on the interest of people to use more environmentally products. Natural dyes derived from flora and fauna compared to synthetic are believed to be safe because of their non-toxic, non-carcinogenic and biodegradable nature (Mirjalili *et al.*, 2011).

Recent studies present that natural colorants extracted from plants could use to color and protect the wood material against harmful threats (Ozen *et al.*, 2014a; 2014b; Goktas *et al.*, 2008; Colak, 2016). Though natural dyes have been used for coloring for centuries, there is a lack of scientific research from many aspects. In recent years, importance attached to natural dyes as environmental friendly materials has increased. Although synthetic dyes are cost-effective, natural dyes can compete with them due to variety of their sources (Dixit and Jahan 2005; Colak, 2016). For this reason, the importance of the protection of wood material by natural sources is gaining importance day by day.

In recent years, various scientific studies were performed on developing natural sources as protector for wood materials. Ozen *et al.* (2014a) antifungal and antimicrobial properties of madder root, Yeniocak *et al.* (2015) color stability of red beetroot, Colak *et al.* (2015) antifungal and antimicrobial properties of indigo, Goktas *et al.* have studied, color stability of saffron (2009a), madder root (2009b) and laurel (2008), Ozen *et al.* (2014b) colorability wood material with *Punica granatum* and *morus nigra* extracts, Yeniocak *et al.* (2016) fire resistant performance of *Punica granatum* extracts on wood surfaces. These studies showed that the natural dyes can be used as an alternative to synthetics on wood surfaces. Goktas *et al.* (2013), have studied leaching performance of *Rubia tinctorium*, *Rhamnus petiolariss*, *Juglans regia* L., *Boreava orientalis*, *Lawsonia inermis* L., *Carthamus tinctorius* L., *Indigofera tinctoria* L., and *Beta vulgaris* paints on different wood types. They reported that; leaching performance of all natural dyes was not found good enough to be used in outdoor conditions.

The main idea of this study was to improve the combustion properties of wood material treated with liquid glass (SiO₂) and to color the surfaces with smoke tree extracts in meanwhile. The leaves and the hardwood of smoke tree are used for the dyeing of leather, wool and silk into a yellowish colour (Gajić, 1975). The leaves and young branches were utilized for the production of essential oil with a terpenic odour for use in perfumery (Tsankova *et al.*, 1993).

In this study, we focused on the coloring wood material using smoke tree extract (natural colorant) + mordants (oak ash and vinegar) + liquid glass and determined effect of them on combustion properties.

2. MATERIALS AND METHODS

Materials

Wood specimens were cut from randomly selected first grade Scots pine (*Pinus sylvestris* L.) and beech (*Fagus orientalis*) in conformity with the ASTM-E69-02 (2002) standards in sample size (9.5x19x1016 mm) (longitudinal x radial x tangential directions). All specimens were oven-dried temperature of 103 ± 2 °C before and after treatment.

Preparation Bio-Colorant and Mordant Agents

The smoke tree was purchased from the local store located in Mugla (Turkey). The flowers of the smoke trees (5% by weight) were poured into 45 °C temperature water and extraction were performed for 180 min. time. At the end of the extraction time, the evaporated water was added to the solution and the plant residues was filtered off. To obtain different color options and to improve binding, extracts were mixed with grape vinegar (10 % by weight) (CH_3COOH) and oak ash (3 % by weight) mordant. As the final step, the liquid glass (20 % by weight) was added to suspension.

Dyeing Test Samples

The smoke tree extracts + liquid glass mixture was applied to wood blocks by classic dipping and vacuum-assisted impregnation (ASTM-D 1413-76) methods. Application was performed in accordance of Table 1. Retention (kg/m^3) of smoke tree concentrations and weight gain of wood material (%) were calculated with the following equations:

$$R = \frac{G \cdot C}{V} \times 10^3 \text{ kg/m}^3 \quad (1)$$

$$\text{Weight gain (\%)} = \frac{W_f - W_i}{W_i} \times 100 \quad (2)$$

where: G - amount of solution absorbed by wood that is calculated by $T_2 - T_1$,

T_2 – masses of wood after impregnation (g),

T_1 - masses of wood before impregnation (g),

C - solution concentration as percentage, and,

V - volume of the specimen as cm^3 ,

W_f - final conditioned weight of a wood block,

W_i - the initial weight.

Table 1. Application parameters

Colorant	Method	Temperature (°C)	Time (Min.)
Smoke tree	Dipping	45	60
Smoke tree + Liquid glass	Vacuum-assisted impregnation	-	According to ASTM-D 1413-76 According to ASTM-D 1413-76

Combustion Test Procedure

The fire resistance test was performed and weight loss of wood species calculated according to the ASTM E-69-02 (2002) method. In order to measure temperature °C variation and concentration of the released gasses (O_2 , CO), Testo 340 M and XL flue gas analyzers were used.

3. RESULTS AND DISCUSSION

Retention Rates

The retention rates and amounts of smoke tree-mordant and liquid glass mixes given in Table 2. Retention is an important parameter for dyeing and impregnation to determine the amount of substance bonded on wood material.

Table 2. Retention amounts (kg/m³) and rates (%)

Dye	Mordant	Solution	Scots pine				Beech			
			Dipping		Vacuum		Dipping		Vacuum	
			Mean	St.dev.	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.
Smoke tree (kg/cm ³)	Control	With liquid glass	0.33	0.04	0.81	0.04	0.67	0.07	1.37	0.39
		Without liquid glass	0.20	0.07	0.48	0.08	0.36	0.04	1.28	0.31
	Oak ash	With liquid glass	0.29	0.08	0.66	0.07	0.67	0.16	1.54	0.12
		Without liquid glass	0.16	0.03	0.47	0.12	0.38	0.04	1.15	0.09
	Vinegar	With liquid glass	0.35	0.03	0.91	0.08	0.75	0.08	1.95	0.18
		With liquid glass	0.23	0.04	0.46	0.02	0.47	0.04	1.75	0.09
Smoke tree (%)	Control	With liquid glass	1.34	0.31	2.29	0.18	1.28	0.23	2.39	0.25
		Without liquid glass	2.08	0.20	2.21	0.10	1.31	0.29	2.38	0.35
	Oak ash	With liquid glass	2.54	0.11	3.19	0.39	1.97	0.11	3.49	0.54
		Without liquid glass	2.29	0.14	2.50	0.27	1.96	0.09	3.31	0.40
	Vinegar	With liquid glass	1.47	0.31	2.82	0.19	1.93	0.05	2.05	0.13
		Without liquid glass	1.25	0.11	3.78	0.39	1.95	0.54	2.08	0.26

According to Table 2. the retention amount (kg/m³) obtained from the vacuum method found higher than the dipping method as expected. The maximum hold was determined in the vinegar mordant group mixed with liquid glass in both types of wood.

When the retention percentages are examined; it was found that the amount of adhesion was higher in the groups applied with the vacuum method compared to dipping method.

The weight loss (%) of wood species given at Table 3.

Table 3. Weight loss of species after combustion (%)

Method	Dye	Scots pine				Beech			
		Without liquid glass		With liquid glass		Without liquid glass		With liquid glass	
		Mean	St.dev.	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.
Dipping	Control	84,23	2,20	84,50	1,27	89,68	2,22	90,31	1,52
	Oak ash	85,64	3,10	86,38	1,01	90,17	0,97	88,13	1,77
	Vinegar	82,65	1,55	83,10	1,28	86,78	1,97	85,23	0,82
	Smoke tree	83,55	1,48	79,57	2,73	88,61	2,19	89,76	1,98
	Smoke tree + oak ash	87,00	1,31	86,08	2,08	91,41	2,17	90,99	2,20
	Smoke tree + vinegar	82,65	1,55	83,31	2,60	86,78	1,97	91,11	1,11
	Sythetic	83,18	1,03	-	-	87,21	1,45	-	-
Vacuum	Control	85,56	1,99	84,02	2,88	90,47	2,09	87,30	3,60
	Oak ash	87,92	1,43	84,13	3,86	93,74	1,34	91,91	2,39
	Vinegar	84,42	1,55	82,10	1,15	88,66	2,16	87,66	1,72
	Smoke tree	84,99	1,35	86,07	1,07	93,87	2,44	87,44	1,77
	Smoke tree + oak ash	87,95	2,17	91,59	1,92	90,73	3,14	92,78	1,72
	Smoke tree + vinegar	84,42	1,55	81,67	1,10	88,66	2,16	87,18	2,12

According to Table 3; weight loss measured between 82,65 % and 93,87 %. Unfortunately, neither the application method nor the smoke tree solution and addition liquid glass have not contributed positively effect on combustion. These results were similar with; Baysal *et al.* (2007 and Baysal, 2002) reported that mass losses of Scots pine wood specimens treated

with aqueous solutions of the natural extractives were around 85–94 % and also with Yeniocak *et al.* 2016 reported effect of pomegranate skin extracts on mass loses on some wood species recorded between 75.1% and 99.4 %. The O₂ reduction values given at Table 4.

Table 4. O₂ (ppm) values during combustion

Dye	Solution	Scots pine				Beech			
		Dipping		Vacuum		Dipping		Vacuum	
		Mean	St.dev.	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.
Control	Without liquid glass	17,16	2,92	17,36	3,23	16,75	3,06	16,20	2,54
	With liquid glass	16,85	1,13	16,60	4,06	16,20	3,81	16,02	2,40
Oak ash	Without liquid glass	16,34	3,76	17,33	2,56	16,94	2,90	15,98	3,15
	With liquid glass	16,76	0,42	17,56	2,14	17,00	2,91	16,39	2,35
Vinegar	Without liquid glass	16,56	3,45	14,73	2,96	16,76	3,31	16,63	3,54
	With liquid glass	17,56	1,15	16,20	2,90	17,01	2,97	16,81	3,62
Smoke tree	Without liquid glass	16,66	3,83	16,78	3,33	14,45	2,71	16,87	2,75
	With liquid glass	17,58	0,33	16,32	3,42	16,64	3,47	16,95	3,09
Smoke tree + oak ash	Without liquid glass	17,05	3,58	17,58	2,41	16,41	3,66	17,27	1,46
	With liquid glass	15,90	0,63	18,69	1,12	16,38	3,69	17,68	2,15
Smoke tree + vinegar	Without liquid glass	17,14	2,55	16,39	2,37	14,44	5,58	17,21	2,98
	With liquid glass	16,97	1,04	17,37	1,67	16,47	3,42	16,49	3,01

As a result of combustion test the highest reduction (18,69 %) of O₂ concentration was measured in group applied with vacuum method of Scots pine wood samples treated with smoke tree + oak ash added liquid glass. The lowest value of O₂ concentration was determined in case of smoke tree + oak ash without liquid glass treated beech wood samples (14,44 %). The proportion of oxygen in air is normally 21%. Reduction of O₂ was showed important modification depending on mordants, wood species or treatment method. The temperature (°C) values given at Table 5.

Table 5. Temperature (°C) values during combustion

Dye	Solution	Scots pine				Beech			
		Dipping Mean	St.dev.	Vacuum Mean	St.dev.	Dipping Mean	St.dev.	Vacuum Mean	St.dev.
Control	Without liquid glass	307,73	62,38	331,29	71,17	290,08	79,69	350,35	82,79
	With liquid glass	316,63	26,52	359,82	87,69	333,36	62,88	244,29	84,27
Oak ash	Without liquid glass	335,58	77,63	267,00	73,06	279,60	88,38	315,87	97,41
	With liquid glass	308,28	29,89	254,58	63,04	247,27	65,51	248,16	90,77
Vinegar	Without liquid glass	368,47	55,28	383,80	90,72	320,38	69,91	330,47	99,45
	With liquid glass	323,57	15,65	352,00	69,99	306,59	89,70	288,48	78,32
Smoke tree	Without liquid glass	325,93	78,82	327,61	75,58	382,32	84,56	270,82	73,91
	With liquid glass	297,67	19,91	362,43	63,47	263,70	73,53	239,95	121,96
Smoke tree + oak ash	Without liquid glass	326,13	58,91	261,11	85,45	305,71	86,48	285,97	59,05
	With liquid glass	361,68	15,66	217,40	42,60	294,36	88,75	256,15	63,69
Smoke tree + vinegar	Without liquid glass	275,69	78,38	275,69	78,38	380,97	82,96	380,97	72,96
	With liquid glass	306,78	40,95	306,78	62,78	304,76	77,90	304,76	77,90

According to Table 5, the highest temperature value (383,80 °C) was observed in wood samples Scots pine treated with only vinegar. The lowest value (217,40 °C) was found in wood samples Scots pine treated with smoke tree+oak ash and liquid glass mixes. The CO reduction values given at Table 6.

Table 6. CO (ppm) values during combustion

Dye	Solution	Scots pine				Beech			
		Dipping Mean	St.dev.	Vacuum Mean	St.dev.	Dipping Mean	St.dev.	Vacuum Mean	St.dev.
Control	Without liquid glass	1052,62	64,56	1605,84	78,58	1270,53	85,50	2542,20	87,33
	With liquid glass	1444,18	70,30	2334,09	77,26	2065,44	65,78	2218,88	74,27
Oak ash	Without liquid glass	1824,46	85,14	1296,86	94,75	2416,17	93,23	3869,25	78,88
	With liquid glass	1167,03	92,43	873,58	44,11	1193,92	53,62	3572,57	80,48
Vinegar	Without liquid glass	1595,09	95,12	3995,38	89,05	1705,64	66,73	2536,17	79,19
	With liquid glass	1191,96	86,96	2069,45	71,10	695,65	68,46	2301,25	72,00
Smoke tree	Without liquid glass	1425,10	78,76	1648,90	95,11	2594,40	84,02	1869,13	76,36
	With liquid glass	681,77	55,96	1877,75	78,03	1908,23	74,85	1634,66	66,66
Smoke tree + oak ash	Without liquid glass	1422,23	76,54	1822,10	73,39	1773,98	80,83	1315,83	69,49
	With liquid glass	2359,08	85,98	556,53	82,86	1258,87	86,66	667,20	94,90
Smoke tree + vinegar	Without liquid glass	690,35	68,78	610,35	77,78	2563,47	94,42	2211,41	94,42
	With liquid glass	1430,66	79,89	1130,66	96,91	2896,00	72,77	2541,00	69,77

The highest value of CO concentration (3995,38 ppm) was observed in Scots pine wood samples of vinegar without liquid glass addition; the lowest value of CO concentration was determined in Scotch pine wood samples treated with smoke tree+oak ash with liquid glass addition (556,53 ppm).

Fire resistance properties of wood species treated with smoke tree, chemical free mordant mixes and liquid glass additive extracts were studied. Extracts were showed some fire resistance. Unfortunately, these performances are not enough to retard the fire effect on the wood materials.

Nowadays, the importance given to health increases and environment, it is obvious that the use of natural-colorant and preservation materials for wood surfaces are necessary. The results showed that; smoke tree has well potential to color the wood material, but unfortunately test performances are not enough to retard the fire effect on the wood materials. Eco-friendly smoke tree colorant maybe uses in places where protection against fire is not desired, instead of synthetic paints.

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Therapeutic Power of Natural Areas

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Abstract: The Today's living conditions cause people to live under intense stress. This intense stress creates many negative effects on people in terms of physical, psychological and behavioral and triggers serious diseases. Many studies have shown that nature has many positive effects on people such as reducing stress hormones and relaxing. In this study, the negative effects of stress on human and the positive effects of nature on stress will be determined and the rehabilitating characteristics of natural areas on humans will be revealed. In addition, the characteristics of the therapeutic areas will be determined. In order to reveal the healing properties of natural areas, these areas have been investigated under three headings of Experiential Qualities: Sensory Stimulation, Movement and Control. The result shows how the landscape characteristics of the therapy provider areas should be. Therefore, it is important that not only to consider these areas as green areas but also taking them into account as therapeutic open area units when designing the open-green areas. When designing this type of areas, it is very important to pay attention to these criteria to increase their therapeutic effects.

Keywords: Natural Area, Therapeutic Effects, Healing Garden, Therapeutic Landscape

1.INTRODUCTION

There is a common fact about natural spaces have relaxing and soothing effects on people but how are these spaces relaxing, soothing, providing to feel ourselves more youthful and getting away us from psychological problems and stress? Most of us don't know the answers of these questions exactly. Although there are plenty of studies about natural areas in which their visual values are assessed, the studies about rehabilitative features of them have small amounts. However, the need of therapy providing areas increases nowadays as a result of intense living conditions.

Benefiting from nature and especially one of its parts open green spaces are a requirement for modern men. The importance of open green spaces which are in and need to be in urban areas is quiet great in terms of urban health and people health. The concept of naturalness- nature is lifeblood and always thought with human. Most of researches Ulrich (1992), Kaplan and Kaplan (1989), Lewis (1994) and others found out that being close to natural areas is quite significant. People need designed natural areas for staying away from stress and therapeutic aims (Kaplan, 1992). As a result of human's split from his natural environment and sense of belonging to nature atrophy, city dwellers have been living more aggressive, unhappy and introverted by losing their natural behaviours. In contrast, watching to nature or being part with nature and nature districts actively or inactively decreases the daily stresses of life.

Stress affects people physically and psychologically negative and shows itself as nervousness, fear and anger (Ulrich, 1991). Living under pressure and anxiety is an uncontrollable process. When the amount of stress hormone rises in blood, digestion, blood pressure, tension and breathing are affected negatively. This causes sleeping and resting problems (Ulrich, 1981;1991;1993; Marcus and Barnes, 1999; Marcus, 2000). Intense, permanent and long- term stress makes quite important responses. Long- term stress causes to trigger and aggravate serious sicknesses. While measured negative psychological symptoms of stress show itself as high heart beat, high blood pressure and high tension, behavioural symptoms are retreat, abstinence, alcohol and cigarette use and difficulties in detecting events. Nature is seen as healing and health- giving by most of adults in their daily lives. Nature displays being features of gaining experience, detecting and understanding physical environment and being food resource.

In this study, the negative effects of stress on human and the positive effects of nature on stress will be determined and the rehabilitating characteristics of natural areas on humans will be revealed. In addition, the characteristics of the therapeutic areas will be determined.

Positive Effects of Nature Areas on People

Studies about positive effects of nature on human psychology had a growing trend in last 3 decades. One of the first accepted examples of these kinds of studies investigates the psychological benefits of residential gardens (Kaplan, 1973). Ulrich, (1979) presented the effects of visual landscape on stressful students' emotional situations who took their final exam, stress decreases on students who watch the natural scenes and stress increases on students who watch urban scenes after exam is observed as a result of the study.

Researchers have been mentioned the power of naturalness as healing and soothing factor since 1983. After one year, Ulrich (1984) and Kaplan (2001) found out that even looking out the window to natural and open green spaces has positive effects on patients in addition to this Bowers (2003) discussed the role of looking out the window for understanding the time of the day and the season by patients is important. Ulrich (1984) investigated the positive effect of therapy gardens on two groups who got the same surgery and emphasized their healing processes show noticeable change according to rooms' positions. Moreover, in another study of the author in 1991, differences in levels of stress between individuals exposed urban areas and natural areas were asserted and in 1992 the effects of a design on individuals' well-being were determined. Furthermore, Ulrich et al., (1993) made a contrast amongst rooms in which landscape pictures exist or not and attained similar results. Hartig et al., (1991) presented relatively more strong evidences on touching to nature decreases mental tiredness. In that study, a comparison between three groups, which include holidaymakers going to natural areas and urban areas for vacation and non-holidaymakers, was made, finding mistakes in a text was asked to each group and consequently holidaymakers going to natural areas got the highest score. It is confirmed that nature scenery and noise are effective methods on pain control, decrease anxiety, provide relaxation during medical surgery and affect blood pressure and heart beat positively (Tse et al., 2002; Diette et al., 2003). Also, touching to nature cause to diminish stress, cholesterol, pain and staying in hospital (Ulrich, 1999). Patients looking to natural appearance roof instead of brick roof feel different pain levels (Diette et al., 2003). There are also studies about naturalness have confusing effects in positive aspect (Ulrich, 1991), decline anxiety and dissolve focusing to pain (Varni et al., 1996). Patients watching to natural scenery and spending time in well organised gardens feel less pain than patients taking strong painkillers like analgesics was found out in Ulrich's research in 1999. Rachel and Stephen Kaplan has been examining the psychological contributions of the relation between human and nature for more than 20 years in Michigan University and determined significant psychological benefits of garden. Restorative environments heal patients faster was found out in one of these researchers studies in 1990. Furthermore, naturalness alerts senses and this makes out restorative experiences and these experiences have healing roles on patients' recovery were reported in their book "The Experience of Nature: A Psychological Perspective" in 1989. Dannenmaier (1995) notifies that being close to nature decreases stress, causes positive attention dispersion, encourages social relations (communicate relatives and friends) and these environments provide sense control.

Healing Spaces and Properties

The meaning of "healing" is the development of health situation or individual's development by accepting his new conditions and also it is a useful process named feeling good by self-knowledge in most times. In addition to this, Ulrich (1999) specifies that gardens which provide useful effects to people can be taken into account as healing areas. These areas provide to users being aware of seasons, making exercises by walking through pathways, developing individual and social behaviours, noticing nature and perceiving the passage of time, benefiting from the valuable effects of outdoor spaces with sensory signals and connecting to life.

Healing gardens are passive or semi-passive activity providing open areas which causes physical relaxing, stress decrease, well-being enhancement, memory regeneration, physical movement and motivation enhancement (Elings, 2006). These activities are observation, relaxing, strolling, visiting, sitting, and feeling the space... etc. (Marcus and Barnes, 1999).

An environment easy on the eye can cause an appealing spatial behaviour to people the other way round can cause off-putting behaviours. When people don't feel relax themselves in a space, they won't spend so much time in there and their perception and movement performances will decrease.

Art studies (sculpture, seating walls...), acoustic experiences (music, water, leaves' noise...), water flow, natural light, material, plant species and green area, animals, feeling the clean air, sun light, breeze, closure sense of natural and artificial elements and multi sensory stimulation are the elements providing relaxation and visual attention. Natural areas could be healing and therapeutic thanks to their diverse features. Spending time in open air, feeling sun light, watching trees and flowers, hearing water and bird noises, realizing garden components which embellish the space in natural or naturelike areas cause stress reducing effects on people. Space has positive effects on people until it provides seasonally blooming plant species, attractive birds and butterflies, moving leaves with breeze, outstanding and diverse plant materials which attract wildlife, stabile and active water which is visual as well as auditory, sculptures and other design elements (Marcus, 2001).

If a place creates positive effects on individuals (gaining health, connecting to life, giving hope, avoiding negative thoughts, getting relaxation, inhibiting restraint, getting comfortable, providing new relations, amusing), it could be called as therapeutic. Stressful participants' blood pressure decreases and tension gets normal when they spend 4-6 minutes in natural areas is observed (Ulrich and Parsons, 1992). Moreover, these kinds of areas creates good mood. On the other hand, studies taken account with healthy people show that natural areas or natural area simulations have significant

psychological restorative effects within 3-5 minutes in terms of visuality (Hartig et al., 1995; Fredricksan and Levenson, 1998; Parsons and Hartig, 2000). Ulrich also has many other studies which demonstrate that spending time in nature brings positive senses (Ulrich, 1981, 1984, 1992, 2000).

The Determination of Restorative Experiential Qualities in Natural Areas

Therapy providing spaces should have 3 empirical qualities. These are sensory stimulation, movement and control.

Sensory Stimulation: Natural areas designed for providing therapy should be far from monotony and support multi sensory stimulations (Brawley, 1992; Ghose, 1999). Getting away from monotony is available for all recourse values (water component, morphology of the land, green space, plat composition, rocky area... etc.) (Table 1). The more sensory stimulation in an area, the more attractiveness and as a result people become distant from their stress and nuisance. Sensory stimulation is created by making up differences in similarities and addressing senses. Lack of emotion reduces mental activities. (Kaplan, 1992).

Table 1. Components Providing Sensory Stimulation in Open Space Therapy

Related to visuality	Water surface and flow Characteristic features of plant species Different branching, flower, fruit, leaf, colour, form, texture, line features, seasonal variation Lighting (voltage diversity)
Related to audition	Acoustic experiences Music, water splash, leaf rustle, bird and insect voice, wind noise.
Related to smelling	Fragrant species Aromatic leafs Soil smell
Related to touching	Species showing different textures Trachea, Smoothness, imparipinnate, softness Architectural elements showing different textures Wall, pavement, kerb, railing materials
Related to taste	Regenerative feature of some plants

Movement: Movement can simply be defined as using major muscle groups by making exercise or moving in a site. Activating the body and making exercises occur by using muscles. Marcus and Barnes (1999) demonstrate that making exercise reduces anxiety and depression, helps to keep stress under control.

Control: Simple meaning is choice. It could be defined as ability of activity choice. Security, privacy, social activity, play and movement opportunities of a site provide therapy features.

Therapeutic areas giving power to people should contain place diversity and a green-intensive feature by taking the type of plants to be used in these areas into consideration. Providing diversity in the area provides the user with the chance to choose and encourages him/her to use the area. This kind of area lowers the level of stress as it increases the sense of self-guidance. While these types of open-green areas provide activity diversity, it is necessary to pay attention to use of sensuous elements. When doing this, using natural elements and minimizing artificiality make positive contributions to the therapeutic effect of the area. Areas used by individuals must accommodate staying alone and thinking to empower the individual to get rid of his/her problems by means of environmental factors while areas particularly designed for common use shall provide an opportunity for socialization. When you want to convert a field to an therapeutic area landscape features that must be fulfilled are summarized in Table 2.

Table 2. Recommended Landscape Design Features for therapeutic effect (Sakıcı, 2009)

Negative Feature	instead	Positive Feature
Confusing Design		Being plain, simple and clear (Bentley et al., 1985; Marcus, 2001)
Strait, hard, linear, regular lines		Rounded, curvilinear, arched lines (Wohlwill, 1983; Carpmann and Grant, 1993; Barnhart et al., 1998; Whitehouse, 1999)
Instead of always being open and distinguishable		Creating close, secret, secure private spaces for users who can stand (Appleton, 1990; Whitehouse, 1999)
Sharp sudden transitions		Smooth transitions (Wohlwill, 1983; Barnhart et al., 1998; Whitehouse, 1999)
Having same characteristics		Landmarks, space diversity, creating mystery (Bentley et al., 1985; Ulrich and Gilpin, 2003; Bowers, 2003)
Monotonous organizations		Systematic and well balanced organizations which show diversity (Wohlwill, 1983; Barnhart et al., 1998; Whitehouse, 1999)
Artificial elements		Natural elements (Wohlwill, 1983; Ulrich, 1991)
Even roads		Bumpy roads (Tyson, 1998; Rook et al., 2003)
Geometric forms		Organic (circular curved lines) (Carpman and Grant, 1993; Whitehouse, 1999)
NOISE		
Silent conditions		Acoustic experiences (music, water, birds, leaves) (Marcus, 2001)
TEXTURE		
Hard fabric		Smooth light fabric (Wohlwill, 1983; Whitehouse, 1999)
Regular smooth texture		Texture gradation, smoothness (Wohlwill, 1983)
LIGHTING		
High voltage		Diverse low voltage elements should be used (Rook et al., 2003)
COLOUR		
Single colour		Multiple colours in harmony or contrast (Whitehouse, 1999; Rook et al., 2003)
Darker tones		Lighter tones (Rook et al., 2003)
Bright colours		Compositions with cool colours (Rook et al., 2003)
Only cool or bright colour		Bright colour: Building entrances and actively used verandas Cool colours: anywhere in gardens (Tyson, 1998; Rook et al., 2003)

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Determination of Site Index with Growth Intercept Model in Brutian Pine (*Pinus brutia* Ten.)

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Abstract: Brutian pine (*Pinus brutia* Ten.) is an important tree species in our country. The reason is, brutian pine has the highest share in terms of supplying the needs of wood product of our country and expansion of growing brutian pine range. That is why we need to know *Pinus brutia* Ten. which shows expansion in different region-characteristic of brutian pine growth and yield in a correct way. The important point to determine the qualities of the growth and yield is indentify the growing crops strength that is also known as site index and habitat of the tree. With this study, site index table has been created thanks to reforestation in brutian pine stand in the region of Isparta and Burdur. During summer months of 2015-2016, it was taken 54 sample fields upon different age and class of site index to create site index table. 3 dominant or co-dominant trees cut at each sample field was measured up to rings of branches by taking into consideration annual height growth of the dominant or co-dominant tree. Regional site index table is created by using measured values and growth rate method of which the principles laid down by Nigh (1997). The yield strenght of habitat will be indentified more realistically by using site index tables on brutian pine forestation endemics.

Keywords: Plantations of brutian pine, site index, growth intercept model, branch ring.

1.INTRODUCTION

Brutian pine (*Pinus brutia* Ten.) is a pine native to the eastern Mediterranean region and an important tree species in Turkey where has a spreading area of 5.6 million hectares. It constitutes 25.1% of the forests in Turkey. Brutian pine stands meet an important part of the wood need in Turkey (Anonymous, 2015). During the past 50 years, over 0.7 million of hectares of brutian pine plantations which constituted 40.1 % total plantation area of the country have been established (Konukçu, 2001). Forests of brutian pine are found on different geological formations, parent material and soil types, in Turkey. The brutian pine plantations which fast growth will be harvested in the near and distant future, so it is becoming increasingly important to predict their growth and yield.

The different methods produce site index estimates that differ in accuracy (Philip, 1994; Avery and Burkhart, 2002; West, 2009). Three methods, which use ground collected data, produce site index estimates that are accurate enough for most silviculture and forest management purposes: i)Biogeoclimatic method where site index is predicted from the strata's biogeoclimatic ecosystem classification (usually subzone and site series); ii)Growth intercept method where site index is predicted from height and age of sample trees that are 3-30 years old; and iii)Site index curve method where site index is predicted from height and age of sample trees that are over 30 years old.

Growth intercept models are effective tools for estimating site index, particularly in juvenile stands. The growth intercept method predicts site index from height and age measurements taken on carefully selected sample trees (Nigh, 1997). This methods used for different species (Nigh, 1997; Nigh and Klinka, 2001; Mailly and Gaudreault, 2005; Kwiaton et al., 2011).

Currently, there is no reliablesite-quality, specifically GI or SI, evaluation tools available for brutian pine plantations in south Turkey. The objectives of this study were to develop height growth, SI, and associated variable GI models to provide forest managers the necessary tools to evaluate site quality of both mature and juvenile brutian pine plantations in south Turkey.

2.MATERIALS AND METHODS

Data Collection

In this study, 54 plots were located in the Bucak, Eğirdir and Burdur forest region. Plot measurements were taken on an 11.28 m radius plot, but the sample trees were selected from a 10.75 m radius plot to conform with the sampling standards for top height. Plot measurements included the diameter at breast height and species of all trees greater than 4 cm dbh. As well, a full ecological description of the plot was recorded, as were access notes (Nigh, 1997). Three sample trees in each plot were felled and their total height was measured. The height of the annual whorls, from the tip of the tree to as far down the stem as possible, were recorded.

Growth Intercept Modelling

In this study, the method used for growth intercept data analysis was similar to the one presented in Nigh (1997). The mean height growth was calculated by plot (Eq. 1). The site index was obtained by calculating the top height reached at 30 years of age taken at 1.3 m.

$$H_A = \frac{1}{3} \sum_{i=1}^3 h_{i,A} \quad (\text{Eq. 1})$$

In this equation, H_A = plot height (m) at breast height age A , $A=1, 2, 3, \dots$ (yrs), h_i, A = height (m) of tree i at A .

Growth intercepts were calculated by plot according to Eq. 2 for each 1.30 m age from 1 to 30.

$$GI_A = \frac{H_A - 1.3}{A - A_1} * 100 \quad (\text{Eq. 2})$$

In this equation GI_A =growth intercept (cm/yr) for $A=1, 2, \dots, 30$ (yrs), A_1 =proportion of height growth that occurred below breast height (Eq. 3). A_1 was always 0.5.

$$A_1 = \frac{1.3 - H_0}{H_1 - H_0} \quad (\text{Eq. 3})$$

A site index and growth intercepts for breast height ages one to 30 for each plot are available for further analysis. The growth intercept model is given in Eq. 4.

$$SI = b_0 + b_1 * (GI_A)^{b_2} \quad (\text{Eq. 4})$$

where SI is the estimated site index, GI_A is the growth intercept (cm/yr) for age A at reference height, b_0 is reference height (1.30 m) and b_1 and b_2 are model parameters.

The model described above are non-linear; therefore model fitting was carried out with non-linear regression (NLIN) procedure of SPSS statistical analysis software package. The initial values of parameters were obtained by starting the iterative procedure also used by other authors in similar studies (SPSS-Guide, 2010).

3.RESULTS AND DISCUSSION

Table 1 present the analysis results of Eq. 4 for ages 1 to 30 for brutian pine. The table includes the parameter estimates, standard error (Se), coefficient of determination (R^2) and the root mean square error (RMSE), which is a measure of model accuracy.

Table 1. Parameters values, standard error, root mean squared error, coefficient of determination for ages 1-30 at breast height.

Age	Parameter	Parameter value	Standard error (Se)	Coefficient of determination (R^2)	Root mean square error (RMSE)
1	β_1	1.84630	0.13722	0.202	2.69417
	β_2	0.16704	0.04707		
2	β_1	0.02106	0.20836	0.723	1.58637
	β_2	0.68711	0.06025		
3	β_1	-0.62449	0.16465	0.872	1.07831
	β_2	0.85389	0.04626		
4	β_1	-0.88612	0.12939	0.929	0.80143
	β_2	0.91997	0.03600		
5	β_1	-0.96959	0.11178	0.949	0.67990
	β_2	0.93910	0.03094		
6	β_1	-0.99739	0.09549	0.963	0.57905
	β_2	0.94225	0.02629		
7	β_1	-0.99877	0.08412	0.971	0.51303
	β_2	0.94055	0.02310		
8	β_1	-1.01903	0.07813	0.975	0.47469
	β_2	0.94461	0.02142		
9	β_1	-1.03038	0.07110	0.98	0.43142
	β_2	0.94565	0.01945		
10	β_1	-1.00066	0.07195	0.979	0.43961
	β_2	0.93579	0.01965		
11	β_1	-1.02177	0.06661	0.982	0.40553
	β_2	0.94084	0.01817		
12	β_1	-1.05112	0.06030	0.985	0.36441
	β_2	0.94810	0.01644		
13	β_1	-1.07725	0.05827	0.987	0.34949
	β_2	0.95514	0.01588		
14	β_1	-1.09798	0.05741	0.987	0.34232
	β_2	0.96072	0.01565		
15	β_1	-1.13012	0.05141	0.99	0.30406
	β_2	0.96961	0.01401		
16	β_1	-1.14255	0.04969	0.991	0.29302
	β_2	0.97275	0.01354		
17	β_1	-1.15722	0.04995	0.991	0.29323
	β_2	0.97715	0.01362		
18	β_1	-1.16828	0.05075	0.99	0.29680
	β_2	0.98050	0.01384		
19	β_1	-1.18113	0.04956	0.991	0.28883
	β_2	0.98406	0.01351		
20	β_1	-1.17629	0.04506	0.992	0.26305
	β_2	0.98299	0.01229		
21	β_1	-1.18629	0.04237	0.993	0.24672
	β_2	0.98597	0.01156		
22	β_1	-1.20376	0.03995	0.994	0.23150
	β_2	0.99088	0.01090		
23	β_1	-1.20868	0.03940	0.994	0.22791
	β_2	0.99236	0.01075		
24	β_1	-1.21570	0.03716	0.995	0.21465
	β_2	0.99464	0.01014		
25	β_1	-1.22095	0.03671	0.995	0.21180
	β_2	0.99629	0.01002		
26	β_1	-1.22170	0.03195	0.996	0.18435
	β_2	0.99685	0.00873		
27	β_1	-1.21534	0.02818	0.997	0.16293
	β_2	0.99528	0.00770		
28	β_1	-1.21547	0.02449	0.998	0.14168
	β_2	0.99633	0.00670		
29	β_1	-1.21406	0.01991	0.999	0.11532
	β_2	0.99665	0.00545		
30	β_1	-1.21360	0.01544	0.999	0.08954
	β_2	0.99763	0.00423		

According to Table 1, as age increases, R^2 increases, whereas standard error and root mean square error decrease. Using the coefficients of the equation, site index table is obtained. Site index table is presented as estimated site indices in Table 2.

Table 2. Estimated brutian pine site indices from the growth intercept model.

Age at dbh	Top height (m)								
	2	3	4	5	6	7	8	9	10
1	15.8								
2	15.6	27.6							
3	10.5	21.0	30.5						
4	7.8	16.0	23.8	31.3					
5	6.3	12.8	19.0	25.1	31.1				
6	5.4	10.7	15.8	20.8	25.7	30.5			
7	4.7	9.2	13.6	17.8	21.9	26.1	30.1		
8		8.2	12.0	15.6	19.3	22.9	26.4	30.0	
9		7.4	10.7	14.0	17.2	20.3	23.5	26.6	29.7
10		6.8	9.7	12.6	15.5	18.3	21.0	23.8	26.5
11		6.2	8.9	11.6	14.2	16.7	19.3	21.8	24.3
12		5.8	8.3	10.7	13.1	15.4	17.8	20.1	22.4
13		5.4	7.7	10.0	12.2	14.4	16.6	18.7	20.9
14		5.1	7.2	9.3	11.4	13.5	15.5	17.5	19.6
15			6.8	8.8	10.7	12.7	14.6	16.5	18.4
16			6.4	8.3	10.1	11.9	13.7	15.5	17.3
17			6.1	7.9	9.6	11.3	13.0	14.7	16.4
18			5.8	7.5	9.1	10.8	12.4	14.0	15.6
19			5.6	7.2	8.7	10.3	11.8	13.3	14.9
20			5.4	6.9	8.3	9.8	11.3	12.7	14.2
21			5.2	6.6	8.0	9.4	10.8	12.2	13.6
22			5.0	6.3	7.7	9.0	10.4	11.7	13.0
23				6.1	7.4	8.7	10.0	11.2	12.5
24				5.9	7.1	8.4	9.6	10.8	12.1
25				5.7	6.9	8.1	9.3	10.5	11.6
26				5.5	6.7	7.8	9.0	10.1	11.2
27				5.4	6.5	7.6	8.7	9.8	10.9
28				5.3	6.3	7.4	8.4	9.5	10.6
29				5.1	6.2	7.2	8.2	9.2	10.3
30					6.0	7.0	8.0	9.0	10.0

Table 2. Continued

Age at dbh	Top height (m)									
	11	12	13	14	15	16	17	18	19	20
10	29.2									
11	26.7	29.2								
12	24.7	27.0	29.3							
13	23.0	25.2	27.3	29.4						
14	21.6	23.6	25.6	27.5	29.5					
15	20.3	22.2	24.1	26.0	27.9	29.8				
16	19.1	20.9	22.7	24.5	26.3	28.0	29.8			
17	18.1	19.8	21.5	23.2	24.9	26.6	28.3	29.9		
18	17.2	18.8	20.5	22.1	23.7	25.3	26.9	28.4	30.0	
19	16.4	17.9	19.5	21.0	22.5	24.0	25.6	27.1	28.6	
20	15.7	17.1	18.6	20.0	21.5	22.9	24.3	25.8	27.2	29.5
21	15.0	16.4	17.8	19.2	20.5	21.9	23.3	24.7	26.1	28.1
22	14.4	15.7	17.0	18.4	19.7	21.0	22.4	23.7	25.0	26.9
23	13.8	15.1	16.4	17.6	18.9	20.2	21.5	22.7	24.0	25.7
24	13.3	14.5	15.8	17.0	18.2	19.4	20.7	21.9	23.1	24.7
25	12.8	14.0	15.2	16.4	17.5	18.7	19.9	21.1	22.3	23.7
26	12.4	13.5	14.7	15.8	16.9	18.1	19.2	20.3	21.5	22.9
27	12.0	13.1	14.2	15.3	16.4	17.4	18.5	19.6	20.7	22.1
28	11.6	12.7	13.7	14.8	15.9	16.9	18.0	19.0	20.1	21.3
29	11.3	12.3	13.3	14.4	15.4	16.4	17.4	18.5	19.5	20.6
30	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0

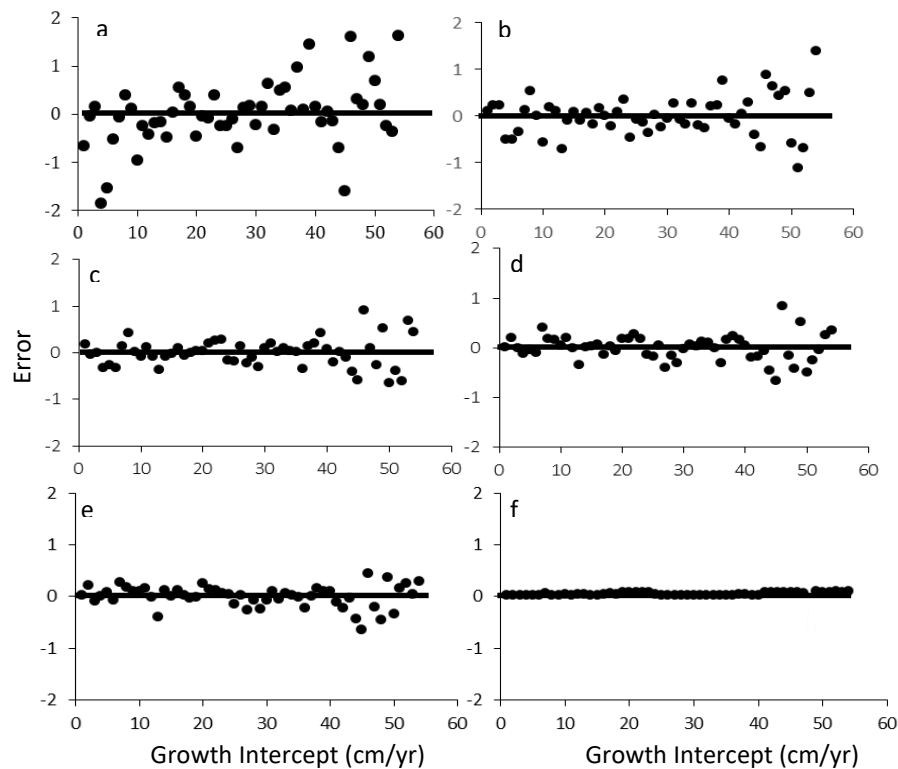


Figure 1. The error values of growth intercept models for 5 (a), 10 (b), 15 (c), 20 (d), 25 (e) and 30 (f) age groups

As the growth rate in each age group increases, the estimated errors increase (Figure 1a-f). However, as the age groups increases, the prediction error is obviously reduced. At the age of 30, the estimated amount of error falls well (Figure 1f). For each sample area, the difference between the predicted value of site index and site index value of Usta (1991) is compared with the paired t-test. The comparison result is obtained as t-value 13.338. According to this value, both tables are different at 99.9% confidence level. It was obtained mean site index value 17.562 ± 0.81 in this study. Site index mean for Usta (1991) was fixed 14.907 ± 0.64 .

This study produced a growth intercept model for brutian pine in South Turkey. The root mean square error, which is one measure of how well a model performs, indicates that the brutia pine growth intercept model provides accurate site index estimates. This model is presented in Table 1 as a series of functions, one for each breast height age between one and 30. The results are also presented as estimated site indices in Table 2. This table assumes that the height of the tree was 1.30 m (breast height) exactly midway between breast height age zero and one.

Brutian pine site index can be estimated with the growth intercept method when the sample trees are between breast height age zero and 30. These tables can be used with adequate accuracy in determining the site index for the brutian pine stands.

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Investigation of the Effects of Production and Transport Activities in Forestry on Water and Wetlands

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Abstract: Forested wetlands provide and reserve a significant portion of utilizable and quality water in all over the world. Water quality and productivity in forest areas is approximately six times higher than the water quality and in non-forested areas. As a big part of efficient and quality water in the world come from forestry areas, it is very importance to protect and / or improve the water productivity and water quality of forested basins and to provide erosion - avalanche measures in these areas. Within the scope of the study, the possible effects of the production and transportation activities in forestry on the productivity and quality of in-forest water areas are emphasized and measures to be taken in order to protect wetlands and increase water quality have been examined.

Keywords: Production in forestry, Forest transport, Wetlands, Water quality

1.INTRODUCTION

Facing the rapidly increasing water demand in the 21st century, the gradual reduction of water resources as a result of global warming and misuse carried the water in the first place on the international agenda. (Aküzüm and Çakmak 2010).

One of the most important natural resources bearing economic value on earth is undoubtedly natural forests.

Generally, the main product of forests in forestry terminology is considered wood. Today, however, forests have come to the forefront with the functional benefits they provide (water production, fresh air, recreation, soil conservation, etc.) (Asan and Şengönül 1987). In general, high altitude regions and mountainous regions constitute the main water production areas. Due to the many reasons that have been effective from the storage conditions to the quality of the water, the upper basins are the main water production areas all over the world. The dominant vegetation of these areas is generally forests. For this reason, the forests have an important influence concerning the rainfall that reaches the earth into the soil, infiltrating into the soil (Şengönül 1997).

Waters that are targeted by near-forest forest management, where pollutants such as chemical fertilization and harmful chemical reactions are not used, biological and mechanical struggle is done instead, erosion is prevented and the amount of sediment is minimized is coming from the forests. Micro organisms that clean and improve water provide the best nutrition and settlement environment for forest ecosystems (Tuncer and Kaya 2010).

The vegetation material covering the surface of the earth, whether it is forest or herbaceous vegetation, plays an important role in the natural balance between soil, vegetation and water. Numerous researches have shown that a good layer of dead cover covering the soil surface both causes the soil surface to retain its structure and this dead cover layer has a very high water retention capacity resulting in a decrease in superficial flow while infiltration increases the amount of water entering the soil . It is also known that this dead cover has made a filter effect that enhances the water quality (Asan and Şengönül 1987).

Forest wetlands are available all over the world and provide and maintain a significant portion of quality water. Water quality and productivity in forested areas is about six times higher than water quality and productivity in forested areas.. Because it is a fact that the forests are more upland and the forests are here because of the precipitation and more rainfall due to the topographical topography. Since most of the world 's fertile and high quality waters have passed through forest areas, it is very important to protect and / or improve the water quality, water quality, and erosion - avalanche precautions in the forest basins.

Within the scope of the study, the possible effects of the production and transportation activities in forestry on the productivity and quality of in-forest water areas are emphasized and measures to be taken in order to protect wetlands and increase water quality have been examined.

Possible Effects on the Water Quality of the Production and Transport Activities in Forestry

The amount of suspended sediment in the water areas rises after the construction or maintenance of forest roads, which is an important facility for the production and transportation in forestry, and the ambient temperature increases after the activities. This affects water quality in the negative direction and causes a decrease in water quantity.

Unplanned and sloppy forest road construction and maintenance studies significantly increase the amount of erosion in forest areas. In addition, the use of heavy equipment in the construction and maintenance of forest roads significantly increases the amount of sediment in the water areas due to surface runoffs on the ground and affects water quality and biological activities in wetlands negatively

The bottom roots of the trees cut with production studies are weakening with time, and movement of the soil increases. The transported soil reaches the rivers and water resources. Thus sediment concentration increases, can cause change of the water flow direction and water floods.

Again, as a result of the cutting activities, the decrease of the forest cover and the increase of the environment and the water temperature affect the fish population negatively.

The production residues remaining in the end area of the cut are also filled in the rivers, causing the edges to become corroded and become shallow.

2.RESULTS AND DISCUSSION

In order to protect water quality, forest roads which will cause least amount the formation of sedimentation should be planned and road density should be kept as low as possible. When a road network plan is made, it is important for erosion formation that avoiding steep slopes and paying attention to the drainage. Around the water resources located in the forest areas should be separated as a zone protection zone and activities such as terrace, machinery cleaning and tillage in the protection zone should be minimized. In the context of forestry activities, the use of appropriate methods and equipments will contribute to the increase of water yield and quality.

Cutting and transporting works should be planned to protect the creek bed and the shores. If possible, lane of untreated vegetation should be left a along the creek, the cut should be carried behind this lane, the logs should be transported from routes that is distant from stream, not from routes that are intersect from stream. The tree bodies and cutting debris that reached the creek bed should also be removed before time runs out.

Along the way all culverts road surfaces and supplies should be cleaned before and during the rainy season. The roads made for temporary use should be drained and reforested by the end of production. On such roads it is appropriate to make transverse earth bumps at frequent intervals to deflect the water to the sides. Where slope slopes are steep and the soil is more suitable for erosion, you should be careful not to set the shoveling section.

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Nanoencapsulation of Antimicrobials in Food Industry

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Abstract: Nanotechnology is defined as creation, utilization and manipulation of materials, devices or systems in the nanometer scale. Nowadays, researchers benefit from nanotechnology for many valuable applications allowing to create innovative food products and technologies. Nanoencapsulation is a novel technology to pack substances in miniature and refers to bioactive packing at the nanoscale range. Nanocapsules obtained from nanoencapsulation are colloidal sized particles with diameters varied from 10 to 1,000 nm. This novel technology provides the protection against adverse conditions and controlled release of bioactive compounds at the desired time and place. Nanoencapsulation applications in food industry involve the incorporation of bioactive materials, including food ingredients, vitamins, antioxidants, enzymes and slimming agents, in small capsules with submicron diameters. Similar to most bioactive compounds, antimicrobial agents may exhibit the interactions with the food ingredients and lose their activity. Nanoencapsulation of antimicrobial compounds represents numerous advantages for food industry such as enhancing bioavailability and solubilization, decreasing their volatility, increasing chemical and thermal stability, and controlling the delivery. Additionally, nanoencapsulation for delivery of preservatives in food has generally showed resistance to stress factors in comparison to the use of free antimicrobials. The high surface area to volume ratio of the nanoencapsulation systems can increase the concentration of the antimicrobials in food areas exposed to microbial contamination and improve passive cellular absorption mechanisms that could lead to higher antimicrobial activity. Recent studies detected that various nanocapsules were available to delivery antimicrobial substances such as antimicrobial peptides (bacteriocins, lactoferrin), plant-derived substances (essential oils, polyphenols, and isothiocyanates) and enzymes (lysozyme) against food spoilage and pathogenic microorganisms. However, researchers have mostly performed in vitro and so, additional studies for use of nanoencapsulated antimicrobial in real food products should be warranted. In the present review, we focused on applications related to nanoencapsulation of antimicrobials in food industry.

Keywords: nanoencapsulation, nanotechnology, antimicrobial

1. INTRODUCTION

Nanotechnology is defined as creation, utilization and manipulation of materials, devices or systems in the nanometer scale (smaller than 100 nm). The National Nanotechnology Initiative (Arlington, VA, USA) defines nanotechnology as ‘the understanding and control of matter at dimensions of roughly 1-100 nm, where unique phenomena enable novel applications’. Nanotechnology has potential applications in all aspects of food chain including storage, quality control, food processing and food packaging (Fathi et al., 2012). Nowadays, researchers benefit from nanotechnology for many valuable applications allowing to create innovative food products and technologies. The correct evaluation and management of food components at the nanometric scale is essential to the effective inclusion of this technology by the food industry (Lopes and Brandelli, 2017). As a matter of fact, the delivery of any bioactive to various sites is directly affected by particle size and thus nanoencapsulation has the potential to enhance bioavailability, improve controlled release and enable precision targeting of the bioactive compounds to a greater extent than microencapsulation-type delivery systems (Mozafari et al. 2006). Nanoencapsulation is a technique of enclosing substances in miniature and refers to bioactive packing at the nano-scale range (Ghahfarokhi et al., 2016; Ghayempour and Montazer, 2016). The reduction in particle size via nanoencapsulation increases the surface-to-volume ratio which enhances their reactivity and offers many advantages such as ease of handling, enhanced stability, protection against oxidation, retention of volatile ingredients, taste masking, moisture-triggered controlled release, pH-triggered controlled release, consecutive delivery of multiple active ingredients, change in flavor character, long lasting organoleptic perception, and enhanced bioavailability and efficacy (Prakash et al. 2018; Neethirajan and Javas, 2011). The focus of the present review will be exclusively on nanoencapsulation applications of antimicrobials in food industry.

Nanoencapsulation in Food Industry

Nanoencapsulation is a process that protect bioactive compounds (polyphenols, micronutrients, enzyme, antioxidants, and nutraceuticals) from adverse environment conditions such as food composition, oxidation, pH and enzymes degradation and provide controlled release at targeted sites (Fathi et al., 2012). Nanoencapsulation applications in food industry involve the incorporation of bioactive materials, including food ingredients, vitamins, antioxidants, enzymes and slimming agents, in small capsules with submicron diameters (Mozafari et al., 2006). Current researchers mostly focused

on the nanoencapsulation of antimicrobial essential oils dealing with micrometric size capsules, which are used for the protection of the active compounds against environmental factors (e.g. oxygen, light, moisture, pH) (Donsi et al., 2011).

Nanocapsules obtained from encapsulation are colloidal sized particles with diameters varied from 10 to 1,000 nm and also expressed as nanoparticles or nanospheres (Ezhilarasi et al., 2013). A nanosphere is a polymeric matrix where the actives may be absorbed at the sphere surface or encapsulated within the particle. A nano capsule is a vesicular system in which the active is confined to an inner liquid core (figure 1).

Various natural and synthetic polymers and organic materials are used as wall in nanocapsules. The natural polymers such as starch derivatives, maltodextrins, cellulosic materials, arabic gum, agar, alginate, chitosan, gellan gum and gelatine have a high potential for using in nanoencapsulation (Ghayempour and Montazer, 2016). Numerous techniques have been developed for nanocapsule production (Carvajal et al., 2010). These techniques are physical processes (spray drying-coating, extrusion, and spray drying), physicochemical processes (simple or complex coacervation and entrapment into liposomes) and chemical processes (interfacial polymerization and molecular inclusion) (Carvajal et al., 2010). The selection of the appropriate encapsulation technique based on physicochemical properties, the core and wall solubility, particle size, thickness, wall permeability, rate of core release, and economic issues (Ghayempour and Montazer, 2016; Ezhilarasi, et al., 2013). Therefore, before the formulation or synthesis of encapsulating material the factors viz., polarity of active compounds, solubility, volatility, availability and food matrix composition must be taken into consideration the functional performance of nanoparticle (Padilla et al., 2014; Prakash et al 2018).

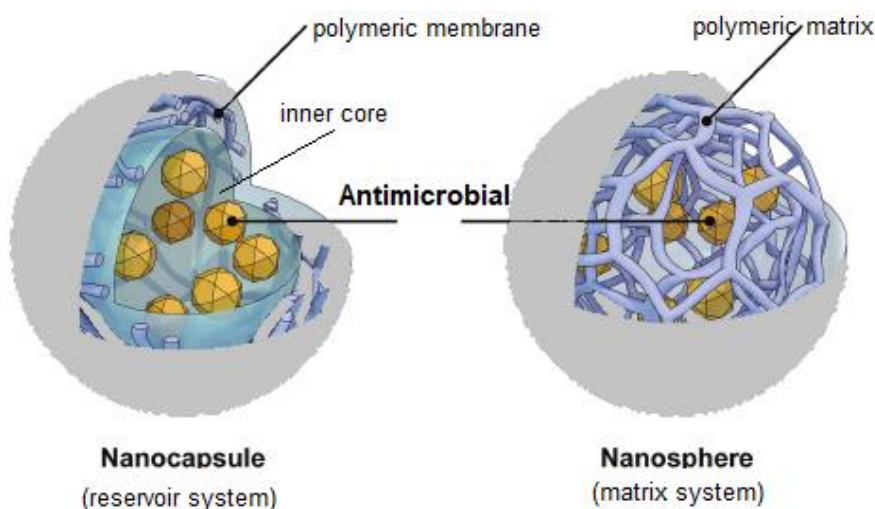


Figure 1. Structure of nanocapsule and nanosphere (modified from Suffredini, et al., 2014; Ezhilarasi et al., 2013).

Nanoencapsulation Applications of Antimicrobials in Food Industry

The use of nanocapsules is an interesting alternative to protect and delivery antimicrobials in food, also providing controlled release of natural compounds such as s antimicrobial peptides (bacteriocins, lactoferrin), plant-derived substances (essential oils, polyphenols, and isothiocyanates) and enzymes (lysozyme) (Lopes and Brandelli, 2017). While microencapsulation systems may guarantee protection of antimicrobial compounds against degradation or evaporation, the high surface area to volume ratio of the nanoencapsulation systems (systems in the nanometer scale, smaller than 100nm) can increase the concentration of the antimicrobials in specific food areas where microorganisms are preferably located and improve passive cellular absorption mechanisms that could lead to higher antimicrobial activity (Padilla et al. 2014).

Nanoencapsulation for delivery of preservatives in food has generally showed advantages in comparison to the use of free antimicrobials (Lopes and Brandelli, 2017). The direct introduction of free form of antimicrobials into food products instead of encapsulated form may led to loss of activity due to degradation and a possible interaction between different food components. Nanoencapsulation as a novel method overcome these limitations, which may improve the antimicrobial activity and stability of biopreservatives in complex systems (Ibarguren et al., 2014; Imran et al., 2015). A number of researches have been done to demonstrate the antimicrobial properties of the nanoencapsulated essential oils (Herculano et al., 2015). In spite of tremendous in vitro antimicrobial efficacy, most of the essential oils fail to exert their full preservative potential in food system due to some of the major intrinsic obstacle viz., low water solubility,

bioavailability, volatility, and stability. The use of nanomaterials as the delivery agent of essential oils represents a promising approach to improve the quality, safety and functionality of food products (Prakash et al. 2018).

Some applications of nanocapsules for delivery of antimicrobial substances are presented in Table 1.

Table 1. Some applications about antimicrobial nanoencapsulation

Nanoencapsulated antimicrobial	Applied samples	Target microorganisms	References
Thyme essential oil (TEO) loaded chitosan nanoparticles	Beef burgers	<i>Enterobacteriaceae</i> , <i>Staphylococcus aureus</i>	Ghahfarokhi et al., 2016
Eucalyptus staigeriana essential oil	In vitro	<i>S. Enteritidis</i> <i>Listeria monocytogenes</i>	Herculano et al., 2015
Thymus capitatus essential oil	In vitro	<i>Staphylococcus aureus</i> subsp. (ATCC 6538), <i>Bacillus licheniformis</i> (ATCC 8480) <i>Enterococcus hirae</i> (ATCC 10541), <i>Escherichia coli</i> (ATCC 8739), <i>Pseudomonas aeruginosa</i> (ATCC 9027).	Jemaa et al., 2018
Nisin	In vitro	<i>L. monocytogenes</i> <i>Lactobacillus plantarum</i>	Prombutara et al., 2012
Pediocin	In vitro	<i>Listeria innocua</i>	Mello et al., 2013
Antimicrobial enzyme lysostaphin	In vitro	<i>S. aureus</i>	Satishkumar and Vertegel, 2011
Bificin C6165	Apple juice	<i>Alicyclobacillus acidoterrestris</i>	Pei et al., 2014
Liposomes containing the antimicrobial peptide P34	Minas frescal cheese	<i>L. monocytogenes</i>	Malheiros et al., 2011
Phosphatidylcholine liposomes with bacteriocin	Goat milk	<i>L. monocytogenes</i>	Malheiros et al., 2016
Silver and Gold nanoparticles	In vitro	<i>S. aureus</i> and <i>P. aeruginosa</i>	Bindhu and Umadevi, 2014; Rai et al., 2015
Garlic extract with nisin	In vitro	<i>Listeria monocytogenes</i> , <i>Staphylococcus aureus</i> , <i>Escherichia coli</i> , and <i>Salmonella enterica</i> serotype Enteritidis	Pinilla and Brandelli, 2016
Cinnamaldehyde	Food packaging	<i>Escherichia coli</i> W1485 and <i>Bacillus cereus</i> ATCC 14579	Makwana et al., 2014
Thymol	Milk	<i>L. monocytogenes</i> Scott A	Pan et al., 2014
Guabiroba fruit phenolic extract	In vitro	<i>Listeria innocua</i>	Pereira et al. 2015 and 2018
Lime essential oil		<i>Staphylococcus aureus</i> , <i>Listeria monocytogenes</i> , <i>Shigella dysenteriae</i> , and <i>Escherichia coli</i>	Boyas et al. 2017

The use of nanocapsule is a useful alternative to protect and delivery antimicrobials in food, also providing controlled release of natural compounds such as bacteriocins and antimicrobial proteins, and also for delivery of plant derived antimicrobials. Most of the researchers proved that nanoencapsulated antimicrobials exhibit stronger inactivation effect on food spoilage and pathogenic microorganisms than their free form. However, studies have been mostly performed in vitro and so, additional studies for use of nanoencapsulated antimicrobial in real food products should be warranted.

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Application of Artificial Neural Networks to Food Technology

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Abstract: An artificial neural network (ANN) is a data processing system based on the structure of the biological neural simulation by learning from the data generated experimentally or using validated models. Artificial neural networks are a family of mathematical models that share among themselves the characteristics that their main algorithmic features are somewhat inspired by some issues of the functioning of the human brain. Artificial Neural Networks (ANNs) have been applied in almost every aspect of food science over the past two decades, although most applications are in the development stage. ANNs are useful tools for food safety and quality analyses, which include modeling of microbial growth and from this predicting food safety, interpreting spectroscopic data, and predicting physical, chemical, functional and sensory properties of various food products during processing and distribution. ANNs hold a great deal of promise for modeling complex tasks in process control and simulation and in applications of machine perception, including machine vision and electronic nose for food safety and quality control. However, compared to other areas, the diffusion of computational models based on neural networks for food analysis is still at a relatively early stage of development, so that on one hand many researchers either do not know about the existence of the technique or ignore its potential for solving food control-related problems, while on the other hand one can find in the literature examples of the misuse of ANNs due to an inadequate knowledge of their principles.

Therefore, the aim of this review is to critically discuss the possibility of applying artificial neural networks for food analysis and technology, by presenting a general introduction to the technique, a description of the main typologies of problems encountered in the field.

Keywords: Artificial Neural Networks, Food, Technology

1. INTRODUCTION

Since the creation of human beings, there has been a learning need that exists in itself, it has revealed the need to imitate nature, and much knowledge has been learned through natural imitation. The studies that scientists have done on this ability to imitate is one of the factors that cause the world of science to improvement in this field. In this sense, many studies on the functioning and functional structure of the brain, taking into account the working principles of the human brain, are now the basis for the studies done in artificial intelligence (Chatterjee and Laudato, 1995).

The main aim of the problems solved by an artificial intelligence is to model the intelligence structure that the human being has innate and to provide some functions of artificial intelligence to computers and computer-controlled machines (Baş, 2006). It was aimed, with these studies, that computer and computer-controlled machines have some of their abilities, such as comprehension, generalization and learning from their previous knowledge. Artificial cell and network models have also been developed for accurate modeling of the whole structure and functions of the brain. This big interest in artificial intelligence, which started in the 1950s, has been increasing and has caused the same interest to be renewed and increased day by day. Thus, today's computers have a different field from classical algorithmic computation methods (Çanakçı and Hosoz, 2006).

The widely used fields of artificial intelligence technology are expert systems, fuzzy logic, genetic algorithm and artificial neural networks (Elmas, 2003). Artificial neural networks are systems that learn about the relationships between events from examples and decide on examples that they have never seen by using this information they have learned before (Öztemel 2006). The characteristic features of artificial neural networks can be summarized as follows:

1. Handles symbolic information instead of numerical information.
2. They solve problems by using intuitive and experiential approaches instead of solving problems by using specific algorithms.
3. They have the ability to process missing and unclear information.
4. They deal with problems that cannot be mathematically modeled with known techniques.
5. They have the ability to learn.
6. They can make mistakes (Sofu, 2006).

Artificial neural networks, which have a widespread usable area in almost all sciences today, have gained great importance, especially in medical, economic and engineering sciences. These developments have played an effective role

in finding an extensive usage area of artificial neural networks in today's technology. The aim of this review is to critically discuss the possibility of applying artificial neural networks for food analysis and technology, by presenting a general introduction to the technique, a description of the main typologies of problems encountered in the field.

Structural and Basic Components of Artificial Neural Networks

What distinguishes the brain and computers from each other in term of supremacy properties and the recent increase in the knowledge of the brain's working system has also increased the number of computer researchers working on modeling the human brain. The result of this approach, a mathematical model of the network structure formed by the nerve cells, which are the basic processor elements of the brain, has been trying to be obtained. Various artificial nerve cells and network models have been developed with the thought that the physical components must be modeled correctly in order to model all behaviors of the brain. Thus, "Artificial Neural Networks" (ANN) emerged as a working discipline different from the algorithmic computation methods of today's computers (Saraç, 2004). ANN is described as parallel elements, interrelated networks of simple elements and their hierarchical arrangements that aim to interact with real-life objects as in the biological nervous system (Taşgetiren, 2005).

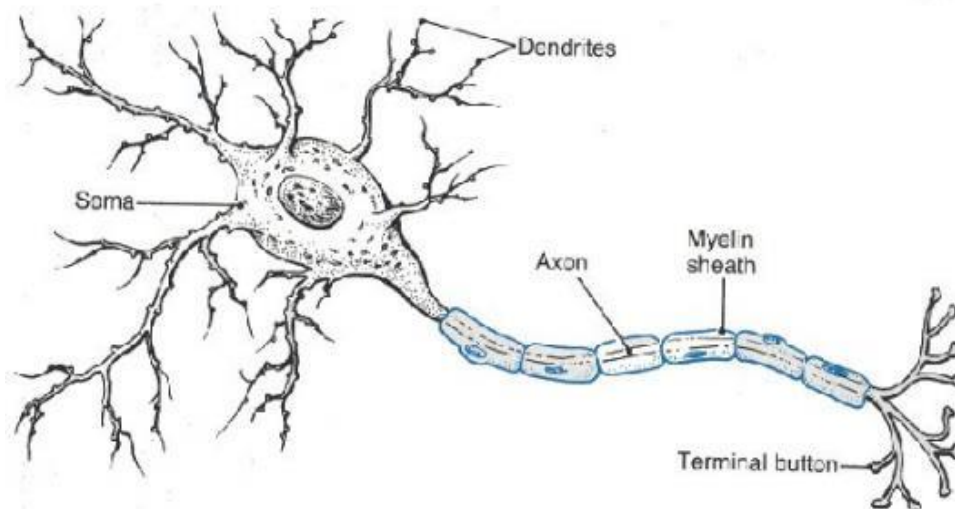


Figure 1. General image of a typical neuron

ANN is designed with inspiration from biological nerve cells. When researchers were considering network shape and algorithms they have investigated the organization of the brain. The artificial nerve cell is designed to mimic the input, processing, and output characteristics of the biological nerve cell (Figure 1). In ANN, each input is multiplied by its own weight, and all these multiples are summed up. This sum represents the level of activation of the nerve cell is used to determine. Figure 2 is shown this model.

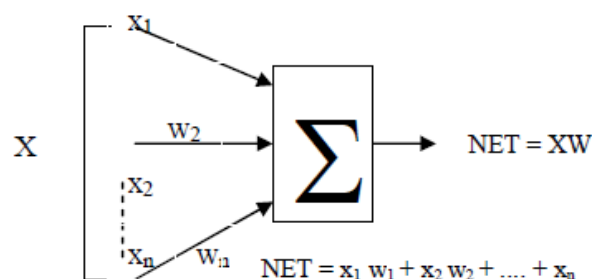


Figure 2. An example artificial nerve cell (Haykin, 1994)

Information processing in artificial neural networks takes place in the simple element called nerve cells. The signal from a nerve cell is transmitted through the connections that provide the connection between the nerve cells. Each link has a weight value, and these links provide an input transition by weighted according to input importance. A separate activation

function is applied to each nerve cell in the neural network (this function is usually a non-linear function) and the output value of this function is used to calculate the output signal of the nerve cell. Any ANN can be defined a model of the link between nerve cells, weights between connections (this calculation is also called a learning rule or learning algorithm) and activation function (Aydın, 2002).

ANN occurs artificial neural cells come together. The integration of nerve cells is not random. In general, the cells are in layers and come together in parallel in each layer to form the network. These layers:

·*Input Layer*: The artificial nerve cells in this layer are responsible for transferring information from the outside world to intermediate layers. In some networks, there is no information processing of the input layer.

·*Intermediate (hidden) layers*: The information from the input layer is processed and send it to the output layer. Processing of this information is performed in intermediate layers. There can be more than one middle layer of a network.

·*Output layer*: The artificial nerve cells in this layer generate output that should be generated for the input set (sample) presented from the input layer of the network of processing the information from the intermediate layer.

The output produced is sent to the outside world. The artificial nerve cells and interlayer relations in each of these three layers are shown in Figure 3. In the figure, the circles that stand parallel to each other on each layer show artificial nerve cells and the lines connecting these artificial nerve cells show the network connections. Artificial nerve cells and their connections constitute an ANN (Öztemel, 2003).

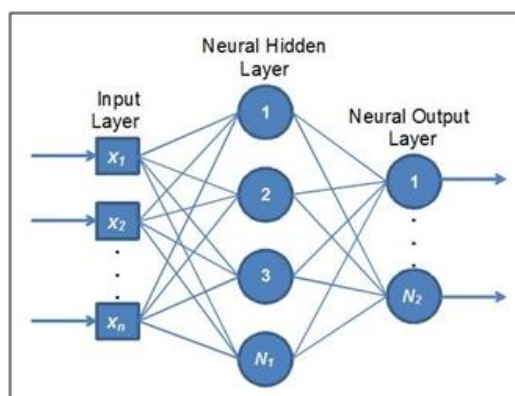


Figure 3. An example Artificial Neural Networks (ANN)

Applications of Artificial Neural Networks in The Field of Food Technology

Quality of food is the complex term and is assessed by a suitable combination of physical, chemical and organoleptic tests. Physical/chemical parameters - though convenient to measure - do not always have straightforward correlations with the sensory evaluation results. However, frequent sensory evaluation is restricted due to the availability of trained judges, and proper ambiance. Several investigators have attempted to apply ANN models for prediction of food properties, and changes during processing and storage of foods. Artificial Neural Networks (ANNs) have been applied in almost every aspect of food science over the past two decades, although most applications are in the development stage. ANNs are useful tools for food safety and quality analyses, which include modeling of microbial growth and from this predicting food safety, interpreting spectroscopic data, and predicting physical, chemical, functional and sensory properties of various food products during processing and distribution.

Some studies on the application of ANN in the literature in food technology can be summarized as follows; Biomass estimation with the artificial neural network in industrial baker's yeast fermentation (Karakuzu, 2003), parameter optimization for the drying of food and estimation of genetic algorithm and adaptive-network-based fuzzy conclusion implementation of the system (Erentürk and Erentürk, 2007), determination of sensory properties of fast foods (Sayeed et al., 1995), classification of all corn grains separated from broken ones (Liao et al., 1993), determination of rheological properties of dough (Ruan et al., 1995), estimation of pores during drying of foodstuffs, heat process evaluation in food products, visible porosity and heat transmittance estimation based on temperature and humidity content and the use of infrared spectrometry (NIRS) in yoghurt fermentation (Cimander et. al., 2002).

ANN has used some microbial studies such as determination of microbial growth (Jeyamkondan et al., 2001), estimation of the lifespan of *Listeria monocytogenes*, *Escherichia coli* O157: H7 prediction of situations of life-death and growth-non-growth, estimation of bacterial growth in frozen foods, estimation of bacterial populations by modeling of *Streptococcus salivarius subsp. thermophilus* and *Lactobacillus delbrueckii subsp. bulgaricus* growth (Sofu et. al.).

As a result, time-consuming operations in food technology can be reduced by using artificial intelligence applications such as classifications, estimations, modeling studies quickly and objectively. Because these applications are stable, effective and cost-effective, many processes can be automated that require high-cost workforce. Artificial intelligence applications including ANN are used successfully in many food industries. Artificial intelligence practices are the best way to define the pattern. Therefore, in the field of food science and technology in the future, it has the potential to be a means of solution in which confidence prediction and forecasting are performed as in other fields. However, compared to other areas, the diffusion of computational models based on neural networks for food analysis is still at a relatively early stage of development. So that, many researchers either do not know about the existence of the technique or ignore its potential for solving food control-related problems, while on the other hand, one can find in the literature examples of the misuse of ANNs due to an inadequate knowledge of their principles. As a result, it is necessary to reduce the probability of errors by increasing the number of studies performed to evaluate the data obtained in the food industry with ANN.

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Semantic Solutions and Security Challenges for the Internet of Things

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Abstract: In this work, an overview of IoT (Internet of Things) has been reviewed. Security issues related to the IoT distributed structure have been examined and information on solutions to these problems has been presented. IoT can be defined as a communication network where objects are connected to each other and to larger systems. IoT has also brought some problems. Within the OWASP (Open Web Application Security Project) Top 10 (2017 Released), IoT security issues can be listed as: 1)Injection 2)Broken Authentication 3)Sensitive Data Exposure 4)XML External Entities 5)Broken Access Control 6)Security Misconfiguration 7)Cross-Site Scripting 8)Insecure Deserialization 9)Using Components with Known Vulnerabilities 10)Insufficient Logging & Monitoring. As a solution to the challenges of IoT such as security, interconnection and interoperability using the service-oriented architectural approach, popular in recent years ontology-based access can be achieved by supporting semantic web technologies. The service oriented architecture approach for IoT frameworks is based on a layered structure. These layers can be listed as follows: Physical layer, information layer and functional layer. In the physical layer, device ontology is presented which represents things. The information layer contains ontologies belonging to the defined domain, including data and metadata about the information provided by things. The functional layer, which is the other layer, provides the ontology that is used by any intermediate software or application that requires IoT services provided by things. It aims to provide ontological demonstration interoperability of data, devices and services in IoT systems at semantic level and to create a reusable, shareable model in different applications. Thus, the application to be made with IoT or the hardware to be produced will be platform independent, making it easier to integrate with different platforms.

Keywords: Internet of Things, ontologies, semantic, services, security

1.INTRODUCTION

The Internet of Things (IoT) is a relatively new paradigm of increasing interest from both scientific and local communities. It consists of expanding the network into the real world by allowing physical objects to be connected. Through communication technologies, objects (such as sensors, actuators, RFID tags) can communicate with each other and with users in order to achieve common goals (Hellaoui vd., 2017). IoT has brought some problems with it. OWASP is a worldwide organization focused on improving software security. Its mission is to highlight software security so that individuals and organizations around the world can make informed decisions about real software security risks. The organization publishes the most familiar web application vulnerabilities to increase awareness of web application security. Table 1 shows the top 10 list of vulnerabilities in web applications (for 2017) (OWASP (2017)).

Table 1. OWASP Top 10 - 2017

Injection	Injection vulnerabilities are usually caused by the fact that the data received from the user, which is not controlled or taken as a precaution, is executed as a command or included in the query. SQL Injection and Command Injection are the most common types of injection, and the fact that neither user's data is checked nor filtered is not "sterilized".
Broken Authentication	The vulnerabilities of broken authentication are usually caused by incorrect implementation of authentication or session management functions. Attackers can seize passwords, session tokens. Attackers often make brute force to reveal their identity.
Sensitive Data Exposure	This kind of vulnerability arises when data is not encrypted or when encrypted data is used as old, default, unencrypted encryption algorithms. Credit card information, passwords, personal records, company documents and many other important information are required to be encrypted.
XML External Entities	This vulnerability stems from the old or incorrectly configured XML parser. An attacker could use this vulnerability to send a malicious XML file to the server to read the file, run code, and perform a dos (denial of service) attack.
Broken Access Control	These openings are caused by the fact that what users can do is not implemented properly. By using these vulnerabilities , attackers can access files that are not authorized, use functions that are not authorized, access other users' data or change the privileges.
Security Misconfiguration	Incorrect or incomplete service settings cause this kind of vulnerability to occur. According to owasp, the most common security vulnerability is security misconfiguration. If this service is disabled, any services that explicitly depend on it will fail to start.
Cross-Site Scripting	The result is that the data received from the user is sent as HTML response without being checked and filtered. Thanks to the XSS vulnerability, attackers can steal a user's session by running JavaScript in the user browser. XSS is a common weakness. An unchecked input can cause the entire application to take over.
Insecure Deserialization	This weakness is the result of unreliable malicious input/un deserialization from the user. This vulnerability could lead to denial of service attacks or remote code execution attacks. Therefore, data from the user needs to be checked.
Using Components with Known Vulnerabilities	This type of vulnerability is caused by the use of old and familiar versions of services, applications, add-ons. After attackers have found versions of these services, they can use familiar exploits to capture the application/server. This is a big risk.
Insufficient Logging & Monitoring	It is a great risk that there is not enough logging and monitoring. Entries, failed entry attempts, transfers and important actions should be logged and always checked and where appropriate, managers should be warned.

The inherent weaknesses of IoT objects and the strong linking of physical objects to the virtual world with intelligent objects. It can be deduced that the autonomy that objects perceive in their own environment and move them will lead to more perceptual and affectable attribution based on the cognitive and systemic approach (Sfar vd., 2017).

2.MATERIALS AND METHODS

The concept of the IoT, first mentioned in 1999, has now become real. At first, only Radio Frequency Identification (RFID) technology was used, but now many sensors, actuators and mobile devices have been used in this area. This diversity has also revealed some difficulties. These; difficulty in scaling, deep heterogeneity, unknown topological structure, missing or incorrect metadata, difficulty of conflict resolution. In order to overcome these difficulties, it was seen that the concept of ontology should be utilized and the concept of IoT ontologies emerged (Gubbi vd., 2013).

Ontology is defined as "a formal, explicit feature of a shared conceptualization" and is used to represent an on-the-ground knowledge as a set of interrelated concepts. There are four main components that make up an ontology. These; classes, relations, attributes and individuals (Uschold & Gruninger, 1996). The classes here are the basic concepts to be defined. Subclasses may also be used if necessary. Individuals are characteristics of classes. Relations are structures that connect all the components of the ontology.

Ontology-based objects have three basic layers: the physical layer, the information layer, and the functional layer. The physical layer contains the device ontology representing the objects. The information layer contains ontologies for the defined domain, including metadata and metadata about the information provided by the objects. The functional layer maintains the ontology used by any intermediate software or application that requires the IOT services provided by the objects. Here the physical layer is represented by device ontology. The information layer and the functional layer are represented by domain ontology and estimation ontology (Bajaj vd., 2017).

Device ontology, hardware devices that can be found in the network. It is a kind of device identification repository. The device ontology is shown in Figure 1. Ontology contains information about the actual location of the device, for example, regardless of device distributions. Instead, the distribution information is presented in the meta-data reported by the

devices during the reconnaissance recording. The ontology thus becomes easily pluggable with any intermediate software or application. IoT devices can be divided in four main classes within device ontology: sensor, actuator, processor, composite (Hachem vd., 2011).

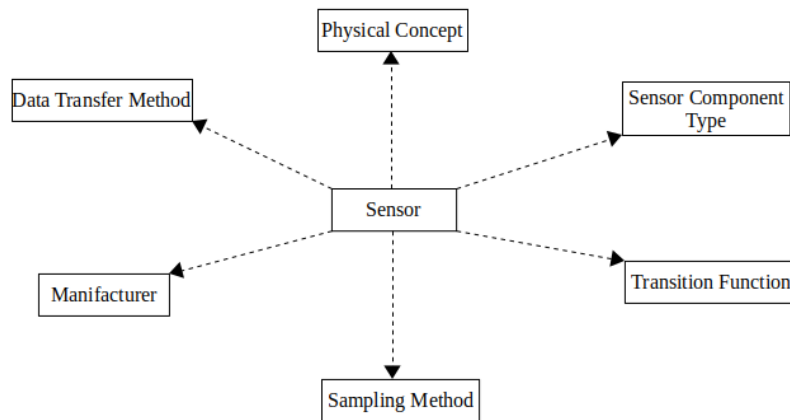


Fig. 1. Device Ontology

Domain ontology provides information on physical concepts in the real world and their interrelations (Hachem vd., 2011). It is intended that the domain ontology be conceptualizing a specific real world business area (Biletskiy vd., 2018). Domain ontology is created with two main goals: First one is model real world entities as physical concepts. Second one is they should model their mathematical formulas and functions as the first alternative to be used when any device can not provide the needed services. Domain ontology consists of five main classes. These are the following: physical concept, physical unit, mathematical datatype, formula and function (Hachem vd., 2011).

Estimation ontology is responsible for storing different mathematical models that form the mental toolbox carried by expert system designers in fields such as robotics, prediction, sensor networks. It regulates the storage and accessibility of these models. For this reason, the estimation ontology should provide a complex set of well-designed features for each model, as well as a complex relationship between models, devices, and physical concepts (Hachem vd., 2011). For example, an ontology can be used to estimate the construction costs to be made in a contract, independently of construction and contract. This is an example of an estimation ontology (Liu & Ma, 2015).

3.RESULTS AND DISCUSSION

Since IoT is still a new concept, some items have not yet become standardized. Now the security issue is one of them. There are two main reasons behind the difficulties in security of institutions that want to work with IoT. These are mainly the endpoint devices used for IOT can not protect themselves. Endpoints are still the weakest points of security systems. The other reason is the size of your scale. Industrial networks are large-scale networks that support tens of thousands of controllers, robots, machines, and applications built for other purposes. IoT solutions deployed in these networks must scale to hundreds of thousands of new sensors, devices, controllers, and non-IoT devices now and in the future. This support includes integration with interoperability, timing, workflow integration, data collection, analysis, decision making, production and business execution systems. It is a difficult task to combine semantic solutions with different aspects of the IoT. Semantic service oriented approach is a convenient solution for IoT that supports increased scalability and requires automated dynamic composition mechanisms.

IoT has started to take place quickly in our lives, but of course it has brought a number of problems, the top of which is security issues. In this study, the proposed Service-Oriented Architecture approach was investigated as a solution to the problems that are likely to occur in the iot field. The Service-Oriented Architecture approach is based on a layered structure. In this layer, the ontological representation of data, devices and services aims to provide a semantic level of interoperability and to create a reusable, shared model for different applications. This allows for easy integration of heterogeneous data and facilitates the ability to carry out reasoning over semantic data.

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Link Discovery with Skos on the Linked Open Data

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Abstract: Nowadays, resources in the web environment contain information in a non-dynamic form, and their availability and shareability is often difficult to efficiently combine by different computer systems. Information on the web can only be interpreted and understood by people. The semantic web, which is considered as the future of the web, provides a common model for reusing and sharing information. Linked Data, which is one of the important components of the semantic web, basically consists of linking the data in different sources in a way that makes semantic conclusions. One of the most important linked data application examples is the LOD (Linked Open Data) Project. This project aims to publish data clusters in RDF (Resource Description Framework) format and semantically associate these data clusters. The process of detecting links between data sets is known as link exploring. Data sets are heterogeneous in terms of dictionaries, formatting, and data representation. This link makes the exploring process much more complex. Determining whether two concepts from different sets of data express the same thing is an example of what is known as the concept resolution problem (ie, the detail information that can be read through). The purpose of this work is to provide data integration between different systems by exploring links between LOD resources such as FOAF (the Friend of a Friend), DBLP (Database Systems and Logic Programming) and SIOC (Semantically Interlinked Online Communities). In this way, special semantic links are defined and the usability of interlinked resources within the web is increased. FOAF defines the persons, the activities of the person and their links with other persons. SIOC aims the data of web-based community in any area is intended to be a connected entity. SIOC is considered as a mode of interacting with users with different web applications such as blogs, forums and mailing lists to easily access existing applications. The DBLP supports the full research of academic publications, the information of authors and co-authors in different researches, their information, journal articles, conference reports, editorial information and information of the different places in one place. The existing FOAF ontology has been expanded by adding new data type and object properties to the FOAF ontology for the DBLP values covered in the prototype work. The DBLP user profiles are defined after the result of the expansion of the FOAF ontology. For example; foaf:research_interest, foaf:teaching, foaf:conference_duties, foaf:publications, etc. SKOS (Simple Knowledge Organization System) is a common data model for semantic interoperability of concept diagrams in a semantic web environment. SKOS is expressed as RDF triples. Three SKOS Mapping features will be covered in this work. Three SKOS Mapping features will be handled in this work. These are skos:closeMatch, skos:exactMatch, and skos:relatedMatch. For example; dblp: publication skos:exactMatch foaf: publications. As a result, there is a mapping file in the result of SKOS mapping between concepts of data sources. This RDF-based file shows the concept features, semantic associations, and mapping properties required for mapping. This file can also be used as a mapping ontology. This ontology includes classes and features that specify the relationship between ontology concepts and properties.

Keywords: Semantic web, linked open data, ontology mapping, SKOS.

1.INTRODUCTION

Linked data is one of the approaches used to acquire a meaningful unity by combining data-related data collections by creating semantic links between the web pages that make up the content of the semantic web. In this way, a data layer based on interrelated data is formed on the basis of the relations between data and data (Bizer & Berners-Lee, 2009).

The following four steps are described as basic principles of linked data: (1) Resource Identifier (URI) is used in resource definition. An RDF expression is a data source defined by a URI. (2) The URI is used to describe things, i.e. resources. The data source can be accessed over HTTP. In the context of linked data, resources are often defined using HTTP URIs. (3) Exploiting RDF data sources using query standards is performed. Thus, semantic relationships between data are determined in the web environment. (4) Finally, it includes links to other URIs so that more resources can be discovered (Berners-Lee, 2006).

There is a need for a common data model for the sharing and semantic similarity of information systems in the semantic web environment. The Knowledge Organization System (SKOS) is a common data model (Gasevic & Hatala, 2006). SKOS is used as a common model accepted by W3C (World Wide Web Consortium) to provide semantic interoperability of concept diagrams in Semantic Web environment. Using SKOS; the information organization system can be expressed as data that machines can also understand (Miles & Brickley, 2005).

In this study, semantic data integration will be provided for academics and research authors based on the relationship between LOD data sets. Significant personal information is displayed using different data sets of Linked Open Data. This will bring a value to a semantic space and increase the visibility of the application areas according to traditional web applications.

2.MATERIALS AND METHODS

The use of ontologies within the academic field is increasing day by day. Some of the ontologies used in the mapping described in the study are listed below:

FOAF ontology: So a Friend of a Friend is a kind of ontology that describes relationships on the web with people, activities and other people and objects. A descriptive dictionary expressed in FOAF, RDF and OWL. Computers can extract and classify information from these profiles using FOAF profiles.

SIOC: The web-based community in any area is intended to be linked to information. SIOC is considered as a mode of interacting with users with different web applications such as blogs, forums and mailing lists to easily access existing applications. Due to the mappings between FOAF and SIOC, it can be regarded as LOD.

DBLP: Supports the knowledge of the authors and co-authors involved in different researches on academic research, information on them, journal articles, conference reports, editorial information and information of the different places in one place.

SKOS: A common data model for sharing and connecting information in the semantic web environment. It will make it easier to find and access the data in different environments, thereby contributing to resource discovery.

As application area; the web page for the conference organized for the purpose of examining the use of social media on authors is examined. The authors participating in the conference are represented by a hierarchical structure associated with linked data sources. It is possible to classify authors into four different categories in the field of information technologies. a) personal b) professional c) academicians and d) academic studies of authors.

All features of an author are collected and obtained in the FOAF ontology. When someone's name appears on the DBLP website, it provides a bridge with the author page of that person. Here is a list of all the publications of this person. The dblp website hosts publication stream pages. The publication stream page summarizes the transaction value of a conference series. A publication stream contains links to pages, journals, or proceedings content tables. The bibliographic information on the proceedings and authors' web pages can be integrated into a publication stream, publication stream page. Establishing a connection with FOAF and SIOC also provides a model for the federation of identity on the web. Different web sites may have different user profiles (shown as sioc:user example), all of which are related to the same physical person (foaf:person). By using relationships, all social media contributions of a particular physical person can be modeled with a single global RDF data graph, which provides a model for interoperability and portability of social data between services. As a result, there is a connection between the properties of an author.

In this study, it is mentioned how people participating in a symposium in the DBLP dataset in the semantic web environment can be done with the information hierarchy of the information mapping model. For this purpose, an ontology based approach is proposed in the access to information.

The SKOS data model demonstrates an information organization system as a conceptual diagram of a set of concepts. Semantic relationships between concepts can be part of a concept diagram (Salvador & Elena, 2006). SKOS concept diagrams and SKOS concepts are defined using URIs. Semantic relations can be defined between SKOS concepts. While the relations between two concepts on the same concept diagram are expressed as semantic relations, the relation between two concepts in different concept schemes is expressed as semantic mapping (Miles & Bechhofer, 2009). In this study, the relations between concepts in different concept schemes are based on semantic mapping. The following SKOS features are used to show semantic relationships between concepts. (Cantara & Library, 2006).

SKOS:related provides the representation of relational (non-hierarchical) links, such as the relationship between an event type and an entity category that usually joins it. *SKOS:closeMatch* claim indicates that the two concepts are so similar that they can be used in place of the two concept schemas they belong to. *SKOS:exactMatch* concepts are used to link two concepts, showing high degree of trust that can be used instead of each other among a wide variety of information retrieval applications. Using the SKOS mapping features, the LOD ontology concepts can be linked to each other as follows:

As a DBLP user, foaf:person can be thought of as a subclass. In addition, sioc:account is shown as a subclass of foaf:onlineAccount. For this reason, the *skos:relatedMatch* relationship can be used to link the person to the sioc account. A relationship *skos:relatedMatch* can be established between sioc:user and foaf:person.

The names of the authors participating in the symposium in the DBLP ontology are related to the FOAF ontology. A relationship *skos:closeMatch* can be established between dblp: articleAuthors and foaf:authorName.

A *skos:exactMatch* relationship can be established between dblp:researcher in the Dblp ontology and foaf:person. foaf:publications, a link to the publications of this person. dblp:publication describing scientific publications in the dblp ontology. Therefore, as a different example of this relationship can be given as to the relationship between dblp:publication and foaf:publications.

3.RESULTS AND DISCUSSION

The role of the social line in moving from Web 2.0 to Web 3.0 is very important. Because the goal is no longer to develop dynamic web pages that only interact with the user in real time. It is also important to give meaning to this content. Things began to gain importance, such as what is 'what' the content is shared on a web page, what it is about or who it is, what it means to link to other web pages. Because now the network must be made semantically processable. This may be possible to describe the content in our web pages with the above mentioned metadata such as FOAF, DBLP, SOIC and RDF, and their implementations.

An ontology based approach has been proposed for ensuring the semantic profile in social network sites. The proposed semantic model is an extension of the FOAF, SIOC and DBLP ontologies, using relationships between concepts and concepts related to academics and researchers, such as conferences and relationships among authors.

SKOS mapping features are used to show the relationships of LOD data sources such as FOAF, DBLP and SIOC to each other. SNOMED CT aims to encode any medical concept. Many data element instances are defined in LOD data sources. There are many common concepts in data sources. Among these concepts, conceptual based mapping defined by ontologies is targeted. The use of SKOS in accordance with this aim is one of the important advantages of the process required to develop a mapping ontology. The mapping ontology allows searching for data sources by providing the availability of external data sources.

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Anesthesia Practice in Sheep and Goats

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Abstract: In this study, it was aimed to give information about the practice of the anesthesia in sheep and goats. Although sheep and goats are evaluated together in terms of anesthesia, the levels of anesthetic response of these species are different. The risk of developing ventricular fibrillation due to shock and catecholamines (adrenaline, noradrenaline) release is high in goats who are quite sensitive to pain. Sometimes suddenly death can occur after surgery. For this reason, these losses can be prevented by appropriate anesthesia and analgesia. General anesthesia in sheep is not economical. Many surgical procedures can easily be done by local or regional anesthesia since normally the sheep can be captured more easily due to their physical structure. In some complex cases, however, general anesthesia especially in stud rams and precious sheep may be needed. However, although it is not economical, it is very important to apply general anesthesia in terms of animal welfare and ethical situations. In sheep and goats, general anesthesia is basically similar to cattle. There are no specific tools and equipment specific to general anesthesia, because these are not economical in sheep and goats. For this reason, equipments used for general anesthesia in pet animals can be used easily by considering the special needs of sheep and goats. Although there is no license in some anesthetic drugs commonly used for anesthesia for use in sheep and especially goats, their use are recommended depending on its clinical experience.

Keywords: Anesthesia, sheep, goat, practice, complication

1. INTRODUCTION

Anesthetic and analgesic techniques are required when specific diagnostic procedures and painful surgery are to be performed. Except that improving animal welfare standards, anesthesia and analgesia are important to facilitate procedures and improve both animal and personnel safety. A variety of techniques can be used to anesthetize and restrain sheep and goats safely and humanely both in the clinic and in the field. Although sheep and goats are evaluated together in terms of anesthesia, the levels of anesthetic response of these species are different. Sheep and goats are adept at masking illness, as are many of the prey animals, and can be sick without showing clinical signs. Therefore, a good physical exam is of utmost importance. The doses of most of the anesthetic drugs are also very different from other species. The risk of developing ventricular fibrillation due to shock and catecholamines (adrenaline, noradrenaline) release is high in goats who are quite sensitive to pain. Sometimes suddenly death can occur after surgery. For this reason, these losses can be prevented by appropriate anesthesia and analgesia.

General anesthesia in sheep is not economical. Many surgical procedures can easily be done by local or regional anesthesia since normally the sheep can be restrained more easily due to their physical structure. In some complex cases, however, general anesthesia especially in stud rams and precious sheep may be needed. Although it is not economical, general anesthesia in terms of animal welfare and ethical situations is very important. In sheep and goats, general anesthesia is basically similar to cattle. There are no specific tools and equipment specific to general anesthesia, because these are not economical in sheep and goats. For this reason, equipment used for general anesthesia in pet animals can be used easily considering the special needs of sheep and goats. This review provides an overview of the anesthetic and analgesic agents and techniques commonly used in sheep and goats.

Preanesthetics for Small Ruminants

Fenothiazines

Acepromazine, which has no analgesic effect, provides a slight sedation when administered at a dose of 0.05-0.1 mg / kg IM or 0.03-0.05 mg / kg IV. It is not recommended to be used for hypovolemic animals because it can cause hypotension. When used in conjunction with barbiturates, it provides a smooth induction and recovery. However, it greatly increases the possibility of regurgitation. Although acepromazine is popular in horses and pet animals, it is rarely used due to limited sedative effects and the possibility of regurgitation during anesthesia in sheep.

Alfa2 receptor agonists

Alfa 2 receptor agonists (xylazine, clonidine, medetomidine, dexmedetomidine, detomidin, romifidine) produce a different effect from mild to severe sedation, depending on the applied doses. When used alone, these drugs provide adequate sedation for the purpose of capturing the animal. They are also used for pre-anesthetic before induction for general anesthesia. Alpha 2 receptor agonists have effects such as analgesia, bradycardia, hypotension, hypoxia, sedation and ataxia. These drugs are contraindicated in risky patients and should be used with caution. Because of the potential ecboic effects of these drugs, they should be avoided especially in pregnant animals in the third trimester of pregnancy.

Death may occur due to pulmonary edema, sometimes resulting in deep arterial hypoxia. When atipemazole, α_2 receptor antagonist, is used in (0.025-0.05 mg/kg as IM or half of IM route dose as IV), the effects of these drugs in sheep can be successfully reversed. However, it should not be forgotten that these effects will be reversed as well as the analgesic effects.

Xylazine produces deep sedation at 0.02-0.2 mg/kg in sheep and 0.05 mg/kg in goats. The dose for intramuscular administration should be 2 times the recommended dose for IV administration. Goats are much more sensitive than sheep. However, there are also differences in sensitivity between races in sheep. Lower doses are required for younger and sick animals, while higher doses are needed for smaller races. Xylazine causes bradycardia, which is more pronounced immediately after intravenous administration and continues throughout the sedation. It causes hypoxemia at significant levels in sheep and sometimes in goats. It should not be used in animals with respiratory distress. If long-term operative interventions have been performed on sheep, oxygen supplementation is required. Side effects of xylazine may be overcome by administering yohimbine (0.125 mg / kg), tolazoline (1.5 mg / kg IV) or atipemazole (0.015 mg/kg, IV) from α_2 receptor antagonists in addition to oxygen administration.

Benzodiazepines

Benzodiazepines (**diazepam**, **midazolam**) are useful sedative and preanesthetic. They can be administered intramuscularly or slowly IV and cause sedation without analgesia. When diazepam is administered slowly at a dose of 0.25-0.5 mg / kg IV, sheep and goats develop a sedation for about 30 minutes. There is no analgesic effect and recovery occurs quite calmly. As midazolam has a water-soluble structure at the dose of 0.2-0.5 mg / kg, it may be preferred IM as opposed to diazepam. Both drugs have minimal cardiopulmonary side effects. It can be combined with opioids such as butorphanol and buprenorphine.

Anticholinergics

Routine use of anticholinergics on premedication is controversial due to its effects on salivation. **Atropine** can be used to block vagal reflexes that may cause tension or pressure increase in the eye in abdominal organs at a dose of 0.4 mg / kg. High repetitive doses that cause tachycardia and mydriasis may be necessary to prevent salivation. However, low doses can block the respiratory tract by making the saliva viscous. Apart from these, gastrointestinal motility can be affected the accumulation of ruminal gas and ultimately cause tympani formation. Because of these adverse effects, it is preferable to use it only in situations where bradycardia develops intraoperatively. However, it can be used preoperatively to prevent bradycardia formation during ophthalmic surgery and internal organ manipulations. Glycopyrrolate is believed to be a better choice in many cases because it has a longer duration of action than atropine and does not cross the placenta.

General Anesthetics for Small Ruminants

Dissociative anesthetics (ketamine, tiletamin)

Ketamine is an injectable anesthetic frequently used for induction and general anesthesia in small ruminants. Ketamine is usually used as IV or IM at a dose of 2.2 mg / kg along with diazepam or xylazine. It can be used up to 5 mg / kg dose for maximum effect. It causes a slight respiratory depression while causing minimal cardiovascular depression. It has analgesic properties and can also be used in newborns. It may cause mild cardiovascular stimulation. Coughing and swallowing reflexes continue to a large extent. Apnea is rare. Significant increase in salivation may be seen, especially after rapid IV injection. Eyes remain open. When used alone, ketamine provides insufficient muscle relaxation and peripheral reflexes persist. This is why it is necessary to use an α_2 receptor agonist or a benzodiazepine in combination with muscle relaxation to facilitate sedation and facilitate endo-tracheal intubation. The combination of ketamine and an α_2 receptor agonist, benzodiazepine or acepromazine is a combination that can be used to induce anesthesia in small ruminants. If the duration of anesthesia is desired to be extended, supplemental doses may be administered. The combination of an α_2 receptor agonist with ketamine improves the degree of analgesia and prolongs the duration of the anesthesia. However, when large doses are used, respiratory depression is exacerbated and the duration of recovery is delayed. In such a case, hypoxemia can be prevented by administering oxygen.

Tiletamines are commercially sold together with zolezepam. It provides rapid and smooth induction, good anesthesia and recovery. It doesn't provide adequate of analgesia for laparotomies. It has been reported that intravenous tiletamin-zolezepam (6-8 mg / kg) produces longer anesthesia than diazepam-ketamine combination. In this case, however, the use of an analgesic drug becomes compulsory. When xylazine is administered at a dose of 0.1 mg / kg followed by 4 mg / kg IV tiletamine, anesthesia is achieved approximately 45-60 minutes

Barbiturates (thiopental, pentobarbital, methohexital)

Thiopental is short acting. It has fast and smooth induction after IV injection at 7-20 mg / kg dose, and anesthesia last 5-10 minutes. Endotracheal intubation is easy. However, it usually causes apnea 1-2 minutes after the rapid application of large doses. For this reason, starting doses of 5-7 mg / kg can be applied to avoid apnea. Subsequent doses are made every 20-30 seconds. If premedication is given, 5-10 mg / kg dose is enough for induction. Thiopental causes respiratory and mild cardiovascular depression. There isn't analgesic effect. Muscle relaxation and recovery without premedication are partly weak. Due to thiopental accumulation, it is not recommended to use for more than 15 minutes of anesthesia. In goats, the duration of recovery is at least twice as high as propofol. It should be applied as IV because it is an irritant for the tissues. It is also a relatively inexpensive inductive drug compared to other injectable anesthetics.

Pentobarbital is another short-acting barbiturate that is cheap and very quickly metabolized. It is especially ideal for short-term applications and causes minimal cardiovascular and respiratory depression. However, overdose may cause a deep respiratory depression. It is an inductive agent that needs to be diluted before it is used. It is necessary to administer slowly at IV dose of 20 mg / kg IV. Due to the presence of irritation, injection into the perivascular tissue area should be avoided.

Methohexital sodium, one of the short-acting barbiturates, is administered by IV route at a dose of 4 mg / kg and anesthesia is provided for about 5-7 minutes. In anesthesia, excitement and fear can be prevented by a sedative such as midazolam, diazepam, medetomidine or xylazine. Medetomidine and xylazine reduce the dose of barbiturate for induction. When xylazine is used, the duration of recovery and standing can be shortened with yohimbine at the dose of 0.125 mg / kg by IV route.

Propofol

Propofol is an intravenous anesthetic whose effect is rapid onset and rapidly metabolized. It is used for both induction and short-term anesthesia and for the maintenance of anesthesia when there is no inhalation anesthesia. Rapid onset of action, short duration, and rapid recovery from anesthesia are important because they reduce the risk of tympani and hypoxemia associated with anesthesia during the operation in small ruminants. Its utilization in adult animals is limited due to its high cost. However, it can be used easily in newborns. It causes cardiovascular and respiratory depression. Therefore, adequate ventilation is necessary. Dosage is recommended as 4-6 mg / kg (IV). Propofol is ideal for the maintenance of injectable anesthesia. After IV administration at 3-7 mg / kg dose, induction is smooth and quick, despite myoclonic movements in the face or extremities. Anesthesia lasts 5-10 minutes and is suitable for intubation. Anesthesia can be sustained as continuous infusion with a calculation of 0.3-0.6 mg / kg / min. There is no analgesic effect. Apnea can often be seen depending on the applied dose and the rate of application. For this reason, apnea can be prevented by slowing application and paying attention to dose adjustment. Hypoventilation, hypoxemia and hypercapnia occur when anesthesia is continued with propofol. Preferably oxygen support and ventilation is required after intubation. Administration of detomidine, butorphanol and propofol in combination with induction and anesthesia with propofol is one of the recommended combinations for castration and ovariectomy in goats. It is known that the combination of ketamine and propofol is also used for the induction and maintenance of anesthesia in sheep. Since the propofol structure has a suitable medium for bacterial growth, antibacterial is not added to the product, so the opened vials should be used within 6 hours due to the risk of contamination.

Saffan

An adequate induction in healthy sheep and goats is provided by intravenous injection of saffan 3 mg / kg dose. Intubation is comfortable and the transition to inhalation anesthesia is straight. Lambs and kids can be used alone for intravenous doses of 4-6 mg / kg for horn blunting. Effect of the Saffan on the heart rate, arterial blood pressure and respiratory rate vary depending on the effects of the doses. IV administration of Saffan at a dose of 2.2 mg / kg results in a rapid decrease in heart rate and blood pressure and a slight slowing in respiration. While anesthesia occurs at this dose for about 10 min, standing from the anesthesia is 20 min. Intravenous administration of saffan at a dose of 4.4 mg / kg results in a prolonged decrease in heart rate and blood pressure. Anesthesia lasts 15 minutes and a full recovery takes 30 minutes.

Inhalation anesthetics

Volatile anesthetics are the most suitable for sustaining anesthesia in small ruminants. Inhalation anesthesia is the safest method in small ruminants, especially in weak, pregnant, very young and older, more than 1 hour long operations and complicated surgical applications, although it is both no economical and feasible compared to injectable anesthesia. In addition, controlling the depth of anesthesia is the most important advantages of rapid recovery. Inhalation anesthesia in animals under 50 to 100 kg body weight (especially young and weak ones) can be performed with a mask. Although recovery from anesthesia is fast, it is not generally recommended due to the excessive consumption of anesthetic agents and anesthetic gas release, delayed induction, increased risk of regurgitation and aspiration, and difficulty of intubation

in large and healthy adult animals. It may be preferred for the maintenance of anesthesia following induction with an injectable anesthetic. **Isoflurane** and **halothane** are the most economical volatile substances. **Sevoflurane** is another agent, but its use is limited due to cost. Isoflurane is a preferred volatile anesthetic agent in very young animals with cardiovascular problems. Although the halothane has been used more in the past, isoflurane and sevoflurane is a better choice than halothane in currently, because of the lower side effects and faster induction and recovery. However, all of these inhalation anesthetics cause cardiovascular and respiratory depression, which can be severe, sometimes due to diarrhea. Halothane is administered 3-5% for induction and 1-2% maintenance for anesthesia. Isoflurane is administered by 2-5% for induction and 1.5-3% maintenance for anesthesia. Sevoflurane is administered 4-6% for induction and 2.5-4% maintenance for anesthesia. Oxygen flow rate should be 2-4 L / min during induction and 0.5 -1 L / min maintenance for anesthesia.

In conclusion, although there is no license in some anesthetic drugs commonly used for anesthesia for use in sheep and especially goats, their use are recommended depending on its clinical experience.

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Examination of the Lower Calorific Value of Lignite Coal by Multiple Regression Method

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Abstract: The calorific value of coal varies depending on type of coal and foreign matter content. The calorific value of coal from pits is determined by analysing moisture, volatile matter, ash and sulfur content in laboratories. This analysis process imposes a burden on businesses both in terms of time and cost. However, it can be determined by simpler methods, especially using the values of temperature, ash and humidity. In this study, we are aimed to develop a model that reduces the time and labor costs by determining the relation between LCV value and variables by using statistical package program. The model was designed based on data obtained from the laboratory analyses of raw coals from the pits of Garp Lignite Enterprise operating under the General Directorate of Turkish Coals and raw coals extracted from the mining areas of Çelikler Seyitömer Lignite Company. While the values of vault moisture, volatile matter, original ash, dry ash content and sulfur were determined as independent variables, the lower temperature values were selected as the dependent variable. A model was created by calculating the coefficients of the multiple regression equation. The LCV values calculated by the model were compared with the LCV values obtained in the real laboratory, and the R² value was found to be 0.952. As a result, we have developed a multiple regression model that can be used to find coal LCV without the need for laboratory analyses.

Key Words: Garp Lignite Plant, Coal Analysis, Tunçbilek Coal, Seyitömer Coal, Multiple Regression

1. INTRODUCTION

A major characteristic of developed countries is their high capacity of energy production. It is vital that the energy production of any country be higher than its energy consumption for the development of the industry and the increase of the national income. The high level of energy production depends on the most efficient utilization and use of energy production resources. Fossil fuels are a large part of energy production. Particularly due to the oil crisis in the 1970s, the use of coal as an alternative to oil, which meets most of the global energy production need, started to increase and the coal-related exploration and research boosted. Today, 30% of the world's energy is produced using coal. In addition, metallurgical coke produced from coking coal is used for 75% of the world's liquid pig iron production (Kural, 1998). Energy production is vital for Turkey as for the whole world. As a country that is rich in coal reserves, Turkey needs to improve the efficiency and technology of coal production. In this study, laboratory analyses of raw coals and other coals produced in all of the processes in Tunçbilek and Seyitömer pits were examined by using multiple linear regression model in order to minimize time and cost. The objective at this stage was to determine whether multiple linear regression model could be used to predict the laboratory analysis values of moisture, volatile matter, original ash and sulfur content of coal without actually carrying out laboratory analyses for lower calorific value (LCV) and ash content. This study compares the LCV and ash content values estimated by the proposed model and the LCV and ash content values obtained in real laboratory settings.

2. MATERIALS AND METHODS

For the design of the model in the study, data of raw coals from the Garp Lignite Enterprise operating under the General Directorate of Turkish Coals and Çelikler Seyitömer Lignite Company mining sites have been used. Data are the results of 2500 laboratory analysis.

The lower calorific values (LCV) were chosen as the dependent variable, while the values of the moisture, volatile matter, original ash, dry ash content and sulfur were determined as independent variables. IBM SPSS 20 package program was used in the analysis.

In the Multiple Regression method, the Enter method is applied first. When all variables are unconditionally included in the Enter method, (Morgan et al., 2011) the model is as follows;

Calorific value = $b_0 + b_1$ (Humidity) + b_2 (Volatile matter) + b_3 (Ash) + b_4 (Sulfur) + b_5 (Original ash)

The Coefficient of Determination (R^2) indicates that the dependent variable is revealed by the independent variables included in the model. In other words, % of the change in the dependent variable is explained by the independent variable(s). (Gamgam and Altunkaynak, 2017)

Table 1. Model of the Enter method

Entered/ removed Model	Variable Entered	Method
1	dry ash, dry sulfur, humidity, dry volatile, original ash	Enter

The results of the Enter method are as follows; as seen in the table, the independent variables describe 95.2% of the dependent variable (LCV), which is a very large percentage and is a desired result.

Table 2. The results of the Enter method

Model	R	R^2
1	,976	,952

The result of the Enter method has a quite high R^2 value. But the use of all of the independent variables is not desirable. The coefficients of independent variables are as follows:

Table 3. The coefficients of independent variables

Model		B	t	Sig.
1	(Constant)	8471,456	130,427	,000
	Humidity	-95,950	-45,125	,000
	Original ash	-9,091	-,731	,465
	Dry sulfur	11,296	3,685	,000
	Dry volatile	-12,236	-9,399	,000
	Dry ash	-69,429	-6,613	,000

According to this model result, when the independent variables were taken as zero, the LCV value was found as 8471,456 kcal / kg.

If the independent variable humidity is 1 unit, then LCV decreases 95,950 units.

If the independent variable original ash is 1 unit, then LCV decreases 9,091 units.

If the independent variable the dry ash is 1 unit, then LCV decreases 69,429 units.

If the independent variable dry volatile is 1 unit, then LCV decreases 12,236 units.

Only if the independent variable dry sulfur is 1 unit, then the LCV increases by 11,296 units.

As the result of Anova table shows that $P = 0,000$, the model is a meaningful model. (Field, 2005)

All independent variables obtained from the laboratory were considered in the model.

As the aim of this study is to reduce number of the independent variables so to reduce the cost; alternative regression models were tested in order to check if the number of the independent variables are decreasing without decreasing R^2 . (Ünver et al., 2006)

In the Stepwise method, each variable is added in turn and the model is evaluated. If the added variable contributes to the model, this variable remains in the model. However, all other variables in the model are retested to assess whether they contribute to the model. If it doesn't make a significant contribution, it is removed from the model. Thus, the model is explained with at least number of variables. (Kalaycı, 2005)

In the forward selection method, SPSS inserts the variables in order of the correlation strengths with the dependent variable.

In the backward selection method, SPSS includes all variables in the model. The weakest independent variable is subtracted from the model and the regression is recalculated. (Darlington and Hayes, 2017)

The values obtained from the Stepwise method are as follows.

Table 4. Model Summary, The values obtained from the Stepwise method

Model	R	R ²
1	,579 ^a	,335
2	,975 ^b	,951
3	,976 ^c	,952
4	,976 ^d	,952

a. Predictors: (Constant), humidity

b. Predictors: (Constant), humidity, Dry ash

c. Predictors: (Constant), humidity, Dry ash, Dry volatile

d. Predictors: (Constant), humidity, Dry ash, Dry volatile, Dry sulfur

For the four different models, the independent variable coefficients and the model significance test results are as follows.

Table 5. For the four different models, the independent variable coefficients and the model significance test results are

Model		Unstandardized Coefficients	t	Sig.
	B			
1	(Constant)	6323,961	198,229	,000
	humidity	-66,655	-35,496	,000
2	(Constant)	7955,664	626,568	,000
	humidity	-95,482	-177,677	,000
	Dry ash	-73,162	-176,388	,000
3	(Constant)	8445,614	149,396	,000
	humidity	-94,933	-178,183	,000
	Dry ash	-76,579	-136,505	,000
	Dry volatile	-11,423	-8,887	,000
	(Constant)	8447,896	149,812	,000
4	Humidity	-94,447	-172,604	,000
	Dry ash	-77,094	-133,754	,000
	Dry volatile	-12,254	-9,416	,000
	Dry sulfur	11,400	3,723	,000

In the stepwise method, i.e. the second method, $R^2 = 0.951$ is found when moisture and dry ash are taken as independent variables. This value can be ignored as there is only 0.001 difference from Enter method value and three independent variables are decreased.

Moreover, no significant changes are seen in the independent variable coefficients.

Forward selection results is as follows and gives the same results as the stepwise method.

Table 6. Forward selection results

Model Summary		
Model	R	R Square
1	,579 ^a	,335
2	,975 ^b	,951
3	,976 ^c	,952
4	,976 ^d	,952

a. Predictors: (Constant), humidity

b. Predictors: (Constant), humidity, Dry ash

c. Predictors: (Constant), humidity, Dry ash, Dry volatile

d. Predictors: (Constant), humidity, Dry ash, Dry volatile, Dry sulfur

In **Backward selection method**, only the original ash was removed from the model.

Table 7. Backward selection method results

Model	R	R Square
1	,976 ^a	,952
2	,976 ^b	,952

a. Predictors: (Constant), Dry ash, Dry sulfur, Humidity, Dry volatile, Original ash

b. Predictors: (Constant), Dry ash, Dry sulfur, Humidity, Dry volatile

3.RESULTS AND DISCUSSION

Humidity, volatile matter, original ash, dry ash content and sulfur values obtained from the laboratory results are independent variables, and LCV is dependent variable. When using Multiple Linear Regression methods for LCV with all independent variables in the model, the $R^2 = 0.952$.

If stepwise or forward methods are applied, and if only moisture and dry ash are taken as independent variables, the difference in R^2 is only 0.001.

In these two models, volatile matter, original ash, and sulfur values are out of the model.

The dependent variable (lower calorific value-LCV) can be explained by measuring only two independent variables (humidity and dry ash), so there is a considerably reduction in terms of cost and time loss.

According to the results of the analysis, it is seen that the classification achieved by Multiple Linear Regression methods for LCV is $R^2 = 0.952$. These results show that the developed model can be used in estimating the lower calorific value. This achievement is not satisfactory, we think that success of developed software will increase by diversifying the data from other mineral fields.

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Fatty Acid Composition of Bastard Grunt [*Pomadasys incisus* (Bowdich, 1825)]

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Abstract: Bastard grunt (*Pomadasys incisus*, Bowdich, 1825) is a fish species in Mediterranean region and called “gargur” or “yalancı isparoz” in Turkey. The aim of the present study is to investigate fatty acid composition of this fish. This research points out some basic information about fatty acid contents of bastard grunt which is a fish species around the region. The results indicated that the average level of the saturated fatty acids (SFA), monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA) of the fish muscle were calculated in the shown order; MUFA < PUFA < SFA. In addition, the average levels of arachidonic acid (ARA, C20:4n6) was found to be lower than that of eicosapentaenoic acid (EPA, C20:5n3) in muscle lipid of the fish. The mean docosahexaenoic acid (DHA, C22:6n3) level of the fish was almost three times higher than that of EPA. The total omega 3 fatty acids in muscle of the fish were calculated to be around 20% which was higher than total omega 6 fatty acids. The ratio of n6/n3, PUFA/SFA, and DHA/EPA in fish muscle were calculated to be 0.52, 0.89, and 2.84, respectively.

Keywords: Fatty acid, Bastard grunt, *Pomadasys incisus*, DHA, EPA

1. INTRODUCTION

Bastard grunt, *Pomadasys incisus* (Osteichthyes: Haemulidae) (Bowdich, 1825), is a subtropical species native to Atlantic and entered the Mediterranean Sea through the Straits of Gibraltar in the first half of the nineteenth century, and has colonizing the whole Mediterranean coast (Bodilis et al., 2013). It is known to be a coastal demersal species inhabiting marine and brackish waters, usually near sandy or muddy substrate, at depths from 10 to 100 m (Kapuris et al. 2008, Keskin et al., 2011). The fish has a rapid growth pattern during the first year of life, the early maturity and the moderately short life cycle contribute to the relatively fast spreading of the species (Chater, et al., 2015). Individuals grow quickly in their first year, attaining approximately 60% of their maximum length; after the first year, their growth rate drops rapidly as energy is probably diverted to reproduction (Pajuelo et al., 2003). The fish was reported as a well-adapted and has rapidly expanded fish species in the Mediterranean Sea. (Chater, et al., 2015) and also has preliminary biological data in the Aegean Sea, Greece.

Additionally, bastard grunt’ diet was especially constituted of crustacean species, benthic and planktonic organisms. *Crangon crangon*, *Hyperocche* sp. and *Geryon longipes* were the most abundant prey in the diet (Fehri-Bedoui and Gharbi, 2008). One study revealed that length at first sexual maturity of the bastard grunt was 16.6 cm for males and 16.8 cm for females, which correspond to an age of about 2 years (Chater, et al., 2015) while another study showed that the size at first maturity (L50) was reported to be estimated at 15.33 cm for both sexes of bastard grunt (Fehri-Bedoui and Gharbi, 2008).

Bastard grunt is one of the coastal demersal species inhabiting Turkish coastal waters especially in Mediterranean (Keskin et al., 2011, Turan et al., 2007). Fish has a place in fish markets because of its affordable prize comparing other fish species. Fish has an important food item because of its many benefits. That is why people are encourage to consume fish regularly. Many health concerning departments advise specifically fish to stay healthy.

When we search for this fish species there is not sufficient information about this species and non for fatty acid profile for this fish species. People around the region raised some question about it. We decided to study this fish species. Therefore, the aim of this study is to determine the components of fat and fatty acids of the Bastard grunt fish species

2. MATERIALS AND METHODS

Materials

Fish specimens used in this current study were obtained in 2014 from İskenderun in a fish market. Dorsal parts of the fish gathered together without their skins and mixed very well and called mixed muscle (MM) which given names for the figure and tables in results part of this paper. All chemicals used in this study were in analytical grade and obtained from Merck (Darmstadt, Germany) and Sigma Aldrich (St. Louis, MO, USA).

Methods

Procedures of modified Bligh & Dyer by Olley and Hanson (1963) method has been used for crude lipid level. A GC-MS (Gas Chromatography-Mass Spectrometry) was used to determine fatty acids of the fish muscle. The conversion and separation of FAMES were carried out as described in Ozyilmaz 2016.

3.RESULTS AND DISCUSSION

The mean lipid level of the bastard grunt were calculated to be 0.59%. Additionally, fatty acid profile of the fish showed that average level of the saturated fatty acids (SFA), monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA) of the fish muscle were calculated to be 35.48%, 31.50%, and 26.39% respectively. Saturated fatty acids (SFA) in muscle of bastard grunt were given in Table 1. As it can be seen in the table 1. The major component of the SFA is the palmitic acid followed by stearic acid with the average values of 20.27% and 9.72, respectively.

Table 1. Saturated fatty acids (SFA) in muscle of bastard grunt (%)

Fatty Acids	MM1	MM2	MEAN	SD
C12:0	2,71	2,31	2,51	0,28
C14:0	0,54	0,49	0,52	0,04
C15:0	0,38	0,41	0,40	0,02
C16:0	20,91	19,62	20,27	0,91
C17:0	1,39	1,59	1,49	0,14
C18:0	9,76	9,68	9,72	0,06
C20:0	0,67	0,49	0,58	0,13
ΣSFA	36,36	34,59	35,48	1,58

MM: Mixed muscle was composed of sixty one individual fish muscle, SD: Standard Deviation

Monounsaturated fatty acids (MUFA) in muscle of bastard grunt were given in Table 2. Oleic acid constitute majority part of the monounsaturated fatty acids. Approximately 60% monounsaturated fatty acids is oleic acid in muscle of bastard grunt.

Table 2. Monounsaturated fatty acids (MUFA) in muscle of bastard grunt (%)

Fatty Acids	MM1	MM2	MEAN	SD
C16:1n9	1,04	1,04	1,04	0,00
C16:1n7	3,80	3,52	3,66	0,20
C17:1	1,92	2,18	2,05	0,18
C18:1n9	15,85	16,17	16,01	0,23
C18:1n7	2,79	3,12	2,96	0,23
C20:1n9	0,71	0,63	0,67	0,06
C16:1n9	1,04	1,04	1,04	0,00
ΣMUFA	26,11	26,66	26,39	0,90

MM: Mixed muscle was composed of sixty one individual fish muscle, SD: Standard Deviation

Polyunsaturated fatty acids (PUFA) in muscle of bastard grunt were given in Table 3. The average levels of arachidonic acid (ARA, C20:4n6), eicosapentaenoic acid (EPA, C20:5n3), Docosapentaenoic acid (Dpan3, C22:5n3) and docosahexaenoic acid (DHA, C22:6n3) were calculated to be 3.19%, 4.27%, and 2.08%, and 12.12%, respectively.

Table 3. Polyunsaturated fatty acids (PUFA) in muscle of bastard grunt (%)

Fatty Acids	MM1	MM2	MEAN	SD
C16:4n1	2.63	1.99	2.31	0.45
C16:2n4	0.92	0.87	0.90	0.04
C18:2n6	1.84	2.37	2.11	0.37
C20:2n6	0.53	0.49	0.51	0.03
C20:3n6	0.37	0.31	0.34	0.04
C18:3n6	0.61	1.00	0.81	0.28
C20:4n6	3.29	3.08	3.19	0.15
C22:4n6	0.57	0.55	0.56	0.01
C22:5n6	1.24	1.21	1.23	0.02
C18:3n3	0.68	0.57	0.63	0.08
C20:4n3	0.54	0.41	0.48	0.09
C20:5n3	4.36	4.17	4.27	0.13
C22:5n3	2.16	2.00	2.08	0.11
C22:6n3	12.34	11.90	12.12	0.31
ΣPUFA	32.08	30.92	31.50	2.12

MM: Mixed muscle was composed of sixty one individual fish muscle, SD: Standard Deviation

Total SFA, MUFA, PUFA, omega 3, omega 6, and their ratio of in muscle of bastard grunt were given in Figure 1. The total omega 3 fatty acids in muscle of the fish were calculated to be around higher than that of omega 6 fatty acids. The ratio of n6/n3 in fish muscle were calculated to be 0.52 which is in recommended ratio for a healthy diet. Additionally, DHA/EPA is almost 3 which shows richness of DHA.

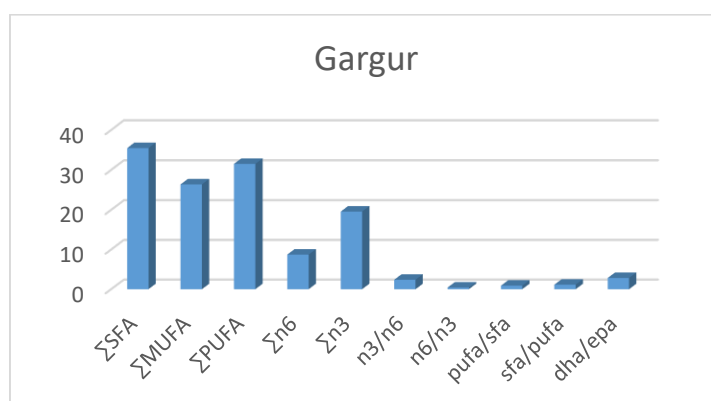


Figure 1. SFA, MUFA, PUFA, omega 3, omega 6, and their ratio of muscle of bastard grunt

Based on our data in this current study about fish lipid level fish can be categorized as lean fish. The average lipid level of the fish used in this study was found to be lower than the fat level of the striped piggy (*Pomadasys stridens*, Forsskål, 1775) which is a new fish for Mediterranean sea and from the same fish family (Özyılmaz et al., 2017). The total omega 3 fatty acids in muscle of the fish were calculated to be around 20% which was higher than total omega 6 fatty acids. The ratio of n6/n3, PUFA/SFA, and DHA/EPA in fish muscle were calculated to be 0.52, 0.89, and 2.84, respectively

In conclusion, bastard grunt has low lipid content and high in omega 3 fatty acids which help out to improve heart health. The fish used in the study were found to be excellent food for consumption considering its omega 3 content.

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Comparison of Antioxidant Effects of Taşköprü Garlic With Its Stalks and Clove Shells

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Abstract: Among plant organs, plant leaves are the primary components that reflect the condition of nutrition elements. Garlic is a functional food product which should be utilised with stems. During the harvest season, garlic bulbs are reaped and used, whereas the stems and leaves are discarded. Processing these parts, which comprise up to 10% of the total weight of the garlic plant, is good for the economy, and it is also important to reduce the 9000 tonne of solid waste. Bioactive compounds in garlic are known to have antioxidant effects. Natural antioxidants are the ingredients that exist in plant and animal tissues which can be extracted and which can come out during food processing. The search for novel natural, plant-based antioxidants is ongoing, and it is important that these resources are cheap, edible and widespread. The use of agricultural and industrial waste as a natural antioxidant source is particularly important. Garlic is rich in selenium and organosulphur compounds, which are active antioxidants. The in vivo and in vitro antioxidant potential of garlic has been reported. In the present study, we found that garlic clove shells contain the highest amount of ash, followed by garlic stems and garlic samples, respectively. The highest average pH value was found in garlic samples, followed by garlic clove shells and garlic stems, respectively. The highest average titratable acidity value was detected in garlic stems, followed by garlic clove shells and garlic samples, respectively. The DPPH inhibition value in garlic samples, garlic stems and garlic clove shells was on average 48.32, 24.94 and 34.90; the ABTS inhibition value in garlic samples, garlic stems and garlic clove shells was on average 36.36, 0.14 and 3.54, respectively, and the FRAP value in garlic samples, garlic stems and garlic clove shells on average was determined to be 0.45, 0.13 and 0.26, respectively.

Keywords: Taşköprü, garlic, stem, shells, antioxidant

1. INTRODUCTION

Many health benefits of garlic have been reported in recent studies (Lee et al., 2015; Wu et al., 2015), and the interest in garlic is increasing day by day. Bioactive compounds, such as sulphur compounds, are responsible for the health benefits of garlic. In addition, several phenolic compounds found in garlic have been shown to possess pharmacological effects (Lanzotti, 2006). Phenolic content in plants and antioxidant activity have been found to be directly proportional (Stratil et al., 2006). The antioxidant effect of garlic involves the destruction of free radicals, the hindrance of their formation and the increase in the activity of antioxidant-rich enzymes (Wei et al., 1998); has synergist effect with other antioxidant agents, non-enzymatically, by the chelation of metal ions, using their reducing power (Yeh et al., 2001; Yin et al., 2002). The most important part is the processes applied to garlic because pH, temperature, concentration, water or oil solubility as well as processing period variables cause changes in organosulphur compounds, and these can display different antioxidant activity properties (Kim et al., 1997). Many sulphur-containing compounds in garlic are partly responsible for its health benefits (Amagase et al., 2001). In whole garlic, compounds that contain important sulphurs, such as γ -glutamyl-S-allyl-L-cysteines and S-allyl-L-cysteine sulfoxide (alliin), turn into thiosulphates (such as allicin) through enzymatic reactions when raw garlic is processed (Amagase, 2006). Bioactive compounds in garlic have been found to possess antioxidant (Borek, 2001; Amagase, 2006), anticancer (Agarwal, 1996), cholesterol-lowering (Yeh and Liu, 2001) and immunological (Amagase et al., 2001; Amagase, 2006) properties in human and animal studies. During the harvest season, most of the stems and leaves are discarded. These stems and leaves are edible, have a spicy flavour and are rich in protein. Garlic stems and leaves contain allicin, which is an important bioactive compound in garlic, but the amount of allicin is lower in stems and leaves than in garlic heads (Arzanlou and Bohlooli, 2010). Garlic leaves are usually eaten fresh or are lyophilised; they are used as additives in meat and dairy products (Rekowska and Skupien, 2009). Garlic stems are known to have anti-thrombocyte properties, but the chemical compounds that prevent coagulation have not yet been determined. The in vitro preventive effects of coagulation of garlic heads and stems have been observed, and different thiosulphate and polysulphide profiles may be responsible for this effect (Tocmo et al., 2015).

In the present study, garlic samples, garlic stems and garlic clove shells obtained from 20 different fields in Taşköprü were tested for dry matter, ash, ash in dry matter, pH and titratable acidity, and antioxidant effects were determined by the assessment of DPPH, ABTS and FRAP scavenging activity.

2. MATERIALS AND METHODS

A total of 20 different garlic plants obtained from Taşköprü fields and the stems and shells of these plants were used for the study. Chemicals used in the experiments were obtained from Sigma Chemical Company.

Chemical Analysis

Determination of total dry matter

Samples homogenised at room temperature were kept in a drying chamber for a certain period and temperature and then weighed, roughly in 5-g batches, in aluminium dry-matter containers which were refrigerated in a desiccator and were dried for 24 h in a vacuumed cabinet drier at 70°C. Following this, dry-matter containers were put back in the desiccator, cooled and weighed. This process was repeated until the weighing differences were eliminated (Cemeroğlu, 1992).

Determination of ash content

Porcelain crucibles which were kept in a drying cabinet at a specified temperature for a specified period were cooled in a desiccator, and approximately 5 g of sample was weighed and kept in a muffle furnace at 600°C for 5 h. Following this, the crucibles were cooled in a desiccator and weighed. This process was repeated until the weighing differences were eliminated (Ağbaş et al., 2013).

Determination of pH

The probe of the pH metre was submerged in the container with the homogenised samples, and the result was read when the value became stable (Cemeroğlu, 1992).

Determination of titratable acidity

In total, 5 g of homogenised sample was mixed with water, and the mixture was shaken and passed through a filter paper. Few drops of phenolphthalein indicator were added, and the mixture was titrated with 0.1 N NaOH; the titratable acidity was calculated (Cemeroğlu, 1992).

Antioxidant Activity Tests

Preparation of extracts

To prepare extracts, samples were homogenised, and samples at the rate of 1:10: ethanol mixture were kept in an ultrasonic water bath for 30 min. The mixture was centrifuged at $10000 \times g$ at 4°C for 20 min. The supernatant obtained was centrifuged again at the same temperature and cycle. The obtained extract was used for determining the antioxidant activity.

DPPH scavenging activity

In total, 150 µL of sample was added to 750 µL of 0.12 mM DPPH ethanol solution and kept in the dark at 37°C for 10 min. The absorbance of the mixture was calculated to be 517 nm (Wang et al., 2015).

ABTS scavenging activity

ABTS radical solution was obtained by mixing 2.45 mM potassium persulphate and 7 mM ABTS solution at the rate of 1:1; this mixture was kept in the dark at room temperature for 16 h. The absorbance of the ABTS radical solution was found to be 734 nm, and it was diluted with phosphate buffer solution (pH 7.0) until the absorbance became 0.70 ± 2 . In a test tube, 950 µL of diluted ABTS radical solution and 6 µL of sample was mixed and kept at room temperature for 6 min. The absorbance of the mixture was calculated to be 734 nm (Wang et al., 2015).

FRAP value

FRAP solution was prepared daily by mixing 10 volumes of 300 mM sodium acetate buffer (pH 3.6), 1 volume of 10 mM TPTZ solution and 1 volume of 20 mM iron-III chloride. Of note, 100 µL of sample was mixed with 900 µL of FRAP solution and preheated at 37°C in a water bath. The mixture was shaken well and kept at room temperature for 10 min. The absorbance of the mixture was calculated to be 593 nm (Wang et al., 2015).

3. RESULTS AND DISCUSSION

In the present study, 20 different garlic bulbs, garlic stems and garlic clove shells obtained from different fields in Taşköprü were tested in terms of dry matter, ash, pH and titratable acidity. Results are shown in Table 1.

In our study, the respective amounts of dry matter in garlic bulbs, garlic stems and garlic clove shells were found to be 35.47, 90.21 and 84.36 at the lowest value; 42.73, 91.71 and 89.96 at the highest value and 38.65, 91.11 and 87.14 on average. The amount of ash in garlic bulbs, garlic stems and garlic clove shells, respectively, was found to be 1.14, 6.08

and 5.74 at the lowest value; 1.53, 9.76 and 9.96 at the highest value and 1.30, 7.89 and 7.70 on average. To comment on the amount of ash, the amount of ash in dry matter was determined in every sample.

Table 1. Chemical analysis results for garlic bulbs, garlic stems and garlic clove shells

Sample		Dry matter (%)	Ash (%)	Ash in dry matter (%)	pH	Titrateable acidity (%)
Garlic bulbs	Lowest	35.47 ± 2.19	1.14 ± 0.10	2.75 ± 0.40	5.94 ± 0.06	0.184 ± 0.00
	Highest	42.73 ± 2.19	1.53 ± 0.10	4.12 ± 0.40	6.19 ± 0.06	0.212 ± 0.00
	Average	38.65 ± 2.19	1.30 ± 0.10	3.38 ± 0.40	6.03 ± 0.06	0.196 ± 0.00
Garlic stems	Lowest	90.21 ± 0.43	6.08 ± 1.08	6.64 ± 1.18	5.32 ± 0.26	0.180 ± 0.02
	Highest	91.71 ± 0.43	9.76 ± 1.08	10.66 ± 1.18	6.26 ± 0.26	0.246 ± 0.02
	Average	91.11 ± 0.43	7.89 ± 1.08	8.65 ± 1.18	5.74 ± 0.26	0.215 ± 0.02
Garlic clove shells	Lowest	84.36 ± 1.48	5.74 ± 1.10	6.53 ± 1.27	5.49 ± 0.17	0.178 ± 0.01
	Highest	89.96 ± 1.48	9.96 ± 1.10	11.49 ± 1.27	6.16 ± 0.17	0.235 ± 0.01
	Average	87.14 ± 1.48	7.70 ± 1.10	8.84 ± 1.27	5.82 ± 0.17	0.205 ± 0.01

The amount of ash in dry matter in garlic bulbs, garlic stems and garlic clove shells, respectively, was found to be 2.75, 6.64 and 6.53 at the lowest value; 4.12, 10.66 and 11.49 at the highest value and 3.38, 8.65 and 8.84 on average. The highest amount of ash was found in garlic clove shells, followed by garlic stems and garlic bulbs, respectively (Table 1). In addition, pH and titrateable acidity values are given in Table 1. The highest average pH value was found in garlic bulbs, followed by garlic clove shells and garlic stems, respectively. The highest average titrateable acidity value was found in garlic stems, followed by garlic clove shells and garlic bulbs, respectively.

Table 2. Antioxidant activity test results of garlic bulbs, garlic stems and garlic clove shells

Sample		DPPH inhibition value (17 µg/mL wet sample weight)	ABTS inhibition value (5 µg/mL wet sample weight)	FRAP value (mM FeSO ₄ ·7H ₂ O/mL extract)
Garlic bulbs	Lowest	41.62 ± 4.84	18.36 ± 8.34	0.36 ± 0.06
	Highest	59.84 ± 4.84	52.70 ± 8.34	0.56 ± 0.06
	Average	48.32 ± 4.84	36.36 ± 8.34	0.45 ± 0.06
Garlic stems	Lowest	14.83 ± 4.76	ND	0.10 ± 0.02
	Highest	29.86 ± 4.76	0.72 ± 0.22	0.21 ± 0.02
	Average	24.94 ± 4.76	0.14 ± 0.22	0.13 ± 0.02
Garlic clove shells	Lowest	31.64 ± 3.43	2.09 ± 1.16	0.20 ± 0.04
	Highest	45.80 ± 3.43	6.68 ± 1.16	0.36 ± 0.04
	Average	34.90 ± 3.43	3.54 ± 1.16	0.26 ± 0.04

ND= not determined

Antioxidant activity test results are shown in Table 2. In the present study, the DPPH inhibition value in garlic bulbs, garlic stems and garlic clove shells, respectively, was 41.62, 14.83 and 31.64 at the lowest value; 59.84, 29.86 and 45.80 at the highest value and 48.32, 24.94 and 34.90 on average. The highest DPPH inhibition value was found in garlic samples, followed by garlic clove shells and garlic stems, respectively. The ABTS inhibition value in garlic bulbs, garlic stems and garlic clove shells was respectively found to be 18.36, ND and 2.09 at the lowest value; 52.70, 0.72 and 6.68 at the highest value and 36.36, 0.14 and 3.54 on average. According to these results, garlic stems contain a negligible ABTS inhibition value, which can be overlooked. The FRAP value in garlic bulbs, garlic stems and garlic clove shells was respectively found to be 0.36, 0.10 and 0.20 at the lowest value; 0.56, 0.21 and 0.36 at the highest value and 0.45, 0.13 and 0.26 on average (Table 2). In an acidic environment, the ferric-tripyridyltriazine complex in antioxidants is reduced to Fe²⁺, and the resulting coloured solution causes an increase in absorbance at 595 nm (Albayrak et al., 2010). Therefore, garlic has the highest antioxidant activity. As determined by the antioxidant activity tests, garlic samples have the highest value, followed by garlic clove shells and garlic stems, respectively.

In a previous study, the antioxidant activity in garlic from Tunceli and Kastamonu was determined. According to the results, the DPPH inhibition value of ethanol extracts of garlic from Kastamonu was found to be 80.35 at 100 µg/mL and the ABTS inhibition value was determined to be 40.84 at 100 µg/mL (Ağbaş et al., 2013). In another study that focused

on the effects of fertilisation on the DPPH inhibition values of garlic, the DPPH inhibition value was found to be 64.76 in control samples (Zor, 2006). In another study, the DPPH inhibition value was found to be 31.35 (Mnyer et al., 2014). A study focusing on the antioxidant activity of Tunceli mountain garlic revealed an ABTS inhibition value of 500 µg/mL to be 18.95 ± 0.32 µg trolox (Takım, 2015). In a study that focused on the antioxidant activity of *Allium tuncelianum* ethanol–water solution (50:50) extract, in ABTS method, $0.156 \text{ mmol} \pm 0.005$ trolox equivalent/g antioxidant capacity was determined (Kutlu et al., 2015).

After reviewing the literature, no study on the antioxidant activity of stems and clove shells of garlic from Taşköprü was found. Besides, no study comparing the antioxidant activity of garlic bulbs, garlic stems and garlic clove shells was found. In this regard, the present study fills a gap and comprises useful information for the public health sector and for producers.

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Heterosis and Combining Ability Estimates in Half-Diallel Crosses of Durum Wheat

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Abstract: Heterosis and combining ability are the two most important aspects of any hybrid crop. The heterotic effect is in general more pronounced in cross-pollinated than in self-pollinated crops, however, significant levels of heterosis have been reported in a number of self-pollinated crops. In the study, the heterosis percentages and combining ability effects were determined for heading time (HT), thousand kernels weight (TKW) and plant yield (PY) of 6 durum wheat parents (Landraces Beyaziye, Bagacak and cultivars Kunduru 1149, Cakmak-79, Diyarbakir-81 and Duraking) and their 15 half-diallel crosses. Two local populations (Beyaziye and Bagacak) and four cultivars (Kunduru 1149, Cakmak-79, Diyarbakir-81 and Duraking) of durum wheats were used as parents in the study. Heterosis percentages for high-parent and mid-parent were - 2.16 % and - 0.74 % for heading date; - 1.64 % and 3.78 % for 1000 kernel weight; - 2.24 % and 5.24 % for plant yield, respectively. The highest heterosis percentage for mid-parent was determined at the hybrids of ‘Kunduru 1149 x Diyarbakir81’ (1.10 %) for heading date; ‘Kunduru 1149 x Cakmak 79’ (12.86 %) for 1000 kernel weight; ‘Beyaziye x Duraking’ (37.67 %) combination for plant yield. The general combining ability (GCA) and specific combining ability (SCA) components of variance were significant for three traits studied. The levels of heterosis and general and specific combining abilities of parental lines were sufficient to sustainable production of hybrid breeding and early selection of breeding lines.

Keywords: Heterosis, Durum wheat, Diallel, General combining ability, Specific combining ability

1. INTRODUCTION

After the success of hybrid maize during the 1930s, the phenomenon of heterosis or hybrid vigour has been investigated in all major self- and cross-pollinated species (Uddin et al., 1992). Heterosis and combining ability are the two most important aspects of any hybrid crop. The heterotic effect is in general more pronounced in cross-pollinated than in self-pollinated crops (Gallais, 1988), however, significant levels of heterosis have been reported in a number of self-pollinated crops (Fonseca and Petterson, 1968; Gyawali et al., 1968; Walton, 1969; Ozgen, 1989; Bitzer et al., 1982; Topal et al., 2004).

Observations of heterosis in wheat date back to 1919, when Freeman (1919) studied heading time, height, and leaf width in crosses involving durum wheat and 3 common wheats. Recent discoveries have stimulated interest in and speculation as to the possibility of commercial production of hybrid wheat (Briggle, 1963). Many reports have been published establishing the fact that heterosis does occur with proper combinations of parents (Altinbas and Tosun, 1994; Larik et al., 1995; Yagdi and Karan, 2000).

Although the concept of hybrid wheat is not new, during the first 20 years, resources were invested in research related to fertility restoration, sterilizing agents, and crossability. Knowledge of heterotic groups from which to draw parental germplasm for hybrid combinations is limited. Improvement of complex characters such as grain yield may be accomplished through the component approach of breeding. This method in general assumes strong associations of yield with a number of characters making up yield and simpler inheritance for these component characters (Edwards et al., 1976). Amaya et al. (1972) found that dominance effects predominated in grain yield; whereas, additive effects primarily controlled plant height and heading date of durum wheat. Generally researches are focusing on the general and specific combining abilities of parental lines and on identifying heterotic groups for yield. Wheat is an important cool season cereal in Turkey with 9.3 million hectares cultivated and 21 million tonnes annual production (Anonymous, 2005). Durum wheat production makes up 30% of the total production of Turkey (Anonymous, 2002). In view of the importance of the durum wheat and the low average yields in Turkey, an improvement programme was initiated at Department of Field Crops, Faculty of Agriculture, Dicle University in 1998 to develop high yielding varieties. However, the breeding of new lines could only be undertaken after the effects of individual components had been determined.

This study was conducted to evaluate the outstanding durum wheat parents grown in the south-eastern part of Turkey and to determine the possible hybrid combinations.

2. MATERIALS AND METHODS

Two local populations (Beyaziye and Bagacak) and four cultivars (Kundur 1149, Cakmak-79, Diyarbakir-81 and Duraking) of durum wheats (Table 1) were used as parents in the study. They were crossed in 6 x 6 half-diallel crosses to produce the 15 possible F₁ hybrids in 1998. Parents and their F₁ hybrids were grown at the experimental field of the Faculty of Agriculture, University of Dicle, Diyarbakir, Turkey during 1998-1999 growing season. The soil characteristic of experimental field was clay loam, with pH 7.6, and organic matter and CaCO₃ contents of 1.44 and 2.64%, respectively. Average temperature, rainfall and relative humidity of the growing seasons are shown in Table 2. Total annual precipitation was 302.4 mm, which was less than average (491.4 mm) of the site. The experimental plots were arranged in a randomized complete block design with 4 replications (Cakmakci and Acikgoz, 1994; Sarawgi et al., 1997; Czapar et al., 2002).

Table 1. Some characters of durum wheat parents used in the experiment

Name of genotype/pedigree	Features
Kundur 1149/released in Turkey (1967)	Winter type, normal yielding, tall plant height, late maturity, normal kernels
Cakmak 79/ released in Turkey (1988)	Winter type, normal yielding, normal plant height, late maturity, normal kernels
Beyaziye/local population	Spring type, normal yielding, tall plant height, late maturity, big kernels
Bagacak/local population	Spring type, normal yielding, tall plant height, late maturity, big kernels
Diyarbakir 81 /released in Turkey (1987)	Spring type, normal yielding, normal plant height, normal maturity, big kernels
Duraking / not released in Turkey	Spring type, normal yielding, normal plant height, late maturity, normal kernels

Sowings were made 10 November 1998. Each block consisted of 15 F₁ and 6 parent plants on single 2 m rows which were 30 cm apart. Plant spacing was 10 cm. By sowing 60 kg ha⁻¹ nitrogen and phosphate in the form of diammonium phosphate (20.20.0.) and in tillering stage 40 kg ha⁻¹ ammonium nitrate (26%), was applied as fertilizer.

Table 2. Meteorological data for 1998-1999 growing season in Diyarbakir (monthly average)*

Months	Average temperature, °C			Rainfall, mm			Relative humidity, %		
	Years			Years			Years		
	1998	1999	LTA ¹	1998	1999	LTA ¹	1998	1999	LTA ¹
January	-	4.5	1.6	-	15.6	74.6	-	71	77
February	-	5.3	3.6	-	45.5	68.4	-	67	73
March	-	8.1	8.3	-	52	66.2	-	65	66
April	-	13.6	13.9	-	76.1	73.5	-	64	63
May	-	21	19.3	-	22.4	40.8	-	43	56
June	-	27.3	25.9	-	1.1	7.2	-	31	36
July	-	-	31	-	-	0.7	-	-	27
August	-	-	30.3	-	-	0.6	-	-	27
September	-	-	24.9	-	-	2.6	-	-	31
October	12.5	-	17.1	0.2	-	30.8	33	-	48
November	5.6	-	9.8	27.2	-	54.6	59	-	68
December	16.2	-	4.1	62.3	-	71.4	79	-	77

¹Long term averages.

* Turkish State Meteorological Service, Diyarbakir Meteorology Station, Turkey.

During the study, heading time (HT), thousand kernel weight (TKW) and plant yield (PGY) were measured. All measurements for the following characters were made on plot basis:

Heading time: number of days from emergence of seedling to the date when the first spike had completely emerged from the flag-leaf sheath.

Thousand kernel weight: weight of 1000 randomly selected kernels

Plant yield: plant number / total grain yield of each plot.

The plant material was evaluated by analysis of the data on heterosis and combining ability for heading time (HT), thousand kernels weight (TKW) and plant yield (PY) at the F₁ generation. The analyses of variance for general (GCA) and specific (SCA) combining abilities were carried out according to Griffing's (1956) Method 2 (half-diallel set), Model 1. Heterosis (MP: mid-parent) and heterobeltiosis (BP: best parent) values were, respectively, calculated by using this formula (Fonseca and Patterson, 1968):

MP= (value of F₁- mean of parents/mean of parents) x 100

BP= (value of F₁- value of best parent/value of best parent) x 100

Analysis of variance was done using a computerised statistical program called MSTAT-C (MSTAT- C, 1990).

3.RESULTS AND DISCUSSION

Analysis of variance showed significant differences among genotypes for heading time (HT), thousand kernels weight (TKW), and plant grain yield (PGY) (Table 3). Mean squares for general combining ability (GCA) and specific combining ability (SCA) effects for HT, TKW and PGY were significant. The fact that GCA and SCA were significant indicates that both additive and non-additive gene action are involved in traits in the genotypes studied. GCA, which measured the additive effects of genes, was superior in magnitude to SCA for HT and TKW. GCA/SCA values were calculated as 5.3 for HT, 1.7 for TKW and 0.5 for PGY. Effects of SCA were of minor importance for HT and TKW. SCA expression was detected only for PGY. Except PGY, there was a marked superiority of GCA over the SCA mean squares, suggesting that these traits were mediated mainly by additive gene action. Interestingly most of genetic variation was due to SCA for PGY. This trait was mediated mostly by dominance gene action (Table 4).

Table 3. Analysis of variance for heading time (HT), thousand kernel weight (TKW) and plant yield (PY) of 6 durum wheat parents and F₁ progeny of durum wheat

Sources	d.f.	Mean Square		
		HT	TKW	PY
Replications	3	9.847*	6.937*	1.955*
Genotypes	20	32.454**	34.732**	1.498**
GCA ⁺	5	109.267**	87.8706**	1.9158**
SCA ⁺⁺	15	6.851**	17.2001**	1.3538**
Error	60	0.692	2.146	0.352
Total	83	42.993	43.815	3.805
CV (%)		0.66	3.75	11.18

*, **= Significant at $p < 0.05$ and $p < 0.01$ level, respectively,

⁺ = General combining ability, ⁺⁺ = Specific combining ability

The parent of 'Duraking' was the earliest over all genotypes and among F₁ hybrids '1 x 6' and '5 x 6' were earliest. The range of HT among genotypes was 7.8 day. The average TKW and PGY over cultivars were 39.0 g and 5.31 g plant⁻¹, respectively. 'Cakmak 79' had the highest PGY among all parents and the F₁ of '3 x 6' had highest PGY. The F₁ hybrids '1 x 4' and '3 x 4' had highest TKW. The TKW for landrace parents 'Beyaziye' and 'Bađacak' were higher than other parent, 41.0 and 42.1 g, respectively. Hybrids had earlier flowering, significantly higher TKW and higher PGY than parents.

Negative values for the GCA and SCA effects for HT indicate a contribution to earliness, or longer grain filling duration, while positive for the GCA and SCA effects indicate a tendency low growing rate. Cultivar 'Diyarbakir 81' and 'Duraking' was characterized by increasing GCA effect for early heading. On the contrary, 'Kunduru 1149' and 'Bagacak' had positive GCA showing long HT (Table 5). The landraces of 'Beyaziye' and Bagacak' were generally found to be best combiners for TKW. Generally 'Cakmak 79' and 'Diyarbakir 81' had high positive GCA effects and contrary 'Kunduru 1149' and 'Duraking' had negative GCA effects. F₁ hybrids had earlier HT and higher TKW and PGY than the parent means.

Table 4. Mean of heading time (HT), thousand kernel weight (TKW) and plant yield (PY) of parents and their F₁ progeny from a half-diallel cross in durum wheat

Parents and crosses	HT, days	TKW, g	PY, g
(1) Kunduru 1149	129.2 a	36.17 gh	4.350 de
(2) Cakmak 79	129.1 a	34.54 h ₁	5.992 ab
(3) Beyaziye	128.6 ab	41.04 bc	5.455 bc
(4) Bagacak	129.7 a	42.06 abc	5.210 bcd
(5) Diyarbakir 81	123.6 def	40.30 cde	5.398 bc
(6) Duraking	122.0 g	33.99 i	4.365 de
1 x 2	129.8 a	39.91 cde	5.392 bc
1 x 3	128.8 ab	41.40 bc	4.780 cde
1 x 4	129.8 a	44.07 a	5.543 bc
1 x 5	127.8 bc	40.33 cde	5.793 bc
1 x 6	122.8 fg	32.71 i	3.955 e
2 x 3	126.8 c	38.54 def	5.588 bc
2 x 4	129.0 ab	36.94 fg	5.000 bcd
2 x 5	123.8 def	38.01 efg	5.615 bc
2 x 6	124.3 de	37.23 fg	5.225 bcd
3 x 4	129.3 a	42.78 ab	5.342 bc
3 x 5	124.5 d	40.46 bcd	5.222 bcd
3 x 6	123.3 defg	39.99 cde	6.760 a
4 x 5	124.0 def	40.31 cde	5.628 bc
4 x 6	124.5 d	40.81 bcd	5.088 bcd
5 x 6	123.0 efg	38.04 efg	5.785 bc
Mean	126.4	39.03	5.31
Parent	127	38.02	5.13
F ₁	126.1	39.44	5.38
LSD (0.05)	1.18	2.07	0.839

In cross combinations, positive and negative SCA effects were identified for all traits. However, the signs of SCA effects were generally positive for TKW and negative for PGY. Five cross combination had positive SCA effects both TKW and PGY. '1 x 4' was the most efficient hybrid for all TKW and PGY. Hybrids had positive or negative SCA effects for HT.

The average difference between parents and hybrids was generally due to heterosis for all traits. Six hybrids for TKW, five hybrids for GYP had best parent heterosis, as expected with a predominance of additive effects.

Heterosis values estimated for investigated traits in F₁ hybrids were given at Table 6. HT, TKW and PGY showed positive and negative MP and BP heterosis in all the hybrids. Heterosis values among all the crosses for HT varied from 1.1 % to -2.2 % and 0.5 % to -5.0 % for mid-parent (MP) and best-parent (BP) heterosis, respectively. MP and BP heterosis values reached to 12.9 % and 10.3 % for TKW, 37.7 % and 23.9 % for PGY, respectively. Especially for PGY, there were very high heterosis values in '1 x 4', '1 x 5', '3 x 6' and '5 x 6' hybrids which had highest PGY among the hybrids. Of 15 crosses, MP heterosis were found to be increasing effects in 10 crosses for early HT, in 11 crosses for high TKW, in 9 crosses for high PGY. One, six and five F₁ hybrids were in the range of best-parental values, indicating over dominance for HT, TKW and PGY, respectively.

When the correlations were calculated using the hybrids or the parents separately, the relationship between PGY, HT and TKW remained non significant (data not shown).

Table 5. Value of general combining ability (GCA) and specific combining ability (SCA) in heading time (HT), thousand kernel weight (TKW) and plant yield (PY) of parents and their F₁ progeny in durum wheat

Parents and crosses	HT, days	TKW, g	PY, g
GCA			
(1) Kunduru 1149	1.598	-0.302	-0.375
(2) Cakmak 79	0.917	-1.684	0.205
(3) Beyaziye	0.654	1.508	0.18
(4) Bagacak	1.442	1.979	-0.018
(5) Diyarbakir 81	-1.783	0.57	0.209
(6) Duraking	-2.827	-2.071	-0.2
<i>gi</i> ⁺ (0.05)	0.018	0.056	0.009
SCA			
1 x 2	0.897	2.862	0.254
1 x 3	0.159	1.168	-0.334
1 x 4	0.372	3.366	0.627
1 x 5	1.597	1.046	0.65
1 x 6	-2.36	-3.944	-0.779
2 x 3	-1.159	-0.301	-0.106
2 x 4	0.303	-2.383	-0.496
2 x 5	-1.722	0.098	-0.108
2 x 6	-0.178	1.958	-0.089
3 x 4	0.816	0.266	-0.128
3 x 5	-0.71	-0.644	-0.475
3 x 6	-0.916	1.526	1.471
4 x 5	-1.997	-1.265	0.128
4 x 6	-0.453	1.875	-0.003
5 x 6	1.272	0.515	0.467
<i>Sij</i> ⁺⁺ (0.05)	0.136	0.421	0.069

⁺ = Critical differences between GCA effects of parents

⁺⁺ = Critical differences between SCA effects of the F₁ hybrid

The best performed hybrid, '3 x 6', outyielded the best yielding parents at 23.9 %. The average yield advantage for '1 x 5', '3 x 6' and '5 x 6' hybrids over MP heterosis were 18.9, 37.7 and 18.5 %, respectively (Table 6). These levels of heterosis are greater than the 15% claimed by Boland and Walcott (1985) to be minimum level of heterosis required for the viable commercial production of hybrid wheat using the cytoplasmic male sterility fertility restoration system. The results obtained in this study indicate that the levels of yield performance and heterosis comparable with those reported by others (Topal et al., 2004; Budak, 2001; Bitzer and Fu, 1972).

The highest yielding hybrids in these experiment, '1 x 5', '3 x 6' and '5 x 6' exhibited the highest level of heterosis. This observation emphasizes that it is absolute yield similar magnitude of heterosis which is important, as heterosis is a real measure dependent on both hybrid and parental performance. This is not correlated the finding of Uddin et al. (1992), emphasized grain yield more important than heterosis.

Table 6. Heterosis values (%) over mid-parent (MP) and better parent (BP) for heading time (HT), thousand kernel weight (TKW) and plant yield (PY) in durum wheat crosses

Crosses	HT		TKW		PY	
	MP, %	BP, %	MP, %	BP, %	MP, %	BP, %
1 x 2	0.5	0.54	12.86	10.34	4.29	-9.93
1 x 3	-0.07	0.16	7.22	0.87	-2.5	-12.37
1 x 4	0.27	0.46	12.65	4.77	15.96	6.39
1 x 5	1.1	3.4	5.49	0.09	18.85	7.31
1 x 6	-2.22	0.66	-6.75	-9.56	-9.24	-9.39
2 x 3	-1.59	-1.4	2.01	-6.06	-2.39	-6.75
2 x 4	-0.3	4.37	-3.55	-12.17	-10.73	-16.55
2 x 5	-2.01	0.16	1.57	-5.68	-1.4	-6.29
2 x 6	-0.99	1.89	8.63	7.78	0.88	-12.8
3 x 4	0.11	0.54	2.96	1.71	0.16	-1.89
3 x 5	-1.26	0.73	-0.51	-1.41	-3.77	-4.27
3 x 6	-1.59	1.07	6.58	-2.55	37.67	23.92
4 x 5	-2.09	0.32	-2.11	-4.16	6.08	4.24
4 x 6	-1.07	2.05	7.31	-2.97	6.26	-2.34
5 x 6	0.16	0.82	2.39	-5.6	18.49	7.16
Mean	-0.74	1.05	3.78	-1.64	5.24	-2.24

The observed level of heterosis of '1 x 2', '1 x 4', '1 x 5', '3 x 6', '4 x 5', '4 x 6' and '5 x 6' was above the value estimated by Brown et al. (1966) (13%), Bitzer and Fu (1972) (9.6%), Rajaram (2001) (11%) as being required to sustain the hybrid wheat production. The coefficient of variation values were low all characters in this study (Table 3). These values indicate that reliable information can be obtained from small plot experiments. This is consisted with the study of Uddin et al. (1992). High heterosis of hybrids for the traits suggested the possible exploration of durum hybrids to raise grain yield potential within the existing genetic variation. Also some hybrids can be successfully designed to capitalize on contrasting heterotic groups present in less adapted parents carrying alien substitutions and translocations, for example, or in genotypes with a more extreme expression of yield components.

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Prediction of The Lower Calorific Value on the Lignite Coal by Using Decision Trees

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Abstract: The Determination of the lower heat value (LCV) of lignite coals used in thermal power plants is very important for energy production. The determination of this thermal value is carried out in a laboratory environment and this process effects as time and labor cost to the enterprises. The model was designed based on data obtained from the laboratory analyses of raw coals from the pits of Garp Lignite Enterprise operating under the General Directorate of Turkish Coals and raw coals extracted from the mining areas of Celikler Seyitomer Lignite Company. In this study, it is aimed to reduce the costs of enterprises through the software developed using decision trees. Using Weka package program, models are created by using LCV value of coal, J48, Random Forest, Random Tree, REP Tree, M5P decision trees classification techniques. It is found that the most suitable decision tree model is constructed with J48 (correct classification rate 67.48%). The tree codes created with J48 are written using the Java programming language. As a result, the model is developed that can be efficiently used to find the LCV value of a coal without requiring laboratory analysis.

Key words: Garp Lignite Enterprises, Coal Analysis, Tunçbilek Coal, Seyitömer Coal, Decision Trees

1. INTRODUCTION

Lignite coal is one of the major energy sources in the world and in Turkey. “Due to the low energy content, high ash and humidity, lignite coals are not preferred for home heating. It is usually used in thermal power plants or in liquid metal industry. In Turkey coal reserves are approximately 3.2% of the total world reserves. Installed capacity of coal-based power plant in Turkey at the end of 2016 is 17.316 MW. This value corresponds to 22.1% of total installed power. In 2016, a total of 92.3 TWh of electricity has been produced from coal-based power plants, with a share of 33.9% in total electricity production.” (ETKB, 2018)

Turbines are used to rotate generator rotors in thermal power plants. Steam must be provided at high pressure and temperatures to turn these turbines. For this reason, coal is burned. For an efficient heat and pressure cycle, the heat must be maintained at a constant value.

During metal production, metal melting is performed by burning coal in blast furnaces. While 70% of the production is done by these and similar methods, 60% of the costs are allocated to the raw material to provide quality energy. (De Castro et al., 2013)

Laboratory analysis is needed to understand the lower calorific value of the coal mine. These analyses also burden businesses in terms of time and cost. The aim is to model a decision mechanism that is simpler, cheaper and usable in coal fields mining. At the same time, efficient use of these and similar energy sources will reduce carbon footprint.

2. MATERIALS AND METHODS

Data

The data used to construct the decision tree model is provided by Türkiye Kömür İşletmeleri Kurumu Garp Linyitleri İşletmesi Müessesesi Müdürlüğü and Çelikler Seyitömer Linyit İşletmeleri A.Ş.. There are moisture, original ash, dry volatile matter, dry ash, dry sulphur, lower calorific value (LCV) of 2500 coal samples obtained by systematic or random sampling and laboratory analysis of the sample in the data set.

A decision tree is a conditional flow diagram. For create this diagram, the frequencies of the variables in the data set are looked at gradually, and the branch with high information gain becomes the root of the decision tree. Similar processing is repeated for the branches.

The raw data from the laboratory are in numerical values. In order to make this available with decision trees, the data values (v) is discretized as follows;

$v \geq \min$ and $v < Q1$ is YOK
 $v \geq Q1$ and $v < \text{median}$ is AZ
 $v \geq \text{median}$ and $v < Q3$ is ORTA
 $v \geq Q3$ and $v \leq \max$ is ÇOK

The results of visualization of the discretization process is shown in Figure 1.

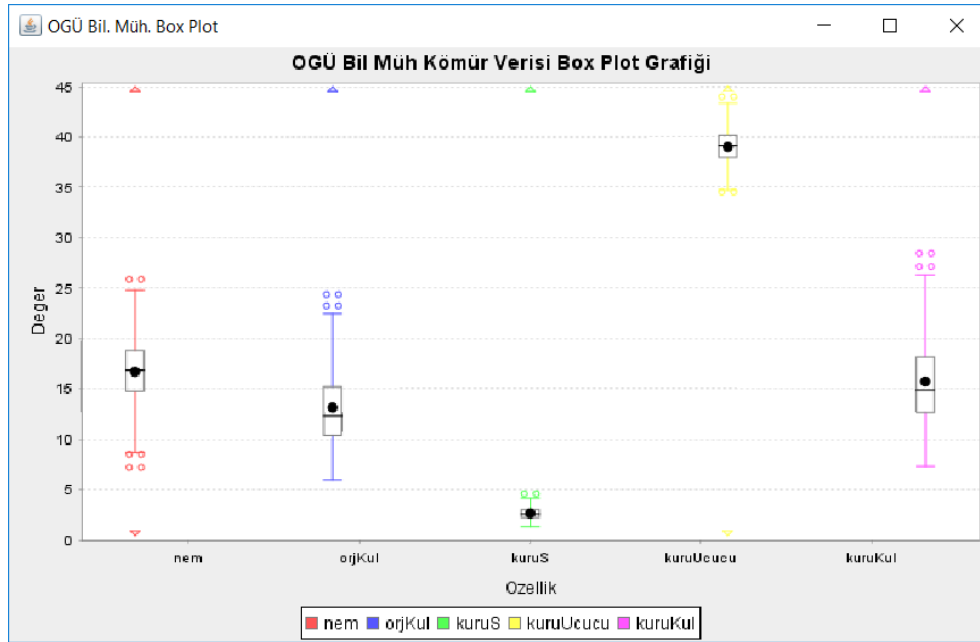


Figure 1. Dataset Box Plot Graph

Method

Later, the data set was exposed to mining operations with decision tree algorithms by using Weka 3.8. (Frank et al., 2016). During this process, the application parameters are left fixed in the application default values. The success of developed models which is decision tree algorithms were calculated with 10-fold cross validation metric.

3.RESULTS AND DISCUSSION

Results

Firstly, the Random Tree (Breiman, 2001) classification algorithm was used to classify the data. The classification results obtained by using the Random Tree algorithm are shown in Table 1. When the results in the Table 1 are examined, it is seen that the performance of the Random Tree algorithm in classification is 63.4%.

Table 1. Classification Results of Random Tree Algorithm

a	b	c	d	<-- classified as
451	21	151	1	a=YOK
6	392	152	75	b=ORTA
159	150	311	4	c=AZ
4	158	34	431	d=ÇOK
Correctly Classified Instances		1585	63.4 %	
Incorrectly Classified Instances		915	36.6 %	

Secondly, similar algorithm which the Random Forest (Breiman, 2001) classification algorithm was used to classify the data. The classification results of the Random Forest algorithm are shown in Table 2. It is seen in the Table 2 that the performance of the Random Forest algorithm in classification is 63.76%.

Table 2. Classification Results of Random Forest Algorithm

a	b	c	d	<-- classified as
437	10	176	1	a=YOK
4	355	164	102	b=ORTA
138	129	351	6	c=AZ
3	133	40	451	d=ÇOK
Correctly Classified Instances		1594	63.76 %	
Incorrectly Classified Instances		906	36.24 %	

Then another classification method, the M5P (Quinlan, 1992; Wang and Witten, 1997) algorithm, was used for classification. Table 3 shows the classification performance results of the M5P algorithm. When analysing the analysis results in Table 3, it is seen that this method has 66.72% of classification success.

Table 3. Classification Results of M5P Algorithm

a	b	c	d	<-- classified as
435	13	175	1	a=YOK
3	381	170	71	b=ORTA
105	115	398	6	c=AZ
0	130	43	454	d=ÇOK
Correctly Classified Instances		1668	66.72 %	
Incorrectly Classified Instances		832	33.28 %	

The classification results obtained by using the Rep Tree (Witten et al., 2011) algorithm are seen in Table 4. This algorithm is used the 66.84% in the successful classification.

Table 4. Classification Results of Rep Tree Algorithm

a	b	c	d	<-- classified as
438	8	177	1	a=YOK
2	393	161	69	b=ORTA
116	114	389	5	c=AZ
0	125	51	451	d=ÇOK
Correctly Classified Instances		1671	66.84 %	
Incorrectly Classified Instances		829	33.16 %	

Finally, for the classification, the classification results of the J48 algorithm, usually known as the algorithm C4.5 (Quinlan, 1993), are given in Table 5. It is seen in the Table 5 that the performance of the J48 algorithm in classification is 67.48%. The success of the 5 algorithms used in our study are shown in Figure 2. It can be said that the classification in Figure 2 and the Tables is close to one of the successes. We also preferred the J48 algorithm in the creation of decision tree, the next process of our work. The basic structure of the decision tree obtained by using the J48 algorithm is shown in Figure 3.

Table 5. Classification Results of J48 Algorithm

a	b	c	d	<-- classified as
427	10	186	1	a=YOK
3	395	158	69	b=ORTA
101	106	411	6	c=AZ
0	126	47	454	d=ÇOK
Correctly Classified Instances		1687	67.48 %	
Incorrectly Classified Instances		813	32.52 %	

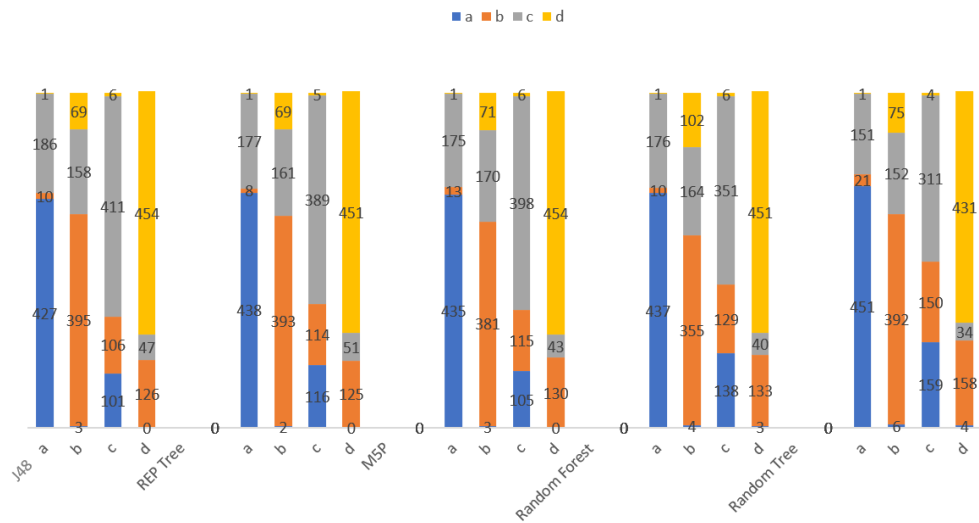


Figure 2. Comparison of the performance of the five different algorithms used in our work

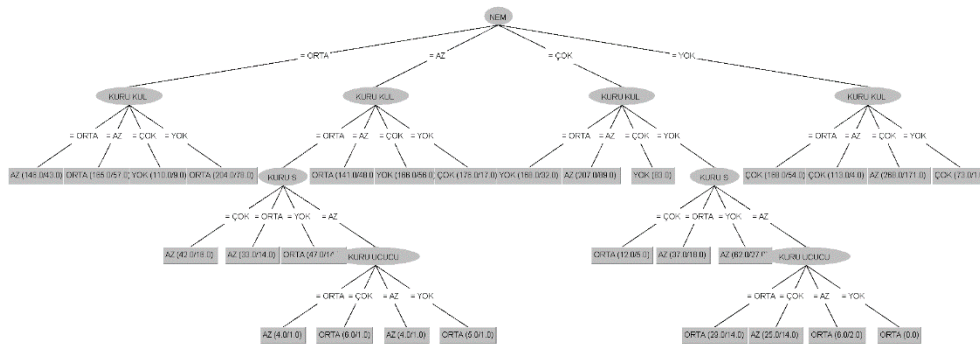


Figure 3. Decision Tree by using J48 algorithm

In this tree, first number in node is total sample count and second number is false classified sample count. This decision tree is usable in the mining processing.

Discussion

Our result show that some data attributes (original ash, dry volatile matter, dry sulphur) minor priority variable than the other variables.

The success of the classification of the new model by eliminating less important variables is shown in Table 6. The decision tree obtained by eliminating the variables is shown in Fig 4. When the results are examined, elimination of the variables does not make a significant contribution to the classification success. However, the reduction of variables will reduce the runtime of the program being written and the number of lines in the program.

Table 6. J48, Random Forest, REP Tree Results

a	b	c	d	<-- classified as
430	3	190	1	a=YOK
2	399	155	69	b=ORTA
95	126	397	6	c=AZ
0	123	50	454	d=ÇOK
Correctly Classified Instances		1680	67.2 %	
Incorrectly Classified Instances		820	32.8 %	

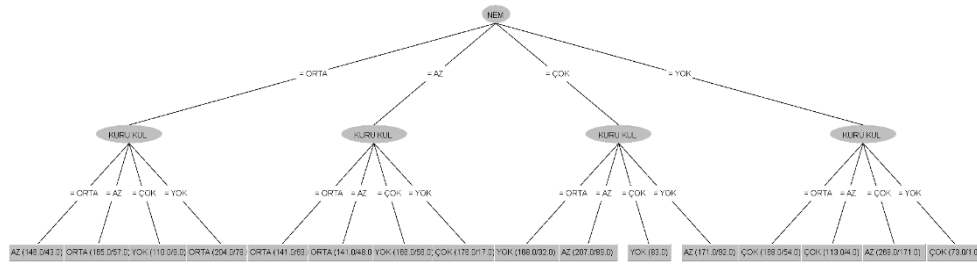


Figure 4. The decision tree obtained by eliminating the less important variables

An application has been developed with the Java programming language for both decision trees in Figure 5. According to this decision tree, it is seen that the classification achieved by giving the same data is 67.2%. These results show that the developed software can be used in estimating the lower calorific value. This achievement is not satisfactory, we think that success of developed software will increase by diversifying the data from other mineral fields.

Figure 5. Application User Interface

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The Effects of Different Ph Semen Extender of *Capoeta trutta* on Post-Thaw Motility Rate

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Abstract: Aim of this study was testing the effect of dimethyl sulfoxide (DMSO, (CH₃)₂SO) as cryoprotectant agents with diluent at four different pH (7.2, 7.6, 8.0 and 8.4) on the cryopreservation process of longspine scraper-*C. trutta* sperm. In this study, the sperm of *Capoeta trutta* (Heckel, 1843) which is widespread distribution in Turkey, Iran, Iraq and Syria, was cryopreserved. The changes in post-thaw motility rate of frozen *C. trutta* sperm using 4 different pH diluents were investigated. The glucose diluent at pH 7.2 gave the best results as spermatozoa motility rate (88.75 ± 1.25%), so it can be considered as the best option for the highest spermatozoa motility rate.

Keywords: Sperm Freezing, Osmolality, Extender, Cryoprotectant, Sperm Quality

1. INTRODUCTION

Longspine scraper belongs to the Cyprinidae that has a wide distribution in both Euphrates and Tigris basins, natural and artificial lakes in Mesopotamia for thousands of years (Özdemir, 1983; Polat, 1987; Ünlü, 1991; Şevik, 1993). It was being caught for commercial fishing and also for the fishing as a sport. Using liquid nitrogen for storing the fish sperm becomes successful and thus is being used for more than 200 species (Brown and Brown, 2000), although this technique is reported as successful, the protocol using for applying liquid nitrogen differs as per species. For Cyprinidae, semen cryopreservation has been examined in many species such as the common carp *Cyprinus carpio* (Kurokura et al., 1984; Koldras and Bieniarz, 1987; Babiak et al., 1995) in the asp, *Aspius aspius* (Babiak and Glogowski, 1998); in the zebra fish, tawes carp-*Puntius gonionotus*, *Labeo rohita*, grass carp-*Ctenopharyngodon idella*, bighead carp- *Aristichthys nobilis* (Withler, 1982). Protocols for cryopreservation of semen has been improved for also species of cyprinidae such as the razorback sucker, the curimbata, *Xyrauchen texanus* (Tiersch et al., 1998); *Prochilodus scrofa*; and the dourado, *Salminus maxillosus* (Coser et al., 1984). It is known that the composition of additives, concentration of cryoprotectant and method of freezing could affect the success of cryopreservation (Sansone et al., 2002; DeGraaf and Berlinsky, 2004). Using ethylene glycol (EG), methanol, glycerol and dimethyl sulfoxide (DMSO) or dimethyl acetamide (DMA) for the cryopreserving the common carp sperm could affect the sperm motility after thawing process and/or hatching process or fertilization (Lahnsteiner et al., 2000; Linhart et al., 2000). Besides, it was observed that using DMSO in equilibration could cause damaging effects to carp sperm (Lubzens et al., 1997), and also other comparative DMSO studies revealed that methanol, glycerol and DMA has a better suitability for freezing the carp sperm (Lakra and Krichna 1997). Although, there has been considerable research on semen preservation in teleosts (Kurokura et al., 1984; Cognie et al., 1989; Zhang and Liu, 1991 Linhart et al., 1988), there is no available data about the *C. trutta* sperm and its cryopreservation.

In order to manage and conserve the species, it is critical to have the knowledge of reproductive biology and physiology. This also allows the prevention of species from extinction and thus, males could be utilized in natural and artificial reproductive programmes (Wildt et al., 2010). Mostly, the immobility of fish spermatozoa is seen in the seminal tract and the motility of sperm is commenced by means of hyposmotic environment in fish species living in fresh water (Morisawa and Suzuki, 1980). In previous studies, Doğu et al. (2015) reported the values of *C. trutta* that the mean values of semen (µl), motility (%), motility duration (sec), concentration (× 10⁹/ml) and pH were 150.71±6.91; 67.74±1.01; 65.74±1.40; 19.68±0.74 and 7.22±0.01 respectively. Özgür and Gürçay (2016), was stated that the motile activity of spermatozoa was evaluated to some parameters characterizing sperm movement which has known that; VSL (µm/s); straight line velocity, VCL (µm/s); curvilinear velocity, VAP (µm/s); the angular path velocity, STR (VSL/VAP)(%); straightness, LIN (VSL/VCL) (%), the linearity, BCF (Hz); beat crass frequency, ALH (µm), amplitude of lateral head displacement and MAD; mean angular displacement in spermatozoa of *Capoeta trutta*. According to results, motility parameters were determined to 13.09, 74.01, 29.88, 42.44, 21.42, 8.81, 15.56 and 0.02, respectively.

As well as several factors could affect the motility of sperm such as; osmolality, pH and temperature (Alavi and Cosson, 2006; Alavi et al., 2006). It is necessary to make and analyze studies which are made on the effects of those above mentioned factors to set up a standard activating agent and immobilizing media in order to improve those techniques using during fertilization and preservation process (Alavi et al., 2009).

pH is known as the most activating factor for sperm of fish species (Stoss, 1983). The fertilizing capacity of the sperm could also be affected by the the activating solution pH (Billard et al., 1995). Ideal motility rate in sperm of *Cyprinus carpio* was observed at pH 7.0 and 8.0 (Cosson et al., 1991).

Purpose of this study was testing the dimethyl sulfoxide (DMSO, (CH₃)₂SO) as cryoprotectant agents at four different pH (7.2, 7.6, 8.0 and 8.4) on the cryopreservation process of longspine scraper-*C. trutta* sperm.

2.MATERIALS AND METHODS

This study was carried out on the species called longspine scraper living in Atatürk Dam Lake (37°23' 9 "03"N, 38°34'38"05"E) by the Department of Bozova Vocational High School, Şanlıurfa. During the study, it was captured in the middle of the spawning season on June 2016. The longspine scrapers (n=10) were fished by using gill nets (42mm×42mm-55mm×55mm) at Atatürk Dam Lake and those fish which were selected randomly, were kept under the temperature of natural lakewater (23.00±4.80°C) with oxygen rate (8.44–9.28mg/l), pH (8.05–8.322). YSI Environmental (YSI 85) was used to measure those parameters of the areas from where samples were taken were measured by using YSI Environmental (YSI 85) in terms of physico-chemical features. Fiberglass tanks were filled with lake water and were used to take those samples to the laboratory. Several scales were used to determine the age of fish by using a stereo microscope (Nikon SMZ 2T stereo). Captive longspine scraper size ranged between 260.00 and 390.00g (mean 335.00±27.23g) in body weight and 30.00 and 34.00 cm (mean 32.80 ±0.93 cm) in total length. Fish age ranges from 5 to 8 years old. Samples taken from milt were put into tubes in order to collect sperms and a gentle manual pressure to abdomen was applied. After the sperm collection process, those tubes which contain sperm were put into a polystyrene box filled with crushed ice (5±2°C). Sperm samples were carefully protected from contamination due to water, urine or faeces.

After those sperm samples were collected, a light microscope with the magnification feature ×400 (Nikon SMZ 2T stereo) was used to observe samples of which 5 µL was examined on a glass slide. Since it is required to obtain an immotile fish sperm to be examined in seminal plasma, when sperm motility occurred, contact in water or any urine involvement was considered as the cause of motility and thus, the sample was not used and eliminated from the study. In immotile samples (n=10 males), the motility of sperm was activated by using 50 mM NaCl (pH 8.0), and for the activating agent, this triggered sperm mobility was used and light microscope was used for estimating it subjectively (Linhart et al., 2003, Aral, 2009). In the subsequent analyses, it is required to use the samples which has only samples at least 80% motile sperm. The ratio of motility and immobility in terms of cells, was estimated in order to the proportion of motile and non-motile cell was estimated in order to determine the motility rate visually as being in tree times more. The rate of motility was estimated the proportion of progressive motile spermatozoa in a microscope field and it can be determined the motility rate visually as being in tree times in different field in a microscope. The duration of sperm motility was subjectively evaluated as the time elapsed from activation until 5% of the spermatozoa maintained forward swimming activity. The osmolality of sperm (approximately 500 µL) from each male was measured at room temperature cryoscopically (Osmometer 3250, Advanced Instruments INC, Massachusetts, USA). Hemocytometric method was used to determine spermatozoa concentration which was expressed as number of spermatozoa ×10⁹/ml. Firstly, in order to dilute the milt in a 1.5-ml test tube, a distilled well water in the amount of 990 µl was mixed with milt in the amount of 10 µl and then the dilution was mixed by using a vortex mixer. The result was obtained after the number of milt cells was counted in a known haemocytometer volume (Thoma chamber, American Opticals, Buffalo, NY).

The freezing medias, including four different pH were used (Table 1). After the sperm collected and exanimated, it was cooled and diluted at 4°C. 350mM glucose (Merck-108337 Chemical Corp) was used as extender. Osmolality of the extenders were measured and set with osmometer as 325 mOsm/kg cryoscopically (Osmometer 3250, Advanced Instruments INC, Massachusetts, USA). Then, extenders were adjusted to four different pH values using with HCl or deiyonized water as: 7.2, 7.6, 8.0 and 8.4 respectively. After that, each extenders were mixed with cryoprotectants (Dimethyl Sulfoxide (DMSO, (CH₃)₂SO) (Merck-102953).

The sperm samples, which were taken from each male, were diluted in each medium with the ratio of 1:5 (sperm: total volume) (10 males × 12 media). After the dilution process; samples were examined under light microscope and it was tried to confirm if the initiation of sperm motility would be prevented by all additive-cryoprotectant combinations or not. The percentage of the motile sperm could be annotated if the motility rate was observed. In order to obtain the optimum proportion including 80% additives, 10% cryoprotectants and 10% sperm, those sperm samples which were taken from 10 males, loaded in freezing medium and they were equilibrated in crushed ice (4±2°C) for 30 min. Before equilibration, sperm samples were diluted into 0.5-mL straws were used to dilute the sperm samples and then they were sealed by using with a metallic globule, at room temperature. A nitrogen vapor tank was used in order to freeze straws (Air Liquide–DMC, Parc Gustave Eiffel, Gutenberg, France) at approximately -110°C and then those frozen straws were kept in liquid nitrogen (M.V.E. Millenium, XC 20, Chart, MN, USA). After 7 days, samples were thawed for 10 s by using a water bath at 35°C (Maria et al, 2006) and motility rate after the above mentioned thawing process (as percentage of motile sperm) and the duration of motility were immediately estimated (as described for fresh sperm).

Table1. Four freezing media at different pH used in the experiment

No	Extender	pH	Cryoprotectant
1	0.3 M Glucose	7.2	DMSO %10
2	0.3 M Glucose	7.6	DMSO %10
3	0.3 M Glucose	8.0	DMSO %10
4	0.3 M Glucose	8.4	DMSO %10

DMSO: Dimethyl Sulfoxide

The mean was \pm SD and expressed as values used in this analysis. SPSS program version 14.0 was used to perform statistical analyses. Univariate analysis was used in order to test the data for normal distribution and Tukey's post hoc test was made after ANOVA was being used for significant differences. The significance level was kept at 5% ($P < 0.05$) for all statistical tests.

3.RESULTS AND DISCUSSION

Results

Age groups of 10 *C. trutta* specimens from Atatürk Dam Lake ranged from 2 to 3 years old. The motility rate of sperm which were cryopreserved in twelve freezing media after the thawing process is shown (Table 1). Fresh sperm, which were taken from 10 male, were processed in this research and included a mean of $85.00 \pm 3.53\%$ spermatozoa motility rate, duration of motility 365.00 ± 9.00 s, spermatozoa volume of 157.50 ± 30.65 μ l, $7.69 \pm 2.83 \times 10^9$ spermatozoa ml⁻¹ and 294.75 ± 3.47 mOsmol kg⁻¹ (Table2). The samples which were cryopreserved using DMSO with pH 7.2 ($88.75 \pm 1.25\%$) resulted with greater motility (Table 3). We determined significant interaction between cryoprotectant and extender pH on the post-thaw motility duration ($P < 0.01$). So, cryoprotectants and extender pH were tested separately (Table 4).

Table 2 Body weight and fresh sperm features of *C. trutta*

Features	n	Mean \pm SD	Range
Total weight (g)	10	335.00 ± 27.23	260.00-390.00
Total length (cm)	10	32.80 ± 0.93	30.00-34.00
Spermatozoa Motility Rate (%)	10	85.00 ± 3.53	70.00-90.00
Spermatozoa Motility Duration (s)	10	365.00 ± 9.00	350.00-390.00
Spermatozoa Volume (μ l)	10	157.50 ± 30.65	100.00-220.00
Spermatozoa Concentration ($\times 10^9$ mL ⁻¹)	10	7.69 ± 2.83	2.30-13.35
Osmolality (mOsmL kg ⁻¹)	10	294.75 ± 3.47	285.00-301.00

Discussion

Table 3. Motility rate (mean \pm SD; n=3 replicate straws \times 10 males) of *C. trutta* sperm cryopreserved in extenders at 4 different pH.

Cryoprotectant (10%)	Diluent pH (Glucose) (80 %)	N	Spermatozoa Motility Rate (%)	
			Mean \pm SD	Range
DMSO	7.2	10	88.75 ± 1.25 a	50.00-90.00
DMSO	7.6	10	82.50 ± 4.78 a	50.00-90.00
DMSO	8.0	10	78.75 ± 4.26 a	30.00-90.00
DMSO	8.4	10	75.00 ± 6.12 b	50.00-85.00
Total		40	81.25 ± 3.21	30.00-90.00

a, b: Different letter superscripts indicate means that were significantly different ($P < 0.05$).

The environmental pH has a regulatory and also indirect role and could be revealed by means of those changes occur in intracellular pH (Parrish et al., 1989; Márián et al., 1997). However, this possibility is ruled out by Márián et al. (1997) experimental finding that any changes occur relatively in pH of the suspending medium did not affect the intracellular pH. The four additives pHs (7.2, 7.6, 8.0 and 8.4) tested in present study affected post-thaw motility rate, but did not affect post-thaw duration of motility. Similarly, Márián et al. (1997) reported that alkaline pH of the environment reveal any effect on the duration of motility.

Glucose is a common additive for preserving the fish sperm. Buffered additives are commonly used during the cooling process for preventing the accumulation of sperm metabolites, therefore it prevents any changes in sperm pH and accordingly any damages to be occurred in the sperm cells (Chen et al., 2004). By using three different additives (202, 335 and 363 mOsm) at different pH values (6.7, 8.2 and 6.5 respectively) in order to cryopreserving the sperm of turbot *Scophthalmus maximus*, best results were obtained at pH 8.2. For the cryopreservation of different species such as dusky grouper (Sanches et al., 2008), Brazilian flounder (Lanes et al., 2008) and fat snook sperm (Tiba et al., 2009), the same pH value is successfully used. But, in this study we had the best motility rate with DMSO at pH 7.2. DMSO in alkaline environment (intracellular pH) may be caused to increase intracellular pH of spermatozoa. This situation may have led to a decrease in sperm motility. Changes in motility may be formed in a long time in developing non-physiological changes in intracellular pH. Hypoosmotic shock caused the intracellular pH become being at more alkaline values. Márián et al. (1997) reported that the alkaline pH of the cytoplasm could cause a decrease in the motile fraction in common carp sperm.

In addition, these differences could be due to the differences in species. Because, former studies show that the additive pH plays an important role for the determination of success in cryopreservation process. It is reported that the best mobility rates for common carp were found at pH 7–8 (Linhart and Cosson, 1997). Besides, the intracellular spermatozoa pH of mammals was determined as almost 6.5 using with pH-sensitive fluorescent probes. After the in vitro capacitation, bicarbonate- containing media (at pH 7.4) were founds as intracellular pH>0.3 units (Zeng et al., 1996; Babcock 1983; Florman et al., 1989; Navarro et al., 2007). When is prevented by glucose incubation, bovine sperm fail to capacitate (Parrish et al., 1989; Galantino-Homer et al., 2004). A similar situation may have occurred in these fish species. High diluent pH may be due to increase the intracellular pH, so this can be lowered duration of post-thaw motility.

As a consequence of our study, post-thaw motility results response to extender pH, resulting in high spermatozoa motility rate in DMSO at 7.2, 7.6 and 8.0 pH; and also cause an increase in the duration of motility.

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The Accumulation of Heavy Metal Levels in Some Rainbow Trout Tissues from Karkamış Dam Lake, Şanlıurfa, Turkey

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Abstract: Organic substances, industrial wastes, petroleum derivatives, artificial agricultural fertilizers, detergents, radioactivity, pesticides, inorganic salts, artificial organic chemicals are specified as pollutants of rivers. Even when toxic substances are present in low concentrations in water (eg 1 mg / L), they can cause toxic effects by damaging human health. Cr, Cu, Zn, Pb, Fe, and Ni are heavy metals that can carry toxic effects and have risk for human and animal health. This study was conducted to determine some heavy metal (Cr, Cu, Zn, Pb, Fe and Ni) levels in muscle, gills and livers of rainbow trout. In the study, the muscle, gill and liver (n=95; in µg/g wet weight) heavy metal concentration of rainbow trout were Cr (0.11±0.02), (0.11±0.01) and (0.07±0.01); Cu (1.28±0.08), (3.26±1.07) and (5.81±3.69); Zn(6.39±2.64), (39.62±2.64) and (17.12±1.01); Pb (0.03±0.00), (0.01±0.00) and (0.03±0.00); Fe (9.17±3.92), (23.69±1.18) ve (45.35±2.68) and Ni (0.07±0.01), (0.08±0.00) and (0.05±0.00) respectively. The results indicate that slightly polluted this damlake might have no negative impact on fish populations that inhabit this damlake.

Keywords: Heavy metal, Accumulation, Tissue, Trout, Türkiye

1.INTRODUCTION

The toxicity of metals depends on the metal type and concentration, the period of exposure and other factors. Also, metals join in the food chain and are responsible for adverse effects and death in the aquatic organisms (Farkas et al. 2002). In addition to this contamination causing an adverse effect on aquatic biota, the metallic contaminants can be ingested by humans through consumption of the seafood products (Farombi et al. 2007).

It is known that heavy metals are the most important forms of pollution and they may accumulate in the tissues of fish which are often at the top of the aquatic food chain. Fish may concentrate large amounts of metals from the water and they might be toxic for human consumption (Papagiannis et al., 2004). The effects of trace metals on human health are of great interest today, especially for aquatic food products. Therefore, estimation of the trace metals in fish became important to estimate freshwater pollution and the risk potential of human consumption (Dural et al., 2007; Göksu et al., 2003). Likewise, many studies have been published on the trace metals in freshwater fish (Alam et al., 2002; Gümgüm et al., 1994). There are a few studies on levels of trace metals in some of the fish caught from Ataturk Dam Lake (Karadede and Unlu, 2000; Karadede et al., 2004).

The aim of the present study was to evaluate the heavy metal levels (Cr, Zn, Fe, Cu, Ni and Pb) in muscle, liver and gill of trout from Karkamış-Birecik Dam Lake. The results obtained from this study will provide information for the background levels of metals in common fish species of the lakes.

2.MATERIALS AND METHODS

The trout that constituted the research material was taken from the facilities that trout breeding in the lakes of Karkamış and Birecik Dam, located in the borders of Şanlıurfa and Gaziantep. There are totally 29 facilities in the region. Five of these facilities were randomly sampled. The seasonal sampling planned for the project was for 1 year, February 2017 (Winter) and May 2017 (Spring), August 2017 (Summer) and November 2016 (Autumn). At least 5 fish were sampled in each sample and the mean values were examined.

For the sample pretreatment, 10 mL of HNO₃ was added to 1 g of the samples, and using the Animal Tissue Method in a CEM MARS6 Microwave apparatus; Stage: 1, Power: 290-1800, Ramp TIME: 20:00, Hold TIME: 15:00, Temperature 200°C. It is subjected to burning process under the conditions of the device. After the heating process, the above-mentioned ICP-OES device was diluted to 10 mL and subjected to reading under the conditions.

Chemicals and Devices: All chemicals used in the process are supplied in analytical purity (Direct-Q 3UV Millipore Co. in the preparation of the solutions TIP-I). Ultra Pure distilled water (Bedford, MA, USA) was used. All plastic and glass materials were rinsed with 20% nitric acid (HNO₃) solution and then rinsed with ultra pure distilled water. It was obtained from 65% HNO₃ (Merck), which is used for muscle tissue disruption. Pretreatment of the samples was subjected to

incineration using the Animal-Tissue Method in the CEM MARS6 Microwave device. The determination of heavy metal concentrations was determined by ICP-OES (SpectroBlue, Germany).

Fish Production and Analyzes: Fish samples were obtained from the trout farms in Karkamış Dam Lake and transferred to the laboratory by cold chain application. Approximately $0.5 \text{ g} \pm 0.01$ muscle, liver and gill tissue were collected from 100 fish. 10 mL of 65% HNO_3 was added to each muscle, liver and gill tissue sample and subjected to incineration at Stage: 1, Power: 290-1800, Ramp TIME: 20:00, Hold TIME: 15:00, Temperature 200°C microwave device conditions. The final volume was completed to be 10 mL. In the ICP-OES instrument, the elements were measured at 1435 W, Pump Speed: 30 rpm, Coolant Flow: 13 L / min, Auxilory Flow: 0.80, Nebulizer Flow: 0.70.

3.RESULTS AND DISCUSSION

Levels of heavy metal in some tissues of fish species from coastal waters of Karkamış-Birecik Dam Lake are shown in Table 1. This study was conducted to determine some heavy metal (Cr, Cu, Zn, Pb, Fe ve Ni) levels in muscle, gills and livers of rainbow trout. In the study, the muscle, gill and liver ($n=95$; in $\mu\text{g/g}$ wet weight) heavy metal concentration of rainbow trout were Cr (0.11 ± 0.02), (0.11 ± 0.01) and (0.07 ± 0.01); Cu (1.28 ± 0.08), (3.26 ± 1.07) and (5.81 ± 3.69); Zn (6.39 ± 2.64), (39.62 ± 2.64) and (17.12 ± 1.01); Pb (0.03 ± 0.00), (0.01 ± 0.00) and (0.03 ± 0.00); Fe (9.17 ± 3.92), (23.69 ± 1.18) and (45.35 ± 2.68) and Ni (0.07 ± 0.01), (0.08 ± 0.00) and (0.05 ± 0.00) respectively.

Heavy metal levels between the organs have changed significantly except for Ni. The levels of heavy metals in the organs were Cu: muscle = gill < liver; $P < 0.001$; Zn: muscle < liver < gill; Pb: Muscle = Gill < liver = muscle; Pb: Gill < Kas = Liver; Fe: Muscle < gill < Liver and Ni: Liver < Muscle = gill.

Table 1. Levels of heavy metal in muscle, gill and liver tissues of fish species from coastal waters of Karkamış-Birecik Dam Lake are shown in Table 1.

Heavy Metals	Tissues	N	Mean \pm Std. Error	Minimum	Maximum
Cr $P < 0.05$	Muscle	95	0.11 ± 0.02 b	0.00	1.45
	Gill	96	0.11 ± 0.01 b	0.05	0.80
	Liver	95	0.07 ± 0.01 a	0.00	0.37
Zn $P < 0.001$	Muscle	95	6.39 ± 0.32 a	0.14	20.34
	Gill	96	39.62 ± 2.64 b	4.10	159.28
	Liver	94	17.12 ± 1.01 c	0.00	73.12
Fe $P < 0.001$	Muscle	95	9.17 ± 3.92 a	0.31	376.06
	Gill	96	23.69 ± 1.18 b	3.38	84.71
	Liver	95	45.35 ± 2.68 c	0.00	153.90
Cu $P < 0.001$	Muscle	95	1.28 ± 0.08 a	0.26	5.42
	Gill	96	3.26 ± 1.07 a	0.77	87.93
	Liver	95	5.81 ± 3.69 b	0.00	198.96
Ni $P < 0.001$	Muscle	95	0.07 ± 0.01 b	0.00	0.54
	Gill	96	0.08 ± 0.00 b	0.04	0.23
	Liver	95	0.05 ± 0.00 a	0.00	0.18
Pb $P < 0.001$	Muscle	95	0.03 ± 0.00 b	0.00	0.12
	Gill	96	0.01 ± 0.00 a	0.00	0.10
	Liver	95	0.03 ± 0.00 b	0.00	0.17

The contamination of heavy metals into the flesh of fish can happen through penetration of the skin, food and gills (Fatima & Usmani, 2013). Furthermore, heavy metals are absorbed by the blood and bind to blood proteins (Fatima et al., 2013) and are distributed to all tissues of the organism and forms deposits (Thakur & Mhatre, 2015). The rate of accumulation of heavy metals in fish tissue is strongly influenced by the concentration of metal, temperature, pH, salinity and dissolved oxygen in the water (Lakshman et al., 2015).

In this present study, the measured Cr concentrations results were found range from $0.07 \mu\text{g/g}$ to $0.11 \mu\text{g/g}$. Uluoğlu et al. (2007) reported the lower value of Cr as $0.95 \mu\text{g/g}$ in tissue from our finding in tissue of rainbow trout and higher value was found as $11.8 \mu\text{g/g}$ by authors (Aucoin et al., 1999). Our Cr concentrations were lower than other study results of Cr concentrations (Mansour and Sidky, 2002).

Determination of the Zn concentrations in fish is another important subject with respect to nature management and human consumption of fish (Amundsen et al., 1997). Turkish Food Codex (2002) sets the maximum limit for Zn as 50 mg/kg d.w. in the muscles of fish. Our mean Zn concentrations were range from $6.39 \mu\text{g/g}$ to $39.62 \mu\text{g/g}$. Papagiannis et al. (2004) studied the Zn levels in freshwater fish from Lake Pamvotis (Greece), and reported Zn levels for *C. carpio* as

52.81 mg/kg d.w., respectively. The lowest zinc concentration has been reported as 30.7 µg/g and 36.92 µg/g respectively (Karadede et al., 2004; Szefer et al., 2003). The highest zinc concentration has been reported as 73.8 µg/g (Atta et al., 1995). Our zinc concentrations lower than other literature values (Papagiannis et al., 2004) and higher than (Celik and Oehlenschläger, 2004; Cid et al., 2001). They mentioned that there are no guidelines on acceptable levels of Zn in fish suggested by EEC or FAO/WHO.

Öztürk et al., (1995) found the highest level of Fe and the lowest level of Cd in the muscle, gill, air sac, stomach-intestine and liver of *C. carpio* samples in Altinkaya Dam, respectively. Also, Öztürk et al., (2008) determined the highest level of Fe in all studied tissues of *C. carpio* samples in Demirköprü Dam Lake. The result of our study (45.35 µg/g) was similar to the above studies.

In the present study, the minimum and maximum levels of mean Fe concentration values were found to be between 9.17 µg/g and 45.35 µg/g in *O. mykiss*. Fe minimum value has been reported as 102.0 µg/g (Mendil and Uluoğlu, 2007) and our Fe values were lower than other values (Karadede et al., 2004).

The concentration of Cu was found from 1.28 µg/g to 5.81 µg/g. The minimum Cu level was found in *Leuciscus cephalus* fish species and maximum Cu level was found in *Capoeta capoeta* fish species. These results have been reported as 9.46 µg/g and 3.1 µg/g, in *Leuciscus cephalus* and in *Capoeta capoeta* fish species, respectively (Szefer et al., 2003; Cid et al., 2001). Our Cu values were lower than (Atta et al., 1995) and higher than other studies (Mendil and Uluoğlu, 2007).

The mean concentrations of Ni were determined from 0.05 µg/g to 0.08 µg/g in the our samples. These results were similar with Özcan and Aktan (2012) lower than other literature reports (Mendil and Uluoğlu, 2007; Cohen et al., 2001).

Pb accumulation was highest in *C. carpio* (19.829 mg / kg) and lowest in *B. bjoerkna* (5.127 mg / kg) in liver. Pb concentrations were found to be 3.515 mg / kg (*B. bjoerkna*), 20.092 mg / kg (*C. carpio*) and 3.721 mg / kg (*C. carassius*) in the gill and 17.564 mg / kg (*C. carpio*) to 4.097 mg / kg (*C. carassius*). Some studies have reported similar results to the findings we have found (Kır and Tümantöz, 2012; Akgün et al., 2007; Öztürk et al., 2009). The maximum levels of Pb were proposed as 0.20 mg/kg d.w for muscle meat of fish (Turkish Food Codex, 2002).

Heavy metal accumulation levels were determined in trout grown in Karkamış and Birecik Dam Reservoirs, which have large reserves in terms of agricultural irrigation, flood protection and freshwater fisheries. Recorded metal concentrations are within or below the limits of previous studies. The concentrations of metals collected in fish tissues are within the limits accepted by international legislation. It has been determined that the determined heavy metals are at a level that does not threaten human health.

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Longline Fishing in Antalya City

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Abstract: This research was carried out to determine the technical and structural characteristics of the longline sets used in the fishing boats in Kaş and Kalkan provinces in Antalya city. Survey was conducted with 12 fishermen and technical and structural features of the longlines, operations, species caught and technical specifications of fishing vessels were given in tables as an evaluation of questionnaires. The overall length of the boats which are using bottom longline with a length ranging from 1000 to 4000 m, varies between 6.5 and 8.9 m in length with 9-85 Hp in engine power. The number of staff varies between 1 or 2 people and fishing is carried out at 40-150 m depth of water. Fish having economic value caught by bottom longline in the region and discarded have been identified as red porgy, dusky grouper, black tip grouper, leervis, two-banded sea bream, white sea bream, common dentex, pink dentex, Mediterranean horse mackerel, Atlantic black skipjack, bullet tuna, bogue, filefish and African threadfish having high economic value and oceanic puffer, lionfish, moray eel, shark, sea turtle, thornback, squirrel fish as discards, respectively. Bottom longline sets are used intensively from January-May and September-December. Particularly tuna and bullet tuna are also intensively caught from March to May. Fishermen set the longlines in the sea at the evening hours and collect 2-3 hours later. Longlines used two and three times per day. It was observed that longline fishermen also use gill nets at the same time.

Key words: Longline, fishing, fishing shelter, Kaş, Antalya

1.INTRODUCTION

Longline is a traditional fishing gear that is used at rocky or sandy sea bed areas to catch economically valuable fish species (Lookeborg and Bjordal, 1992). Longline is a passive fishing gear formed by connecting a large number of needles fixed by hook snood over the long body (Brandt, 1984). The development and diversity of long line and practical applications of fisheries and studies on these fishing tools have been observed under some factors such as target catch, catching area and vessel size (Ulaş and Düzbastılar, 2001).

Longline and passive catch gears are encouraged due to preserving habitat, preventing over fishing and protection purposes. Longline catching is needed to improve in terms of species and length selectivity and to gain fishing yield (Özdemir et al., 2007).

Longlines are mostly used by small-scaled local fishermen in Kaş district of Antalya especially targeting the bottom fish species (Figure 1).

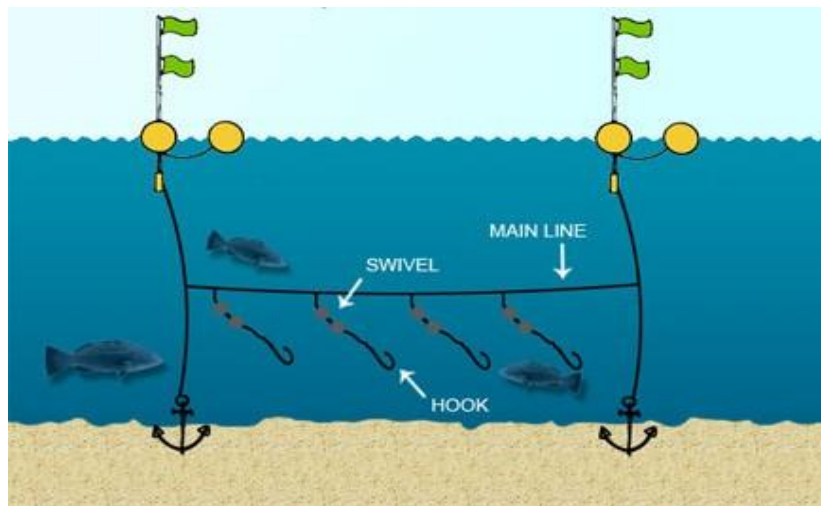


Figure 1. Longline Fishing (<http://www.hookline-fishing.com/fishing-techniques>)

2. MATERIALS AND METHODS

This research was carried out to determine the technical and structural characteristics of the longline sets used in the fishing boats in Kaş and Kalkan provinces in Antalya city (Figure 2).

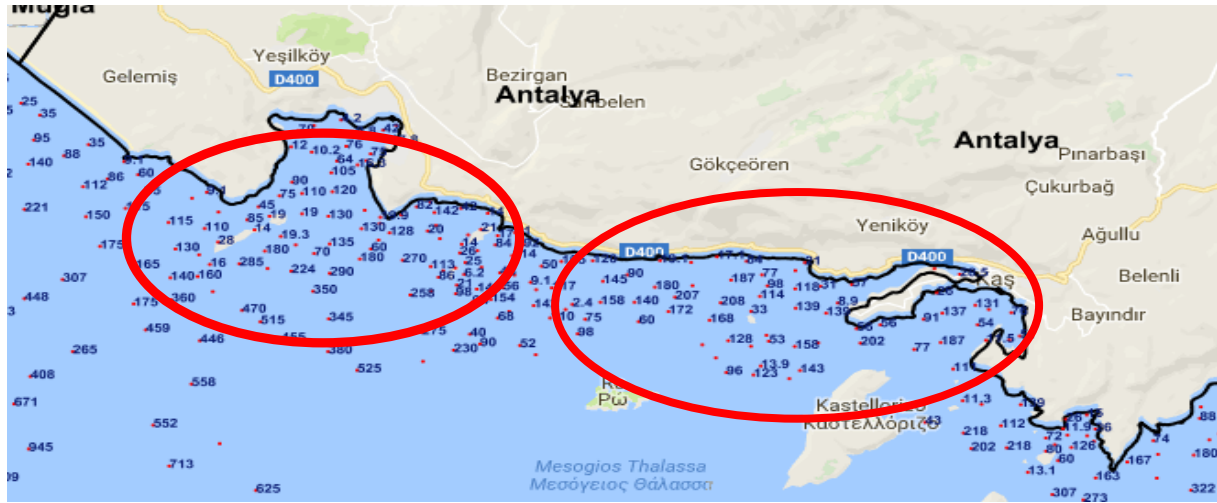


Figure 2. Research Area

Survey was conducted with 12 fishermen and technical and structural features of the longlines, operations, species caught and technical specifications of fishing vessels were given in tables as an evaluation of questionnaires.

3. RESULTS AND DISCUSSION

The overall length of the boats which are using bottom longline with a length ranging from 1000 to 4000 m, varies between 6.5 and 8.9 m in length with 9-85 Hp in engine power (Table 1-2). The number of staff varies between 1 or 2 people and fishing is carried out at 40-150 m depth of water (Table 3). Fishermen set the longlines in the sea at the evening hours and collect 2-3 hours later. Longlines used two and three times per day. It was observed that longline fishermen also use gill nets at the same time.

Table 1. Technical characteristics of fishing vessels

Vessel Number	Vessel length	Motor power (Hp)	Number of employees
T1	7,9	28	2
T2	7,4	28	2
T3	8,05	28	2
T4	7,9	11,5	2
T5	7,9	28	2
T6	7,25	9	2
T7	6,5	13	2
T8	7,5	28	1
T9	7,1	9	2
T10	8,9	85	2
T11	8,7	28	2
T12	7,5	28	2

Table 2. Technical characteristics of longline

Type	Length	Number of hook and No	Monofilament No	Hook snood
Bottom	3000	300/10-11	0,8	0.4-0.6
Bottom	3000	300/10-11	0,8	0.4-0.6
Bottom	2000	200/10-11	0,8	0.4-0.6
Bottom	3000	300/10-11	0,8	0.4-0.6
Bottom	1500	150/10-11	0,8	0.4-0.6
Bottom	4000	400/10-11	0,8	0.4-0.6
Bottom	3000	300/10-11	0,8	0.4-0.6
Bottom	3000	300/10-11	0,8	0.4-0.6
Bottom	1000	200/10-11	0,8	0.4-0.6
Bottom	1500	200/10-11	0,8	0.4-0.6
Bottom	2000	250/10-11	0,8	0.4-0.6
Bottom	1500	200/10-11	0,8	0.4-0.6

Table 3. Depth, location and bait

Depth & Location	Bait
40-150 m	Sardine, Chub mackarel,
Kaş /Kalkan	Cuttlefish, Squid

Bottom longline sets are used intensively from January-May and September-December. Particularly little tuna and bullet tuna are also intensively caught from March to May (Table 4).

Table 4. Fishing periods

Vessel No	January	February	March	April	May	June	July	August	September	October	November	December
T1	X	X	X						X	X	X	X
T2	X	X	X	X	X				X	X	X	X
T3	X	X	X								X	X
T4	X	X	X	X	X	X	X	X	X	X	X	X
T5	X	X	X								X	X
T6	X	X	X	X	X	X		X	X	X	X	X
T7	X	X	X	X	X	X			X	X	X	X
T8	X	X	X	X	X	X			X	X	X	X
T9				X	X							
T10	X	X	X	X	X	X			X	X	X	X
T11	X	X	X	X	X			X	X	X	X	X
T12	X	X	X	X	X			X	X	X	X	X

Main species of catch composition was consisted of red porgay (*Pagrus pagrus*), dusky grouper (*Epinephelus marginatus*), blacktip grouper (*Epinephelus aeneus*), leervis (*Lichia amia*), two-banded sea bream (*Diplodus vulgaris*), white seabream (*Diplodus sargus*), common dentex (*Dentex dentex*), pink dentex (*Dentex gibbosus*), Mediterranean amberjack (*Seriola dumerili*), Atlantic black skipjack (*Euthynnus alletteratus*), bullet tuna (*Auxis rochei*), bogue (*Boops boops*), filefish (*Balistes carolinensis*) and African threadfish (*Alectis alexandrinus*) fish species. Discard species was determined as ocanic puffer (*Lagocephalus sceleratus*), lionfish (*Pterois volitans*), moray eel (*Murena helena*), smoothhound shark (*Mustelus mustelus*), sea turtle (*Caretta caretta*), thornback (*Raja clavata*), marbled electric ray (*Torpedo marmorata*) and squirrelfish (*Sargocentrum rubrum*).

In the study region, longline fishing have been performed non-intensively during July and August at 40-150 m depth throughout all year.

Çeliköz and Kuşat (2016) detected 15 species belonging to 6 families with using number 10-12-14-15 hooks in the Finike Gulf (Antalya). Akyol (2012) carried out that 6 species with using number 4 hooks deep-sea longline for dusky grouper in the Gulf of Antalya. In this research, we recorded 22 species with using number 10-11 hooks.

Bottom longlines are more efficient on fish species which do not spread on a large area. Longlines have minor effect to the habitats that is used at and also inexpensive compared to other fishing gears. Selectivity of longlines can easily be changed due to fish species and fish length. Due to this feature longlines can be considered as an alternative to other fishing gears used in coastal fishing.

Longline fishing is carried out with traditional bottom longline sets in the region. However, the use of mechanical systems would be more beneficial in terms of more effective catching operations.

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Profitability of Bozalan Dam in Terms of Effective Use of Natural Structural Materials

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Abstract: Food demand and irrigation problems are brought forward due to the rapidly growing population and intense immigration issues. To overcome these problems many dams and small dams in our country are being built to recover the agricultural economy in terms of irrigation purposes. Natural structural materials used in dams, especially intended for agricultural irrigation purposes, are sometimes constructed using arable land and agricultural lands can be destroyed. For this reason the environmental justice is frequently emphasized as a conception by many earth and environmental scientist. In this study natural structural materials are investigated for Bozalan Dam in terms of engineering properties and rentability. Parameters such as the distance to the axis location, the material thickness of the material area, the costs of expropriation, and the conditions of the existing transportation roads should be well considered while determining the natural construction material areas in the earth fill projected dams for their profitability and usability. In order to minimize environmental damages and effective use, an objective investigation of natural structural materials is strictly required. For this reason, in this research, which consist of office, field and laboratory works, employability of natural structural materials planned to utilize in earth fill dam body is determined and considering the distance to the axis location, the material thickness, the costs of expropriation, the conditions of the existing transportation roads, the dam body type is specified. It is deduced with different engineering approaches and evaluations that engineering properties of natural structural materials which will be used in a dam is one of a most important parameter for the optimization of body type especially for earth fill dams.

Keywords: Bozalan Dam, natural structural materials, environmental justice, profitability of dam, agricultural irrigation

1. INTRODUCTION

The engineering approaches on the dam structural materials depends on the distance to the dam axis, quality of the material, body type of dam, quantity of the material. In some cases, dams are planned to be constructed on the agricultural areas and these arable lands are destroyed. In this case the effectiveness of some areas increased due to the irrigation and some areas are destroyed. The earth and environmental scientists conduct engineering approaches to overcome this issue in terms of secure the environmental justice (Canoglu and Kurtulus, 2016).

In this study, a suitable dam body type is selected for Bozalan dam considering the qualitative and quantitative conditions of potential natural structural materials sites. For the quantitative analysis the area of the material site and the thickness of the material are considered. Variables such as distance to the axis location, expropriation costs, the conditions of existing transportation roads, and the routing are also considered. For the qualitative assessments laboratory tests have been conducted on the soil samples taken from the trial pits. The determination of the material thickness in the trial pit is also an indicator of the material quantity.

2. MATERIALS AND METHODS

The study area is located in Aegean Region, Izmir City, and Menemen County. Bozalan dam is planned to be constructed on the Akmar River in order to irrigate the 590 Ha of agricultural areas. The additional benefits of the Bozalan Dam is firefighting, recreation, and fishery.

The climate of the study area can be defined as oceanic. In this region, summers are hot and humid, winters are relatively cold and rainy. The mean annual rainfall is approximately 1100 mm. Transport to the Bozalan Dam axis is provided by a dusty road crossing the forest. The access roads is planned to be improved for transportation in winters.

The laboratory tests performed on the impermeable materials are moisture content, specific gravity, natural weight for unit volume, Atterberg Limits, Sieve analysis, and determination of soil classification based on the unified soil classification system. In addition, pin hole test, standard proctor test, unconfined compressive strength test, triaxial compressive strength test, and determination of swelling percentage and pressure are performed.

Within the context of the laboratory tests conducted on the soil samples taken from the permeable areas, relative density, water suction, fine material ratio, Los Angeles abrasion tests, Na₂SO₄ strength to the freezing test, shearbox test, sieve analysis and soil classification based on the unified soil classification system are performed. In addition, modified proctor, alkali silicate reactivity test, and organic matter content determination have been conducted.

3.RESULTS AND DISCUSSION

Results

Within the scope of the natural structural materials investigations, 2 impermeable, 1 permeable and 1 rock material sites have been specified considering the distance to the axis location, material quality and quantity. As a result of the detailed qualitative and quantitative natural structural materials analyses, 230 000 m³ of impermeable material, 270 000 m³ of permeable material and more than 1 000 000 m³ of rock material can be utilized for the Bozalan Dam construction

Discussion

In dam projects, environmental justice is frequently emphasized as a conception by many earth and environmental scientist due to the incorrect application of natural structural materials. For this reason, this study shows that a detailed natural structural material analysis is one of an irreplaceable investigation in dam projects. With this study, the environmental justice is secured with maximizing the benefits and minimizing the unjust treatment.

According to the results of the laboratory tests the optimum dam body type is designed as clay core rock fill dam type.

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Natural Red Clay as a New Adsorbent to Remove Malachite Green from Aqueous Solutions: (Part I) Studies on Adsorption Capacity

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Abstract: The present study was carried out to analyse the capacity adsorption of malachite green (MG) dye onto natural red clay (NRC) by batch-adsorption technique. The effects of process parameters such as adsorbent dosage, pH, contact time, temperature and initial concentration were investigated. The adsorbent was characterized by XRD, SEM, DTA-TG and BET-BJH analysis. Results indicated that the NRC was shown to be a promising adsorbent for the removal of dyes from aqueous solutions.

Keywords: Adsorption, Malachite Green, Clay.

1. INTRODUCTION

In industrial processes there are commercially available more than 100.000 dyes, of which 70% are azo dyes on weight basis. More than 1,000,000 tons of dyes are produced annually, of which 50% are used in the textile industry. The other industries are leather tanning, paper production, food technology, hair colorings, etc. [1,2]. Due to high compositional variability and high color density, it is estimated that about 2% of the dyes processed in textile dyeing facilities are in wastewater [3]. The presence of these dyes in industrial wastewaters is a serious problem due to toxicity for aquatic life and humans [4].

During the past three decades, various methods are used to remove dyes from wastewaters. These methods can be classified into two main categories as follows:

- The physical methods such as adsorption, sedimentation, flotation, flocculation, coagulation, ultrafiltration, photoionization, and incineration
- The chemical methods such as neutralization, reduction, oxidation, electrolysis, ion-exchange, wet-air oxidation) [5].

Adsorption has been found to be superior to other techniques due to features such as initial cost, design simplicity, insensitivity to toxic contaminants. Adsorption also does not lead to the formation of harmful substances [6]. There are two types of adsorption, physical and chemical adsorption. Physical adsorption is reversible due to the presence of weak intermolecular interactions like such as Van der Waals forces, hydrophobicity, hydrogen bonding, polarity, static interactions, dipole-dipole interactions and π - π interactions between the adsorbed molecules and the solid surface. On the other hand, Chemical adsorption is irreversible due to the presence of strong chemical bonds between the adsorbed molecules and the solid surface [7].

In recent years, many adsorption studies have been carried out to remove dyes from wastewater, to find a cheap adsorbent with high adsorption capacity [8-15]. One of these adsorbents is clays. The clays are defined as hydrous alumino silicates having colloidal particles smaller than 2 μm [16]. It contains clay minerals and other minerals such as Calcite, feldspar, Quartz. The prominent ions found on clay surface are Ca^{2+} , Mg^{2+} , H^+ , K^+ , NH_4^+ , Na^+ , and SO_4^{2-} , Cl^- , PO_4^{3-} , NO_3^- . These ions can be exchanged with other ions easily without affecting the structure of clay mineral [17]. Because of its low cost, abundant availability, environmentally friendly, high adsorption capacity and ion exchange clays are used as strong adsorbents [18-20].

The main purpose present study was to remove the adsorption of malachite green (MG) from aqueous solutions on natural red clay (NRC), a clay with majorly smectite supplied from the Oltu/Erzurum region in Turkey.

MG is a basic paint from the triphenylmethane dye family, which is seen as a green crystalline powder when dissolved in water gives a bluish-green colored solution. The three-dimensional molecular structure of the dye is shown in Fig. 1 [21]. It is widely used as the dyeing of cotton, silk, paper, wool, as a fungicide and antiseptic in aquaculture industry to control fish parasites and disease [22]. This dye has not been approved by the US Food and Drug Administration. But because it is low cost, and there is no suitable alternative, it is used in many parts of the world [23-24]. The malachite green has a permanent and acute toxic effect on the organisms. If not removed from the water, it will cause serious public health hazards and also lead to potential environmental problems. Both clinical and experimental observations reported to date indicate that MG is a multi-organ toxicant [25-27]. For these reasons, a zero tolerance has been established.

Some physical and chemical properties of NRC used as adsorbent are given in Table 2 -3. The NRC was characterized by SEM, XRD, DTA-TGA, BET and BJH techniques.

The effect of the contact time, the initial dye concentration, the solution pH, the adsorbent mass and the temperature on MG adsorption were studied.

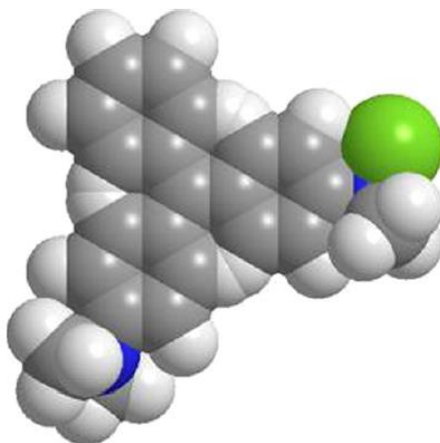


Figure 1. Three-dimensional molecular structure of malachite green (dark gray, carbon atoms; light gray, hydrogen atoms; green, chloride atoms; and blue, nitrogen atoms).

2.MATERIALS AND METHODS

Materials

The MG dye has chemical formula $C_{23}H_{25}N_2Cl$ (molecular weight = $364.92 \text{ g.mol}^{-1}$, C.I. Basic Green 4, C.I. Classification Number 42,000, CAS 569-64-2 $\lambda_{\text{max}} = 617 \text{ nm}$). The MG dye (96%) was purchased from Sigma–Aldrich Chemical. MG stock solution of 1000 mg.L^{-1} was prepared by dissolving the required amount of dye in distilled water. The other concentrations of MG were obtained by dilution of the stock solution.

NRC (mineral from Oltu/Erzurum region) was used as adsorbents. The NRC samples was passed through -200 mesh sieve and was washed with deionize water. It was then dried in an oven overnight at 105°C . Some properties of the adsorbents are shown in Table 1-2. Table 3 shows the Quantitative analysis of NRC.

Table 1. Whole rock analysis of the NRC sample [28].

Content	Quantity %
Clay	69
Calcite	17
feldspar	8
Quartz	6
analcime	-

Table 2. Mineral analysis of NRC sample [28].

Content	Quantity %
Smectite	45
chlorite	27
Kaoline	18
illite	10

Table 3. Quantitative analysis of NRC sample [28].

Content	Quantity %
Na ₂ O	0,20
MgO	8,10
Al ₂ O ₃	14,44
SiO ₂	41,48
K ₂ O	1,23
CaO	11,14
TiO ₂	0,53
Fe ₂ O ₃	9,88
LOI	13

Adsorption Studies

The adsorption of MG on the NRC was carried out using a batch adsorption technique. For adsorption studies, the contact time, the initial dye concentration, the solution pH, the adsorbent mass and the temperature were as 1-180 min, 100–250 mg.L⁻¹, 2-10, 1.0–10 g.L⁻¹ and 25–50 °C, respectively. The values selected for these parameters are given in Table 4.

The mixture was agitated in a temperature controlled shaker (Edmund Bühler GmbH KS-15) at 225 rpm. The pH of solutions was adjusted by adding 0.1 M HCl or 0.1 M NaOH solution and monitored by a digital pH-meter (model Thermo Orion 3 Star pHmeter). At the end of each experimental run, the sample was withdrawn and immediately centrifuged (model Nuve NF 1215) at 5000 rpm for 15 min. Concentration of MG in solution was determined by a Mapada UV–spectrophotometer equipped with commercial software UV Probe which enables absorbance data to be converted into concentration data by using calibration curve pre-established at the maximum wavelength corresponding to MG (617 nm).

Table 4. Experimental parameters and values in MG adsorption.

Parameter	Values
Contact time (dk)	1-5-10-30-60*-120-180
initial dye concentration (mg.L ⁻¹)	100-150*-200-250
temperature (°C)	25*-30-35-40-50
Solution pH	2-4-5.16(free pH) *-6-8-10
Adsorbent mass (g.L ⁻¹)	1.0-2.5-5.0*-7.5-10

* Constant selected values when analyzing the effect of parameters

The dye removal efficiency was calculated using Eq. (1):

$$\text{MG Removal \%} = \frac{(C_0 - C_t)}{C_0} \times 100 \quad (1)$$

where C₀ (mg.L⁻¹) and C_t (mg.L⁻¹) are the concentrations of the dyes at the beginning and time t, respectively. The Equilibrium adsorption capacity was calculated using the following mass balance Eq. (2):

$$q_e = (C_0 - C_e) \frac{V}{m} \quad (2)$$

where, q_e (mg.g⁻¹) was calculated from the initial (C₀) and equilibrium (C_e) concentrations of dye (mg.L⁻¹), V (L) is the volume of the solution and m (g) is the mass of NRC.

Characterizations

X-ray diffraction analysis of the NRC was carried out using Rigaku 2200D/Max, X-ray diffractometer, the radiation used was Cu Kα (λ= 1.5405 Å) radiation in the 2θ range 0-35° was used.

A ZEISS SIGMA 300 scanning electron microscopy (SEM) was employed to characterize the surface structure and the surface morphology of NRC in which the sample was prepared and deposited on the support after mineralization with gold.

Thermogravimetry/Differential Thermal Analysis (TG/DTA) was performed on NETZSCH STA 409 PC Luxx with high-resolution balance systems (the balance and temperature control system can accurately record weight loss of 0.001 mg and temperature of 0.1 K). Before analysis, calibration settings of the instrument were carried out by using calibration sets provided by Netzsch firm. The NRC was put into a pan and analyzed from 20 to 1000 °C at 10 °C min⁻¹ heating rates under atmospheric pressure.

The BET surface area, pore volume and pore size of the NRC were determined by Micromeritics 3Flex device, surface area and pore size analyzer.

3.RESULTS AND DISCUSSION

Characterization of NRC

X-ray diffraction spectrum (XRD) of NRC sample is given in Fig. 1. XRD spectrum of NRC was obtained in three ways. (1) after drying at room temperature (2) after solvation with ethylene glycol (3) after heating at 550°C for 2 h. Clay minerals were identified according to the position of the (001) series of basal reflections in the three (XRD) spectrum [29]. The semi-quantitative estimates of the peak areas of the basal reflection for the main clay mineral groups have been reported as follows [30]:

smectite: $2\theta = 5.3$ (17 Å), illite: $2\theta = 8.9$ (10 Å), and kaolinite/chlorite: $2\theta = 12.6$ (7 Å).

When Fig. 2 is examined, it can be seen that similar characteristic peaks are formed.

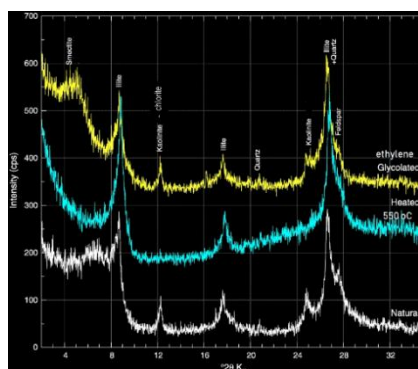


Fig. 2. Typical XRD patterns of NRC

In Fig. 3 a-b, SEM micrograph of NRC, before and after adsorption, are showed complete change in surface texture.

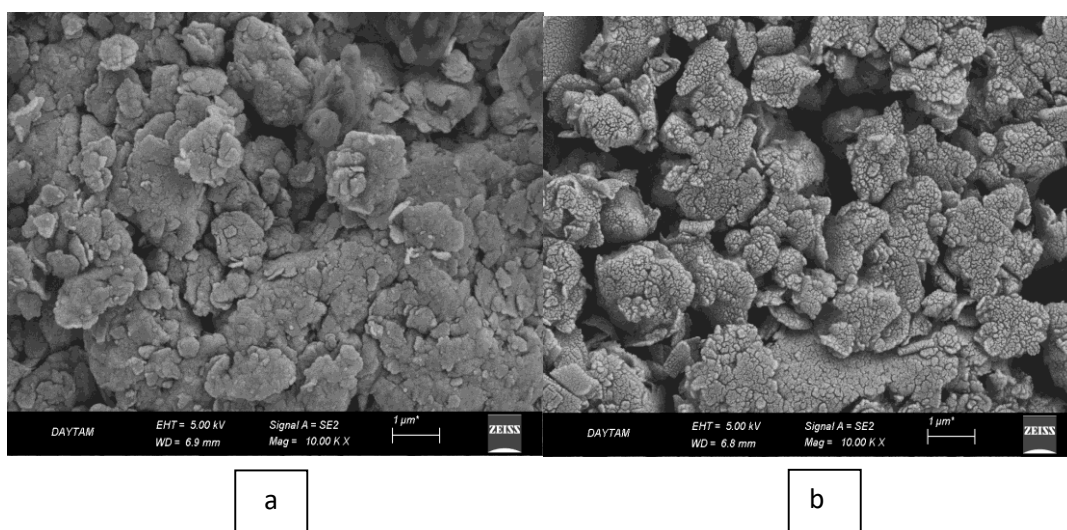


Fig. 3. a and b SEM micrograph of NRC before and after adsorption, respectively.

When Fig. 3a is examined, It can be seen that the NRC has a porous structure and a irregular surface. After adsorption of MG on the NRC (Fig. 3b), the dye molecules were more likely to be trapped and adsorbed on to the surface of the adsorbent.

The DTA-TG analyzes of NRC are given Fig. 4. In examined Fig. 4., it has been reported that the NRC structure lost free water 80-100 °C, lost crystal water between NRC layers at 100-300 °C and that dehydroxylation took place due to endothermic reactions above 300 °C, thus removing structural water. It is also expressed that from curve in Fig. 4. is showed dehydroxylation peaks in illite mineral at 548 °C and montmorillite mineral at 715 °C.

The BET surface area and BJH pore size and volume analysis results of NRC were shown in Fig. 5-6 and Table 5.

Table 5 The BET Surface Area and BJH Pore Size and Volume Analysis Results.

Surface Area(S, m ² .g ⁻¹)	Pore Volume (V _p , cm ³ .g ⁻¹)	Average Por Size (d _p nm)
41,87	0,046	4,37

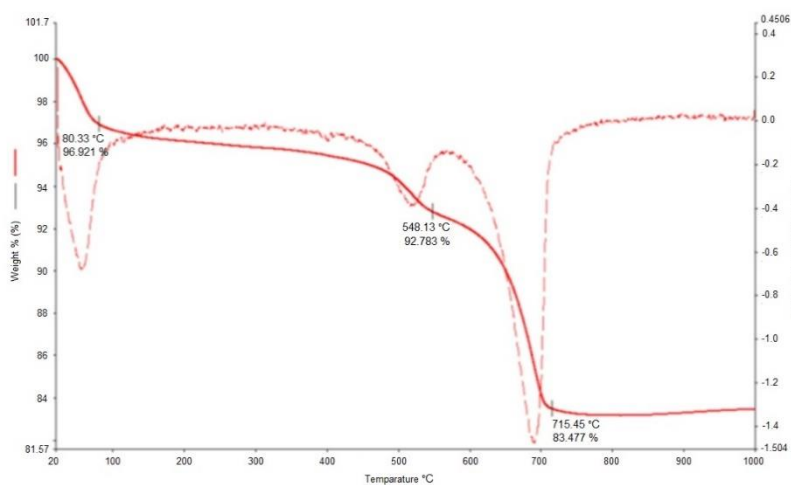


Fig. 4. DTA-TG curves for NRC

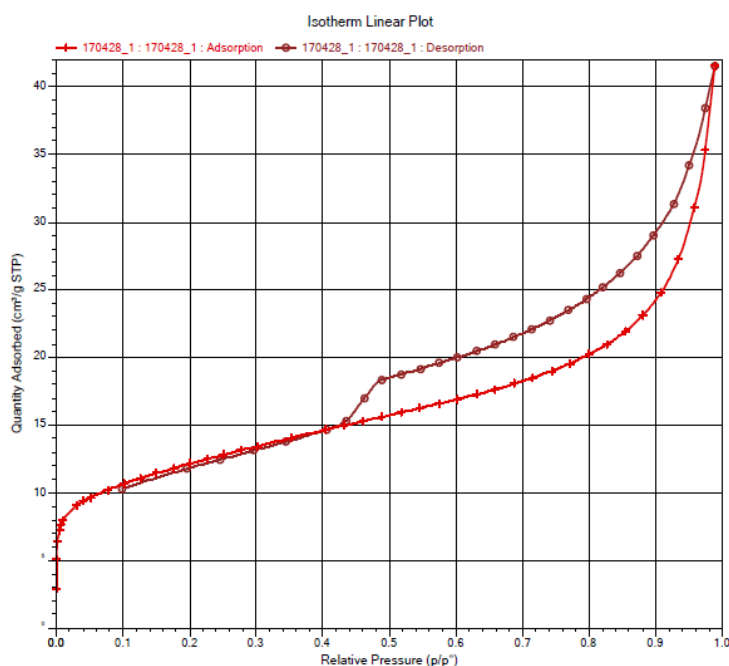


Fig. 5. Adsorption isotherm plot of nitrogen at 77 K for NRC

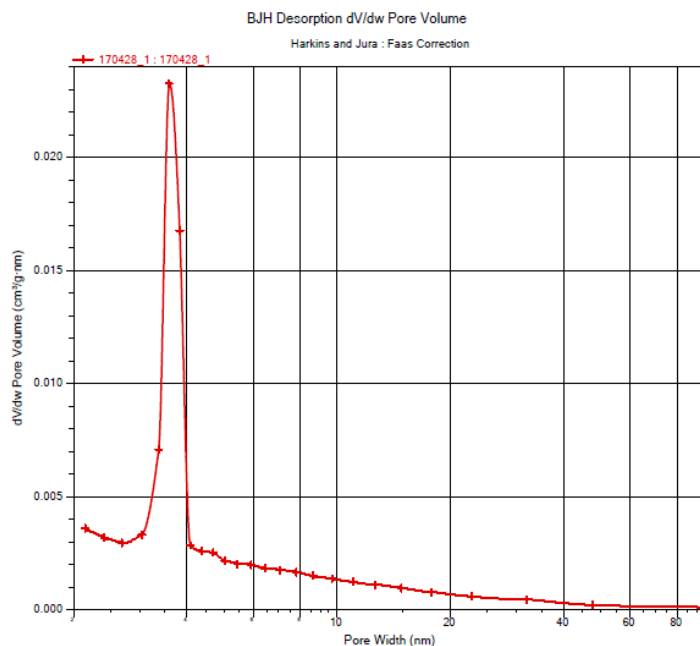


Fig. 6. Pore size distribution of nitrogen at 77 K for NRC

Effect of Contact Time and Initial Dye Concentration on the Adsorption Capacity

Examination of the effect of the contact time and determination of the equilibrium time is very important for designing batch adsorption experiments. It is essential to evaluate the effect of contact time required to reach equilibrium for designing batch adsorption experiments. The effect of different initial MG concentration on NRC is presented in Fig. 7. This figure shows the variation of adsorption capacity vs. contact time. It was seen that the adsorption rate was higher at the beginning of process, then this rate decreased and there was no significant change in speed when reaching the equilibrium. The higher adsorption rate at the beginning can be explained by the more number of active sites in the adsorbent surface and then there is a decrease in speed due to less available adsorption sites. It was observed that there was no change in the adsorption capacity when the adsorption rate was equal to the desorption rate. The adsorption capacity at equilibrium increased with increase in initial dye concentration. This situation can be explained by the increase in the concentration gradient of MG to overcome all mass transfer resistances between aqueous and solid phase and leading to an increasing equilibrium adsorption until adsorbent saturation is achieved. Similar results have been reported in literature for adsorption of dyes [31–33].

As shown in Fig. 7., the equilibrium time for MG adsorption on NRC is approximately 60 min, and this time was used in all subsequent experiments.

Effect of Initial Solution Ph on the Adsorption Capacity

The adsorption of MG dyes onto NRC was determined by changing the pH of the initial solution in the range of 2.0–10.0 and given in Fig. 8. This figure indicates that the maximum adsorption occurred at pH ranging from 6.0 to 10.0. Since the OH^- concentration increases as the solution pH increases, electrostatic interaction between negatively charged adsorbent surface and cationic MG molecule caused the increase in adsorption capacity. Earlier works reported that cationic dye adsorption increases with increase in pH [34–36]. As the NRC surface is positively charged at lower pH, the decrease in adsorption is due to the electrostatic repulsion between the cationic dye species and the positively charged adsorbent surface [8]. Since the adsorption percentage at the free pH is about 94, the free pH value of 5.16 was chosen as the constant parameter.

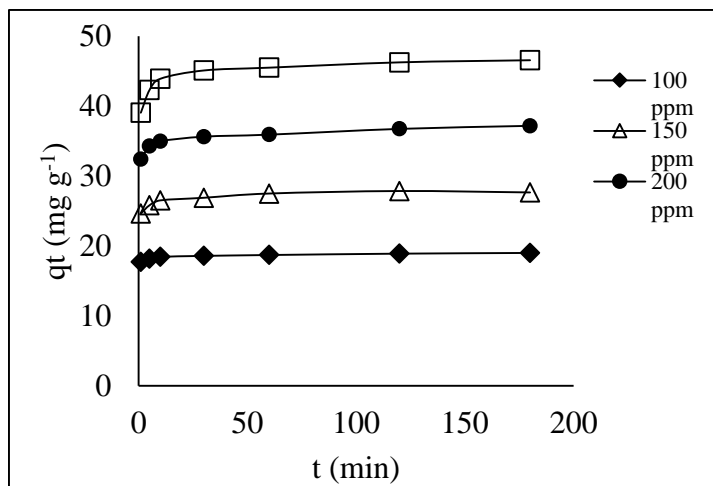


Fig.7. Determination of equilibrium time (free pH 5.16, adsorbent mass 5.0 g/L, temperature 25 °C, string speed 225 rpm, 100-250 ppm MG concentrations)

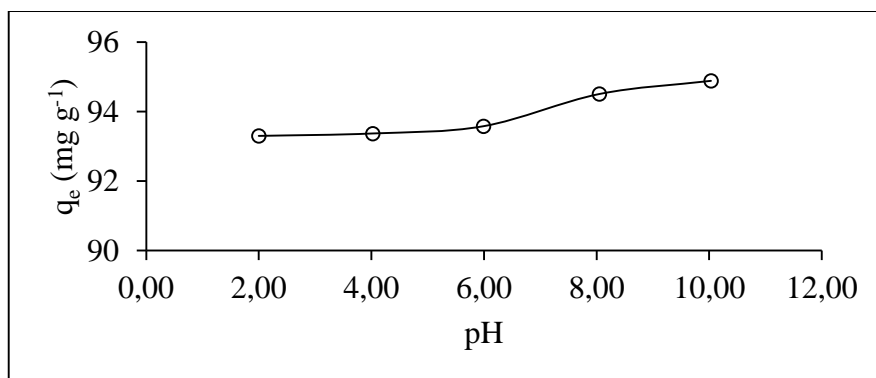


Fig.8. Determination of suitable pH (contact time 60 min, adsorbent mass 5.0 g/L, temperature 25 °C, string speed 225 rpm, 150 ppm MG concentrations)

Effect of Adsorbent Mass Of NRC

Adsorbent mass is an important parameter influencing adsorption processes since it determines the adsorption capacity of an adsorbent under given operating conditions. The effect of adsorbent mass of NRC was studied by changing from 1.0 to 10.0 g.L⁻¹ and given in Fig.9. It could be clearly seen from Fig.9. that the adsorption capacity (q_e), the amount of dye adsorbed per unit mass of adsorbent at equilibrium, decreases and adsorption percent increases by increasing the adsorbent mass from 1.0 to 10.0 g.L⁻¹. It can be easily understood that increasing the adsorbent mass will increase the number of available adsorption sites and it, therefore, results in an increase of the amount of adsorption percent [37]. Furthermore, the decrease in adsorption capacity by increasing the adsorbent mass is mainly because of adsorption sites remain unsaturated during the adsorption process [38,39].

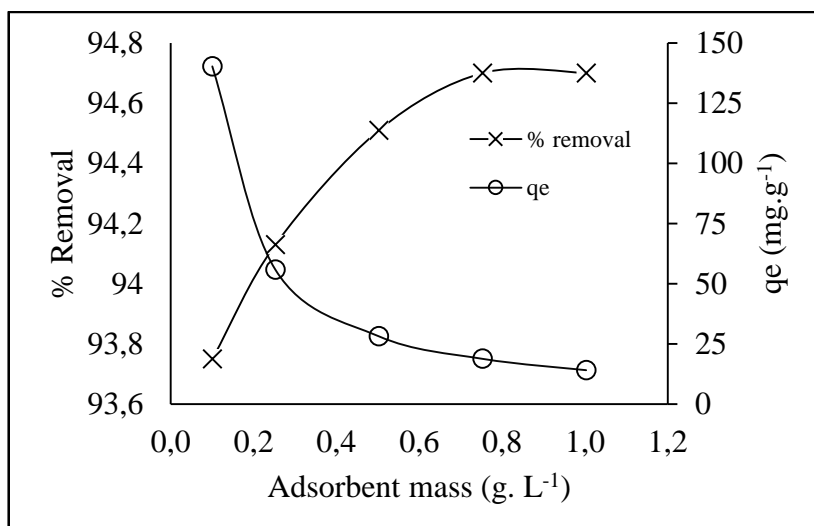


Fig. 9 Effect of adsorbent mass (contact time 60 min, free pH 5.16, temperature 25°C, string speed 225 rpm, 150 ppm MG concentrations)

Effect of Temperature

Fig. 10 shows the relationship between temperature of solutions and the adsorption capacity of MG by NRC. The results of this figure show that the adsorption capacity (q_e) increased by increasing the temperature from 25 to 50°C, which indicated that the process was endothermic in nature. The enhancement in adsorption with temperature can be due to the increase in the mobility energy of large dye ions to the surface of adsorbent with increase their kinetic energy the heat supply. A similar behavior has also been observed [40,41]. Additionally, increasing the temperature was known to increase the rate of diffusion of the adsorbed dye across the external boundary layer and in the internal pores of the adsorbent particle due to the decrease in the viscosity of the solution [42].

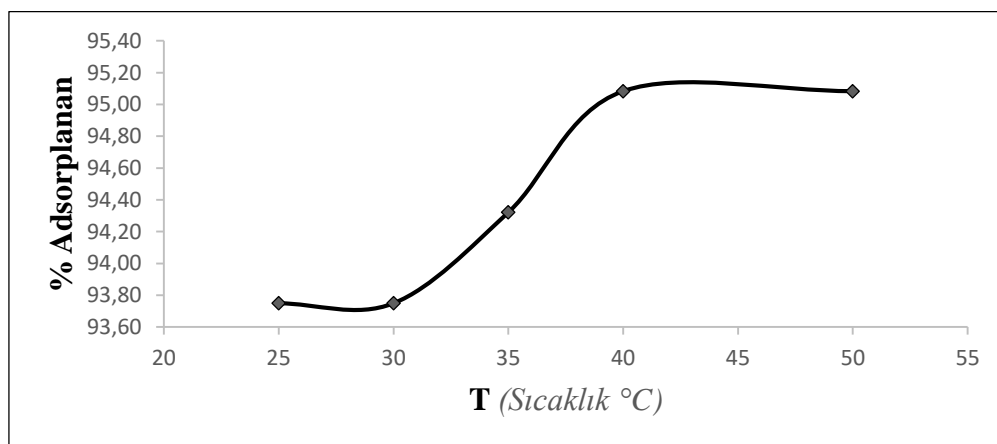


Fig. 10 Effect of Temperature (contact time 60 min, free pH 5.16, string speed 225 rpm, 150 ppm MG concentrations)

In the characterization studies of NRC adsorbent, it was observed that there is a smectite-based clay with porosity and irregular structure. It was showed that MG adsorption increased with increasing of contact time, initial dye concentration and solution temperature. Adsorption equilibrium time was found as 60 min. As a result, Natural red clay can be used as efficient low-cost adsorbent for the removal of malachite green from aqueous solutions.

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Investigation of Using the Earth Air Heat Exchanger Systems in Greenhouse Heating

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Abstract: Greenhouse is an application where required climatic conditions to grow plants are controlled. These places have an important share in agricultural work. These applications allow the products to be grown year-round, not just in a short period of the year. One of the most important parameters in terms of cost is greenhouse heating. Especially in low temperatures, the heating system used to ensure that products in the greenhouse are not damaged has a great importance. However these systems also cause a great financial problem in the greenhouses. Earth-Air Heat Exchanger (EAHX) are low cost systems which have heating and ventilation potentials in the greenhouses. These systems which are based on the use of energy that the soil has, can be used in greenhouses and similar agricultural applications in terms of easy installation, practical structure that does not require any maintenance and very low energy consumption. EAHX consist of pipe systems in which air passes and a fan for air flow. In this study, using the Earth Air Heat Exchanger Systems in Greenhouse heating is investigated. The theoretical analysis of a greenhouse heating with the EAHX system is carried out for Şanlıurfa climatic conditions. EAHX system are made of galvanized pipes with 13 cm diameter and 16 m length at 2 m depth. The heat losses of greenhouse are calculated according to different methods. The heat supplied to greenhouse were determined experimentally. As results of this study, the required pipe lengths in meters per kW of heating were obtained. It is seen that the EAHX systems can be used for greenhouse heating. The results also show that EAHX systems is really an important alternative for renewable and sustainable energy saving strategies for greenhouse systems.

Keywords: Greenhouse, Heating, EAHX, Renewable energy, soil energy

1.INTRODUCTION

Greenhouses; is an agricultural structure in which the conditions suitable for the growth of plants are provided during periods when climatic conditions are not suitable and the factors such as heat, light, humidity and air movements can be controlled and artificial growth environments are provided for plants. Purpose in greenhouse management; the optimum environment conditions and the growing environment which are necessary for the periods in which the external conditions do not allow the plant growth, is to obtain the products with the highest economic value throughout the year. The provision of suitable conditions to the subordinate is closely related to the climate characteristics of the region where the greenhouse will be built. Heating in the greenhouses is required especially in cold periods in order to provide the heat demands required by the plants. However, many greenhouse in our country are produced without using the heating system. This leads to yields and declines in quality during the colder months, resulting in massive losses of producers. Keeping your heating needs to a minimum, getting the highest possible quantity and quality is the main goal of the greenhouse companies. Achieving this goal is made possible by efficient use of the energy consumed for heating and energy saving measures. Greenery can also become one of the most important agricultural activities in our region due to the regular use of labor force during the year. Especially in greenhouses, this heating process can be further accelerated by lowering heating costs by using natural resources (solar energy, geothermal etc.) (Çaylı,2014; Demiray, 2015 and Kaptaner, 2016).

Greenhouse has started in Turkey in the Mediterranean region for the first time in 1940 and then spread to the Aegean and Marmara regions. Today, undergrowth farming is most concentrated in the Mediterranean region. (TÜİK, 2015). Table 1 shows the distribution of greenhouse areas by cities.

Table 1. Distribution of Greenhouse Areas by Cities (TÜİK,2014)

Cities	Greenhouse Areas (dekar)	Percentage
Antalya	248.253	%38,2
Mersin	158.845	%24,5
Adana	94.478	%14,6
Muğla	42.650	%6,6
Samsun	21.511	%3,3
İzmir	14.993	%2,3
Aydın	13.579	%2,1
Hatay	10.487	%1,6
Diğer	44.309	%6,8

When examining greenhouse practices in the world, it is possible to classify them considering different latitudes and different greenhouse technologies in the following way:

Cool Climate Countries: The main countries in the cool climate zone with annual average (at sea level) below 10 ° C are Netherlands, England, Denmark, Germany, Romania, Bulgaria and Russia. With 10,000 hectares of glass greenhouses and production technology, the Netherlands is the first country in these countries. Greenhouse building elements are pipe, profile, steel rod and aluminum, cover materials are glass. A high investment is needed to establish greenhouse construction and heating systems.

Temperate Climate Countries: The main countries in the temperate climate range with annual average (at sea level) between 10 ° C and 20 ° C are Spain, France, Japan, Turkey, Italy, Greece, Israel. Favorable environmental conditions allow greenhouses to be profitable. Greenhouses are rapidly increasing in these countries due to average temperatures are high, especially in winter, as they reduce heating costs which is the largest input to the greenhouse. The covering material used for the greenhouses is usually plastic.

Countries with Two Climate Regions: Main countries in the two climate zones annual average (at sea level) between 0 ° C and 20 ° C are Spain, Netherlands, Italy, Belgium, Egypt, Morocco and China. The common feature in these countries is the glass and plastic greenhouses are together (TUIK, 2015).

Greenhouse heating applications have a huge impact on product quality and growing time as well as crop yields. Especially in recent years, using solar energy from renewable energy sources instead of fossil fuels as greenhouse heating has become increasingly prevalent. Traditional energy production methods are one of the major causes of environmental pollution today and the issue of reducing the consumption of fossil fuels used in these methods by the reasons of international commitments on the environment is on the agenda. Also, the fact that fossil fuels will be end up after a while is also known. While heating the greenhouses may result with high quality yields, also it will reduce the cost of chemicals. This situation is very important in the environment conscious communities and has a great importance for human health and the environment. (Tokgöz, 2006; Baytorun et al., 2013))

The most important parameter in terms of cost is the heating process. For heating greenhouses;

- Heating with stoves,
- Central heating
- Heating with hot air,
- Heating with electrical energy,
- Heating by utilizing waste energy,
- Heating by utilizing renewable energy (solar, geothermal etc.) methods are being used.

Different renewable energy sources are utilized in greenhouse heating processes. These sources are mainly solar energy, geothermal energy and biomass energy. It is mandatory to give importance to using renewable energy sources in the greenhouses to reduce greenhouse heating costs and to minimize the use of fossil energy resources that are harmful to the environment. It can be contributed to energy security and socio-economic development by the using of renewable energy resources, which have a great potential in agricultural applications, especially in greenhouses (Kendirli and Çakmak, 2010; Taşkın and Vardar, 2016). Esen and Yüksel (2013); did an experimental study by using different renewable energy sources in the heating of a greenhouse at 6 m * 4 m * 2.10 m dimensions. According to this study, as the result of working in Elazığ climatic conditions, it has been reached to 23 °C temperature which is required for growing many plants. Therefore, it has been stated that different energy sources can be used for greenhouse heating.

Earth-Air Heat Exchangers are systems that benefit from a certain depth of soil temperature. It consists of a fan that provides air movement and a pipe system located under the ground. A certain depth of soil temperature is higher than outside temperature in winter while lower in summer.(Fig 1) For this reason, the EAHX system can be used for heating in winter and for cooling purpose in summer. There are open circuit and closed circuit systems.

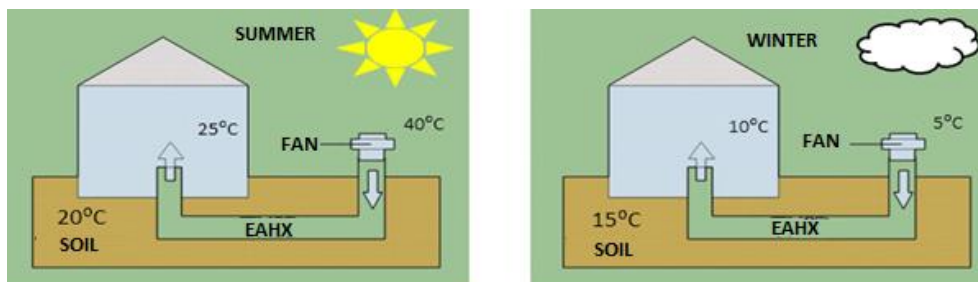


Figure 1. Schematic view of EAHX systems

2. MATERIALS AND METHODS

EAHX Usage in Greenhouse Heating

In this study, heating of greenhouses with EAHX from renewable energy systems was investigated. Figure 2 shows the heating of a greenhouse with EAHX schematically.

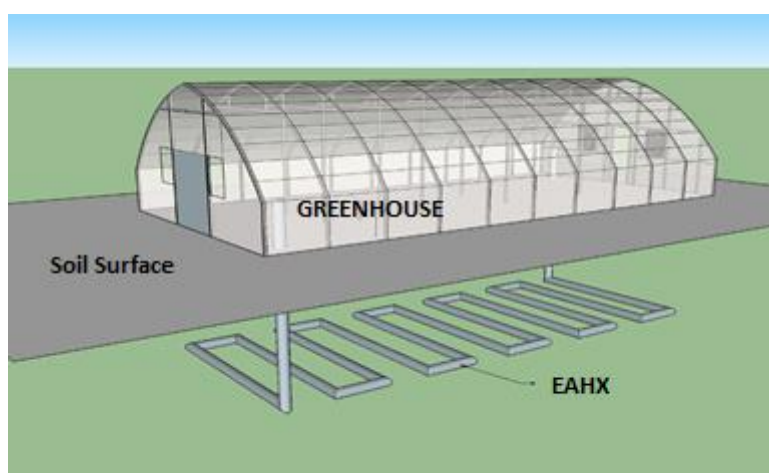


Figure 2. Heating of greenhouse by EAHX

There are many studies on the using of EAHX systems in greenhouse heating. In the greenhouse heating application where the closed circuit EAHX is used; exergy modeling and performance analysis of the used system has been done. In the study where energy and exergy efficiency of the system has been investigated, the use of EAHX in the greenhouse was examined in terms of sustainability index. (Hepbaşlı, 2013)

In another study which the optimal design for EAHX used in greenhouse heating with the help of exergoeconomic analysis is investigated, it was stated that the absence of exergy is arisen from by the losses in the fan and heat exchanger. In order to analyze and improve the system performance, the efficiency of the exergy of both the COP and the general system has been investigated. The average COP and exergy efficiency has been determined as 10.51 and 89.25%, respectively. (Özgener and Özgener, 2011).

In a study investigating the use of PV / T and EAHX in the greenhouses in India with considering four weather conditions for five climatic regions (open, foggy, foggy-cloudy and completely cloudy), the system has been compared with various energy measurements such as energy payback time, electricity generation factor and life cycle conversion efficiency (Nayak and Tiwari, 2010).

In another study set up at the Ege University Solar Energy Institute, the performance characteristics of the U-type EAHX with 47 m horizontal and 56 cm nominal diameter for heating the greenhouse were investigated. As a result of the measurements, it was determined that the average heat taken from the soil is 3.77 kW. When the heat taken from the soil and the pipe length is taken into consideration, it is calculated that 80.21 W / m heat has been gained from EAHX. As a result of the calculated exergy analysis; the maximum daily heating coefficient (COP) value for the system was obtained as 6.18. The total average COP value in the experiment period was found as 4.74 (Özgener and Özgener, 2010).

In another study where a thermal model for greenhouse heating was developed, EAHX has been used with thermal curtain. The thermal performance of a greenhouse with thermal curtain and EAHX is compared to a greenhouse with thermal

curtain and geothermal energy. According to the results obtained with dividing the greenhouse into three regions, it is stated that an earth-air heat exchanger may be an alternative source for heating the greenhouse if there is no geothermal energy. (Shukla et al. 2006).

It has been stated that the closed EAHX system is more efficient than the open system in another greenhouse application, which is placed in a 3.5 m deep soil and is heated by THID system using 42 m length PVC pipe with a diameter of 0.25 m. The thermal parameters such as the heating potential of the THID, COP and pipe yield, are not directly proportional to the performance of the EAHX used greenhouse (Deldan et al. 2017).

Calculation of Greenhouse Heat Requirement

Many different methods are being used to determine the required heat requirement for greenhouses. One of these methods is a calculation based on the minimum or maximum heating load. The maximum heating load is calculated as using the mean value of the month when the highest temperature detected over many years and the minimum heating load is calculated as using the long years average of the month when the lowest temperature detected over many years. The most important factor in the calculation of the heat requirement for greenhouses is the difference between the minimum ambient temperature determined according to the meteorological records at the place where the greenhouse is to be built and the desired temperature level in the greenhouse at that time (Yüksel, 1989; Arın and Akdemir, 2002).

The calculation according to the type of greenhouse and the used covering materials in addition to the external climatic conditions is shown in equation 1. The heat requirement coefficient used in the equation is given in Table 1.

$$Q = A_H \cdot h \cdot (T_i - T_d) \quad A_H = A_G \cdot F \quad (1)$$

The total heat requirement coefficient used in Equation 1 varies depending on the type of greenhouse, the type of cover material used, the external climatic conditions, and the type of heating and irrigation system used in the greenhouse. Table 2 summarizes the total heat requirement coefficients for greenhouses covered with different cover materials and different precautions were taken for heat conservation at 4 m/s wind speeds (Akyüz et al. 2017)

In equation:

- Q : Total heat power requirement [W]
 A_H : Greenhouse exterior surface covering area [m²]
 A_G : Greenhouse floor area [m²]
 F : Cover surface factor
 h : Total Heat Requirement Coefficient [W. m⁻². K⁻¹]
 T_i : Desired internal temperature value at greenhouse [°C]
 T_d : The lowest average outdoor temperature value of the where greenhouse is built [°C]

Table 2. u value according to cover materials

Covering material and material for heat protection	u' value (W.m ⁻² .K ⁻¹)
Single layer glass	6,0-8,8
Single layer PE plastic	6,0-8,0
Double layer glass	4,2-5,2
Double layer hard plastic PMMA 16 mm	4,2-5,0
Double-layer PE plastic	4,0-6,0
Single layer glass with heat curtain or plastic greenhouse	3,2-4,8

The heat energy requirement depending on the greenhouse features and equipment used in the greenhouse is calculated by Rath (1992) with the help of a 2-way equation developed based on DIN 4701 standards (Baytorun et al. 2013)

$$Q = \sum_{n=1}^{8760} ((t_{i_n} - t_{i,OH_n} - \Delta t_{sp_n}) \cdot u' \cdot A_c \cdot (1 - EE_{ES_n})) \cdot t_{si} \quad (2)$$

- Q : Annual heat energy requirement of the greenhouse [W_h]
 $t_{i,OH}$: The true indoor temperature value at unheated greenhouse [°C]
 Δt_{sp} : Temperature increasing due to solar energy at greenhouse [°C]
 A_c : Greenhouse cover surface area [m²]
 $EEES$: Saving rate of energy conservation precaution used in greenhouse [-]
 n : hours of the year [h]

In another study, taking into consideration the climate conditions in Ankara, the heating requirements of seven greenhouse with different types, sizes and materials were calculated according to the approaches of ten different researchers and the obtained results were evaluated. In the study, which results were close to each other, it was stated that the highest heating loads were obtained in PE covered greenhouses when greenhouse type and covering materials were taken into consideration. Since the heating cost is the most important factor in greenhouse cultivation production costs, accurate calculation of heat-demand capacities in the greenhouse is extremely important in reducing production costs. Therefore, a computer program has been developed that can accurately calculate the greenhouse indoor heat-demand capacities with considering the area where the greenhouse is located, grown product, the covering material used, the heating system and the greenhouse floor area criteria. The results belong to Şanlıurfa of the study for different cities and greenhouse characteristics are given in Table 3. (Kendirli 2015; Gürdil et al., 2009)

Table 3. The heating capacities required for 1 da tomato greenhouse according to different cover materials for Şanlıurfa, (kW)

City	Glass (3.8 mm)	PVC (1 mm)	Artificial glass (acrylglass) (2 mm)	Double glass (6 mm) space	Double glass (15 mm) space	Double glass (12 mm) space	Plastic double artificial plate (10 mm)	Plastic double artificial plate (5 mm)
Şanlıurfa	81.70	81.11	78.23	48.03	35.40	41.83	34.26	60.95

Calculation of heat loss in study has been calculated according to Equation 3 (9).

$$Q_s = \left[\frac{A_1}{R_1} + \frac{A_2}{R_2} + \dots \right] (T_i - T_o)(f_w)(f_c)(f_s)$$

(3)

Q_s : Greenhouse heat loss, kW

$A_{1,2}$: Surface area of various components in greenhouse, m^2

$R_{1,2}$: Thermal resistance of the components in the greenhouse $\left(\frac{m^2}{W \cdot ^\circ C} \right)$

T_i : Greenhouse interior design temperature, $^\circ C$

T_o : Greenhouse exterior design temperature, $^\circ C$

f_c : Greenhouse building type factor

f_s : system factor for greenhouse

f_w : Wind or front factor for greenhouse

As a result of the calculations made for Şanlıurfa considering the average temperatures of December, January, February and March months; the greenhouse heat loss was found as 3,2844 2,8322, 3,8794 and 3,6176 kW respectively. The heat obtained from the EAHX system shown in Figure 3 is calculated by Equation 4. (Bulut at al., 2016)

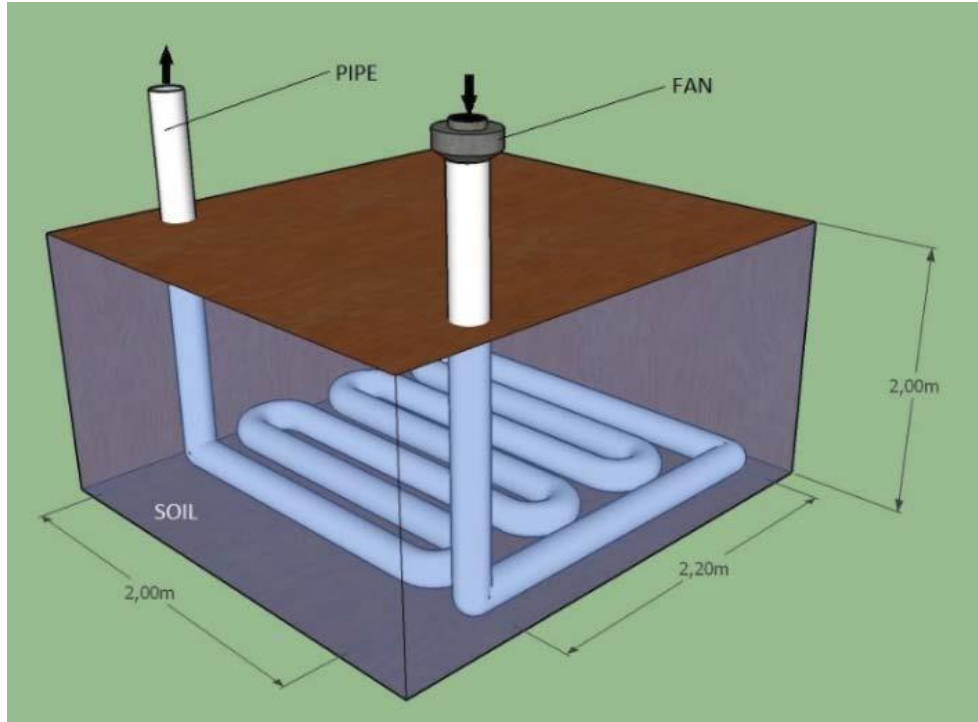


Figure 3. Schematic drawing and general properties of EAHX system

$$Q_{thid} = m \cdot C_{hava} / [T_g - T_{\zeta}] \quad (4)$$

Q_{thid} : Amount of heat extracted from the soil

T_g (°C) : air inlet temperature,

T_{ζ} (°C) : air outlet temperature

m : mass flow of the air (kg/s)

C_{hava} : specific heat of the air (J/kg °C).

As a result of the calculations, the amount of heat extracted from the soil by EAHX was found as 703.674, 686.718, 898.668 and 813.888 W for December, January, February and March, respectively.

3.RESULTS AND DISCUSSION

In this study, greenhouse heating was investigated by using Earth Air Heat Exchanger. By investigating the studies done on this subject, it is investigated that the heat needed in winter of a greenhouse in Şanlıurfa climatic conditions can be met by EAHX. The results are expressed as follows.

- As a result of calculations made for December, January, February and March, it is determined that the heat loss for these months was 3,2844 2,8322, 3,8794 and 3,6176 kW respectively.
- For the same period, the heat taken from the soil by EAHX is calculated as 703.674, 686.718, 898.668 and 813.888 W.
- The average of the heat taken from the soil for these four months was calculated as 775,737 W and the ratio to the length of horizontal pipe below the ground which is 16 m was obtained as 48,48 W / m.

As a result, it has been determined that by using EAHX, the amount of heat required for greenhouse can be compensated in a certain way, thus heating costs can be reduced. It has been observed that the use of EAHX as a closed system will increase efficiency.

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Permeability Problems Encountered in Bozalan Dam Project and Construction of Grout Curtain to Extend the Flow Path

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Abstract: In last decade, agricultural irrigation dams are constructed in Turkey based on the demand of food considering the rapidly increasing population. Apart from its contribution to the economy, many dams returned profit in terms of providing employment opportunities in many sub-sector of construction industry such as drilling and grouting. Permeability problem in a dam project is one of the main subject to overcome for design engineers. Many grouting techniques are utilized in dams for many purposes such as stabilization, strengthening and sealing. Grout curtain is the most demanded technique for providing an impermeable zone along dam axis in order to extend the flow path with the prevention of potential leakages. In this context, drilling and in-situ testing is performed in order to predict potential leakage problems and a grout curtain is designed for Bozalan Dam. For ground investigation 5 boreholes (160 m depth in total) are drilled along dam axis 1 borehole (15 m depth) is drilled on spillway location and 2 boreholes (40 m depth in total) are drilled on the cofferdam. In all boreholes water pressure test is implemented for every 2 meter of test zone. Within the context of designing the grout curtain the water pressure test results performed in the boreholes are considered. However on behalf of to stay in safe side grout curtain depth of thalweg is projected deeper considering the hydraulic head which would be exerted.

Keywords: Bozalan Dam, permeability problems, grouting, drilling, water pressure tests

1. INTRODUCTION

Economic contribution of dams play important role in Turkey in terms of agricultural development and international trade. Suitable valleys, storable watersheds and hydropower potentials can be assessed as the important advantages of Turkey for the accumulation and utilization of surface waters. However, dam projects and construction are expensive and includes complex processes which require a detailed design and prediction of unexpected events such as leakages and seepages.

The leakage problems in dams are generally originated from calculation faults of permeability and incorrect implementation of in-situ tests such as water pressure tests. Another wrongness which leads up the leakage problems is the incorrect application of grouting and misdesigned grout curtains. This is a problem which should be overcome by design engineers.

In this study grout curtain of Bozalan Dam is designed to extend the flow path and accumulate the water in the reservoir area reducing with the flow rate of groundwater. The design of grout curtain of Bozalan Dam is conducted based on the water pressure tests performed along the dam axis.

2. MATERIALS AND METHODS

The study area is located in Aegean Region, Izmir City, and Menemen County. Bozalan dam is planned to be constructed on the Akmar River in order to irrigate the 590 Ha of agricultural areas. The additional benefits of the Bozalan Dam is fire fighting, recreation, and fishery.

The climate of the study area can be defined as oceanic. In this region, summers are hot and humid, winters are relatively cold and rainy. The mean annual rainfall is approximately 1100 mm. Transport to the Bozalan Dam axis is provided by a dusty road crossing the forest. The access roads is planned to be improved for transportation in winters.

Bozalan dam is projected as a clay core rock fill dam. The height of dam from thalweg is 35 m and from the foundation is 40 m. The crest length is planned to be 200 m with a crest width of 8 m. The minimum water level of the reservoir is predicted as 378.6 m and the maximum water level would be 396.12 m. The spillway is projected on left bank with an impact stilling basin.

In this study the permeability characteristics of the dam axis is determined and the grout curtain is optimized. In this context, 5 boreholes (160 m depth in total) are drilled along dam axis 1 borehole (15 m depth) is drilled on spillway location and 2 boreholes (40 m depth in total) are drilled on the cofferdam.

3.RESULTS AND DISCUSSION

Results

In the study area Mesozoic and Cenozoic aged geological units are observed. The study area is located geologically in the northeast of Menemen County along the Foccaia depression. In the base Lower Miocene aged continental sediments, Cretaceous aged Izmir Flysch and Upper Miocene aged volcanic units (Yuntdağ Volcanic Units) are observed. The quaternary aged alluviums and slope debris cover these older units discordantly. Based on the drilling operations the thickness of the Quaternary aged alluvium varies between 4.5 – 5 m. The sieve analysis of this materials show that the grain size distribution is 42% gravel, 52% sand and 6% fine material (silt – clay).

The results of water pressure tests indicates that the mean Lugeon values of the Borehole SK-1 1.90 and Borehole SK-2 is 1.21 which are located in the left abutment. The mean Lugeon value of the Borehole SK-3 which is located in thalweg is 2.41. For the right abutment the mean Lugeon value of the Borehole SK-4 is 2.35 and the SK-5 is 1.30. Based on the permeability classification introduced by Canoglu and Kurtulus (2017) the permeability of the dam axis location is generally lowly permeable.

Based on these Lugeon tests the grout curtain is optimized considering the method suggested by Şekercioglu (2007) and engineering judgement also. In addition the grout curtain is extended through the reservoir area for the sake to stay on safe side. Accordingly, the grout curtain depth for the left abutment varies between 28 – 30 m. The thalweg would have the maximum hydrostatic pressure for this reason the grout curtain depth is designed as 40 m for thalweg in order to mitigate the potential leakages. For the right abutment the curtain depth is projected between 25 – 30 m as for the left abutment.

Discussion

Just as in the developed world countries the quality of dam projects depend on the detailed design of the planning and projection stages. With this study, usable agricultural areas and meadow areas which would be in the Reservoir area is minimized with the inhibition of the potential leakages and dam optimization. A correct design of grout curtain is optimized with the objective engineering approaches. In this way the environmental justice is secured with maximizing the benefits and minimizing the unjust treatment.

According to the results of the Lugeon tests the grout curtain is determined and the grout curtain is maximized in thalweg due to the high hydrostatic pressure in order to be more effective.

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Natural Red Clay as a New Adsorbent to Remove Malachite Green from Aqueous Solutions: (Part II) Studies on Equilibrium Isotherm, Kinetics and Thermodynamics

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Abstract: The present study was carried out to analyse the capability adsorption of MG dye onto NRC by batch-adsorption technique. The adsorption isotherm, kinetics and thermodynamics studies were performed. The pseudo second order kinetic model and Freundlich isotherm model were found to be in good agreement with the experimental values obtained. Thermodynamic studies revealed that the adsorption processes is spontaneous, endothermic and physical nature of MG adsorption onto NRC. Results indicated that the NRC was shown to be a promising adsorbent for the removal of dyes from aqueous solutions.

Keywords: Adsorption, Malachite Green, Clay, Isotherm, Kinetic.

1. INTRODUCTION

In industrial processes there are commercially available more than 100.000 dyes, of which 70% are azo dyes on weight basis. More than 1,000,000 tons of dyes are produced annually, of which 50% are used in the textile industry. The other industries are leather tanning, paper production, food technology, hair colorings, etc. [1,2]. Due to high compositional variability and high color density, it is estimated that about 2% of the dyes processed in textile dyeing facilities are in wastewater [3]. The presence of these dyes in industrial wastewaters is a serious problem due to toxicity for aquatic life and humans [4].

During the past three decades, various methods are used to remove dyes from wastewaters. These methods can be classified into two main categories as follows:

- The physical methods such as adsorption, sedimentation, flotation, flocculation, coagulation, ultrafiltration, photoionization, and incineration
- The chemical methods such as neutralization, reduction, oxidation, electrolysis, ion-exchange, wet-air oxidation) [5].

Adsorption has been found to be superior to other techniques due to features such as initial cost, design simplicity, insensitivity to toxic contaminants. Adsorption also does not lead to the formation of harmful substances [6]. There are two types of adsorption, physical and chemical adsorption. Physical adsorption is reversible due to the presence of weak intermolecular interactions like such as Van der Waals forces, hydrophobicity, hydrogen bonding, polarity, static interactions, dipole-dipole interactions and π - π interactions between the adsorbed molecules and the solid surface. On the other hand, Chemical adsorption is irreversible due to the presence of strong chemical bonds between the adsorbed molecules and the solid surface [7].

In recent years, many adsorption studies have been carried out to remove dyes from wastewater, to find a cheap adsorbent with high adsorption capacity [8-15]. One of these adsorbents is clays. The clays are defined as hydrous alumino silicates having colloidal particles smaller than 2 μm [16]. It contains clay minerals and other minerals such as Calcite, feldspar, Quartz. The prominent ions found on clay surface are Ca^{2+} , Mg^{2+} , H^+ , K^+ , NH_4^+ , Na^+ , and SO_4^{2-} , Cl^- , PO_4^{3-} , NO_3^- . These ions can be exchanged with other ions easily without affecting the structure of clay mineral [17]. Because of its low cost, abundant availability, environmentally friendly, high adsorption capacity and ion exchange clays are used as strong adsorbents [18-20].

The main purpose present study was to remove the adsorption of malachite green (MG) from aqueous solutions on natural red clay (NRC), a clay with majorly smectite supplied from the Oltu/Erzurum region in Turkey.

MG is a basic paint from the triphenylmethane dye family, which is seen as a green crystalline powder when dissolved in water gives a bluish-green colored solution. The three-dimensional molecular structure of the dye is shown in Fig. 1 [21]. It is widely used as the dyeing of cotton, silk, paper, wool, as a fungicide and antiseptic in aquaculture industry to control fish parasites and disease [22]. This dye has not been approved by the US Food and Drug Administration. But because it is low cost, and there is no suitable alternative, it is used in many parts of the world [23-24]. The malachite green has a permanent and acute toxic effect on the organisms. If not removed from the water, it will cause serious public health

hazards and also lead to potential environmental problems. Both clinical and experimental observations reported to date indicate that MG is a multi-organ toxicant [25-27]. For these reasons, a zero tolerance has been established.

Some physical and chemical properties of NRC used as adsorbent are given in Table 2 -3. The adsorption kinetics, thermodynamics and equilibrium studies were performed by batch adsorption technique. Besides, experimental adsorption isotherms obtained are compared with various adsorption isotherm models present in the literature.

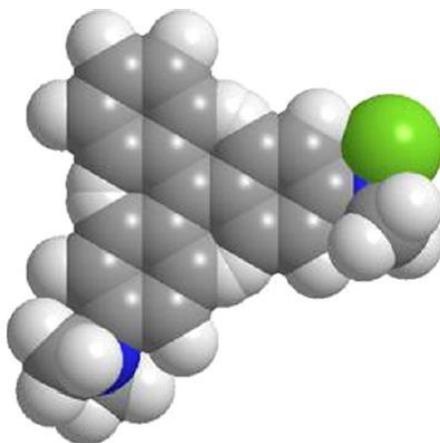


Fig. 1. Three-dimensional molecular structure of malachite green (dark gray, carbon atoms; light gray, hydrogen atoms; green, chloride atoms; and blue, nitrogen atoms)

2.MATERIALS AND METHODS

Materials

The MG dye has chemical formula $C_{23}H_{25}N_2Cl$ (molecular weight = $364.92 \text{ g.mol}^{-1}$, C.I. Basic Green 4, C.I. Classification Number 42,000, CAS 569-64-2 $\lambda_{\text{max}} = 617 \text{ nm}$). The MG dye (96%) was purchased from Sigma–Aldrich Chemical. MG stock solution of 1000 mg.L^{-1} was prepared by dissolving the required amount of dye in distilled water. The other concentrations of MG were obtained by dilution of the stock solution.

NRC (mineral from Oltu/Erzurum region) was used as adsorbents. The NRC samples was passed through -200 mesh sieve and was washed with deionize water. It was then dried in an oven overnight at 105°C . Some properties of the adsorbents are shown in Table 1-2. Table 3 shows the Quantitative analysis of NRC.

Table 1. Whole rock analysis of the NRC sample [28].

Content	Quantity %
Clay	69
Calcite	17
feldspar	8
Quartz	6
analcime	-

Table 2. Mineral analysis of NRC sample [28].

Content	Quantity %
Smectite	45
chlorite	27
Kaoline	18
illite	10

Table 3. Quantitative analysis of NRC sample [28].

Content	Quantity %
Na ₂ O	0,20
MgO	8,10
Al ₂ O ₃	14,44
SiO ₂	41,48
K ₂ O	1,23
CaO	11,14
TiO ₂	0,53
Fe ₂ O ₃	9,88
LOI	13

Adsorption Studies

The adsorption of MG on the NRC was carried out using a batch adsorption technique. For adsorption studies, the contact time, the initial dye concentration, the solution pH, the adsorbent mass and the temperature were as 1-180 min, 100–250 mg.L⁻¹, 2-10, 1.0–10 g.L⁻¹ and 25–50 °C, respectively. The values selected for these parameters are given in Table 4.

The mixture was agitated in a temperature controlled shaker (Edmund Bühler GmbH KS-15) at 225 rpm. The pH of solutions was adjusted by adding 0.1 M HCl or 0.1 M NaOH solution and monitored by a digital pH-meter (model Thermo Orion 3 Star pHmeter). At the end of each experimental run, the sample was withdrawn and immediately centrifuged (model Nuve NF 1215) at 5000 rpm for 15 min. Concentration of MG in solution was determined by a Mapada UV–spectrophotometer equipped with commercial software UV Probe which enables absorbance data to be converted into concentration data by using calibration curve pre-established at the maximum wavelength corresponding to MG (617 nm).

Table 4. Experimental parameters and values in MG adsorption.

Parameter	Values
Contact time (dk)	1-5-10-30-60*-120-180
initial dye concentration (mg.L ⁻¹)	100-150*-200-250
temperature (°C)	25*-30-35-40-50
Solution pH	2-4-5.16(free pH) *-6-8-10
Adsorbent mass (g.L ⁻¹)	1.0-2.5-5.0*-7.5-10

* Constant selected values when analyzing the effect of parameters

The dye removal efficiency was calculated using Eq. (1):

$$\text{MG Removal \%} = \frac{(C_0 - C_t)}{C_0} \times 100 \quad (1)$$

where C₀ (mg.L⁻¹) and C_t (mg.L⁻¹) are the concentrations of the dyes at the beginning and time t, respectively.

The Equilibrium adsorption capacity was calculated using the following mass balance Eq. (2):

$$q_s = (C_0 - C_e) \frac{V}{m} \quad (2)$$

where, q_e (mg.g⁻¹) was calculated from the initial (C₀) and equilibrium (C_e) concentrations of dye (mg.L⁻¹), V (L) is the volume of the solution and m (g) is the mass of NRC.

Adsorption Isotherm, Kinetics and Thermodynamic Equations

Adsorption isotherm

There is a dynamic equilibrium between the adsorbed concentration and the adsorbent interface in a solution. Equilibrium data must be analyzed for the development of mathematical models that can be useful in quantitative description of results. In order to optimize the design of an adsorption system to remove dye from solutions, adsorption isotherm models are very important. These equilibrium models give important information about adsorption mechanisms, surface properties and affinities of the adsorbent [29].

The equilibrium adsorption isotherm is obtained by plotting the concentration of the dye in the solid phase versus that in the liquid phase. There are several isotherm models available for analyzing experimental data [30]. However, the isotherm

models used most popular in adsorption processes in aqueous solutions are Langmuir, Freundlich, Temkin and Dubinin-Radushkevich (D-R) models.

The Langmuir isotherm is valid for adsorption of a solute from a liquid solution as a monolayer adsorption onto a surface containing the identical site. It is predict the maximum adsorption capacity corresponding to complete monolayer coverage on the adsorbent surface. The Langmuir model equation is commonly expressed as follows [31]:

$$\frac{C_e}{q_e} = \frac{C_e}{q_m} + \frac{1}{K_L \times q_m} \quad (3)$$

The essential characteristics of a Langmuir isotherm can be expressed in terms of dimensionless equilibrium parameter (R_L) [32], which is defined by Eq.(4).

$$R_L = \frac{1}{1 + K_L C_0} \quad (4)$$

The essential characteristics of the Langmuir isotherm can be expressed in terms of dimensionless equilibrium parameter (R_L). The value of R_L indicates the type of the isotherm to be either unfavorable ($R_L > 1$), linear ($R_L = 1$), favorable ($0 < R_L < 1$) or irreversible ($R_L = 0$) [33].

The Freundlich isotherm is commonly used to describe non-ideal adsorption on heterogeneous surfaces as well as multilayer sorption and assumes that the adsorption occurs at sites with different energies of adsorption. The value of Freundlich constant (n) ranging from 1 to 10 indicated that the adsorption process is favorable and is expressed by the following Eq. (5) [34]:

$$\log(q_e) = \log \times \log(C_e) \quad (5)$$

The Temkin isotherm is generally applied to explain adsorbent–adsorbate interactions. It is characterized by a uniform distribution of binding energies. It is given as Eq.(6) [35].

$$q_e = B_T \times \ln(K_T) + B_T \times \ln(C_e) \quad (6)$$

where $B_T = RT/b_T$

The D-R isotherm is generally applied to estimate of adsorbents characteristic porosity and as well their apparent energies of adsorption (especially on porous adsorbents) with a Gaussian energy distribution onto a heterogeneous surface. The model has a linear form expressed as Eq. (7) [36]:

$$\ln(q_e) = \ln(q_m) - \beta \times \varepsilon^2 \quad (7)$$

where ε , Polanyi potential, $\varepsilon = R_g T \ln \left(1 + \frac{1}{C_e} \right)$

Adsorption kinetics

The determination of the adsorption kinetics is necessary to select the best adsorption conditions. It also shows how the adsorption rate can be controlled by residence time of the adsorbed material in the solution interface. The adsorption rate is predicted by kinetic parameter values calculated from kinetic models. Knowing this speed is crucial for designing and modelling of adsorption processes [37].

The kinetic models are used to examine the controlling mechanism of adsorption process such as adsorption surface, chemical reaction and/or diffusion mechanisms. Three kinetic models have been widely used in the literature for adsorption processes [30]:

(i) pseudo-first-order kinetic model (Lagergren model), which is defined by Eq. (8);

$$\log(q_e - q_t) = \log(q_e) - k_1 \times t \quad (8)$$

(ii) pseudo-second-order kinetic model (Ho and McKay model) , which is defined by Eq. (9);

$$\frac{t}{q_t} = \frac{1}{k_2 \times q_e^2} + \frac{t}{q_e} \quad (9)$$

(iii) intraparticle diffusion model (Webber and Morris model) , which is defined by Eq. (10).

$$q_t = k_{dif} \times t^{\frac{1}{2}} + C \quad (10)$$

These kinetic models were applied to determine the most appropriate model to data obtained from the experimental study.

Thermodynamic parameters

Thermodynamic parameters such as the Gibbs free energy change (ΔG^0), enthalpy change (ΔH^0), and entropy change (ΔS^0) are often used for better understanding of the effect of temperature on adsorption. If the ΔG^0 value becomes more negative by increasing the temperature, it indicates that the adsorption increases because of the driving force. ΔG^0 is an indication of spontaneity of a chemical reaction and therefore is an important criterion for spontaneity. Reactions occur spontaneously at a given temperature if ΔG^0 is a negative quantity. ΔG^0 for physical adsorption is between -20 and 0 kJ.mol⁻¹ and for chemical adsorption is in a range of -80 to -400 kJ.mol⁻¹ [38].

The magnitude of the enthalpy change indicates that the adsorption process is physical or chemical [30]. On the basis of ΔH^0 value whether the physical adsorption (20<kJ.mol⁻¹) or the chemical adsorption (80–200 kJ.mol⁻¹) takes place in the reaction can be inferred because ΔH^0 is related to the different interactions that are established between adsorbent and the adsorbed dye [39].

ΔG^0 for adsorption of MG onto NRC can be written as

$$\Delta G^0 = -R_g T \times \ln(K_c) \quad (11)$$

K_c is the single point or linear sorption distribution coefficient defined as:

$$K_c = \frac{q_e}{C_e} \quad (12)$$

ΔH^0 and ΔS^0 of adsorption were calculated from van't Hoff equation with the following relation.

$$\ln(K_c) = (\Delta S^0 / R_g) - (\Delta H^0 / R_g T) \quad (13)$$

By using these equations, the effect of temperature on adsorption process of MG onto NRC is examined.

3.RESULTS AND DISCUSSION

Analysis of the Adsorption Kinetics

From Eq.8, when $\log(q_e - q_t)$ versus t is plotted (Fig.2), values of k_1 and q_e can be calculated from the slope and intercept of linear relation. The other kinetic constants in Eq.9-10 can be calculated in the same way. The kinetic constants and correlation coefficients (R^2) for the kinetic models are listed in Table 5.

When Table 5 and Fig.2 is examined, the kinetic model corresponding to the experimental data is pseudo second order model. The correlation coefficients of the pseudo second order kinetic model are larger than 0.993 and the calculated equilibrium adsorption capacity values of pseudo second order model are consistent with the experimental data, which indicates that the adsorption process of MG onto the NRC can be successfully describes the pseudo second order kinetic model. Similar kinetic results have also been reported in the removal of MG from aqueous solution [10,21,40].

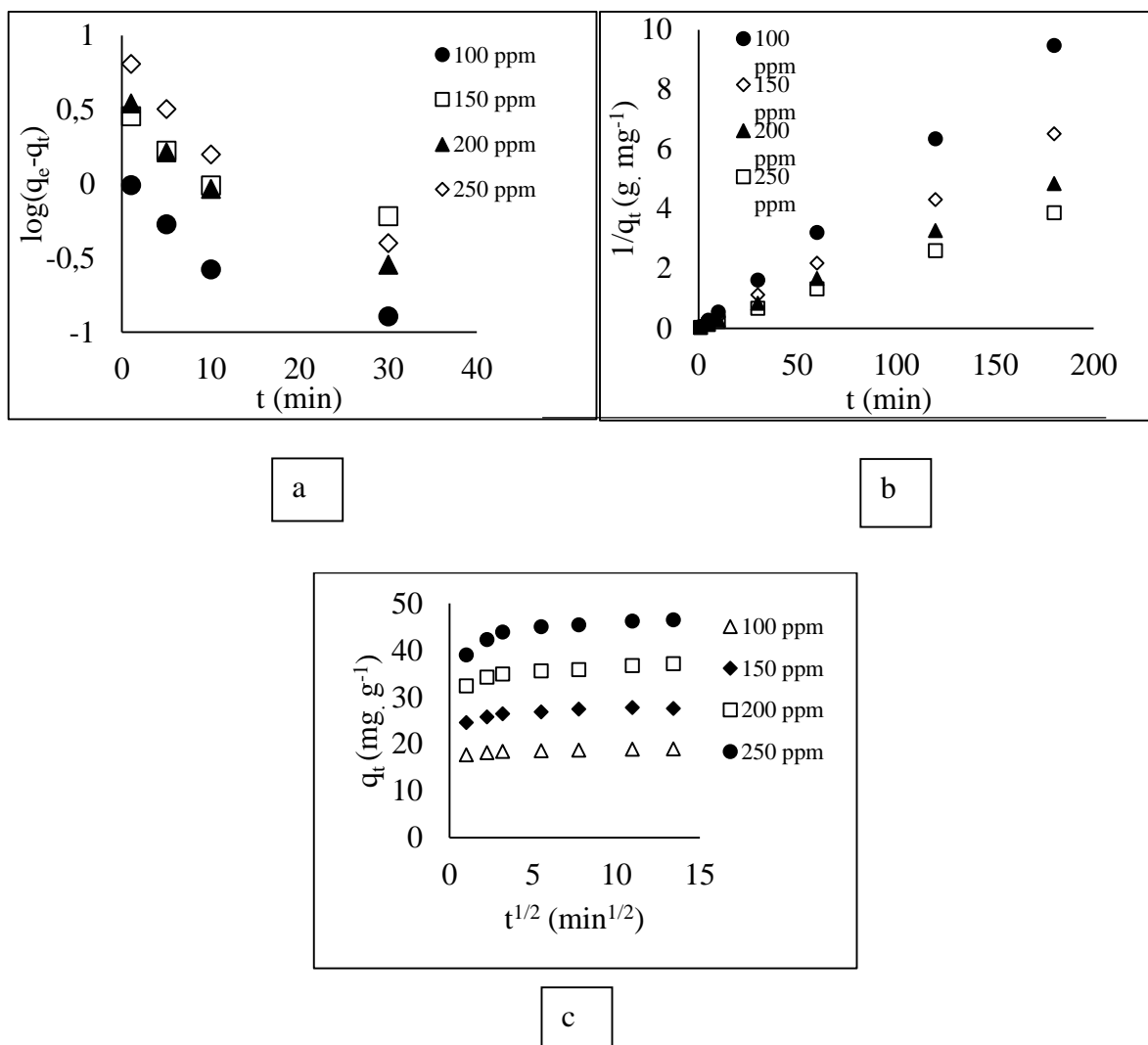


Fig.2 Kinetics curves for different kinetics models (a – Pseudo first order, b - Pseudo second order, c– Intraparticle diffusion,) (adsorbent mass 5.0 g/L, free pH 5.16, temperature 25 °C, string speed 225 rpm)

Table 5. Comparison of the kinetic models for different initial concentrations of MG at 25 °C.

Dye	C ₀ (mg. L ⁻¹)	q _{e,exp} (mg. g ⁻¹)	Pseudo First Order			Pseudo Second Order			Intraparticle Diffusion		
			k ₁ (min ⁻¹)	q _{e,cal} (mg. g ⁻¹)	R ²	k ₂ (g.mg ⁻¹ . min ⁻¹)	q _{e,cal} (mg. g ⁻¹)	R ²	k _{adif} (mg.g ⁻¹ . min ^{-0.5})	C	R ²
MG	100	18.72	0.27	1.32	0.87	0.379	18.76	0.998	0.09	17.97	0.84
	150	27.47	0.81	2.24	0.83	0.104	27.55	0.994	0.77	25.31	0.77
	200	35.91	1.01	2.75	0.94	0.121	35.97	0.997	0.84	33.32	0.84
	250	45.47	1.68	5.34	0.95	0.066	45.66	0.998	0.73	41.01	0.73

Analysis of the Adsorption Isotherms

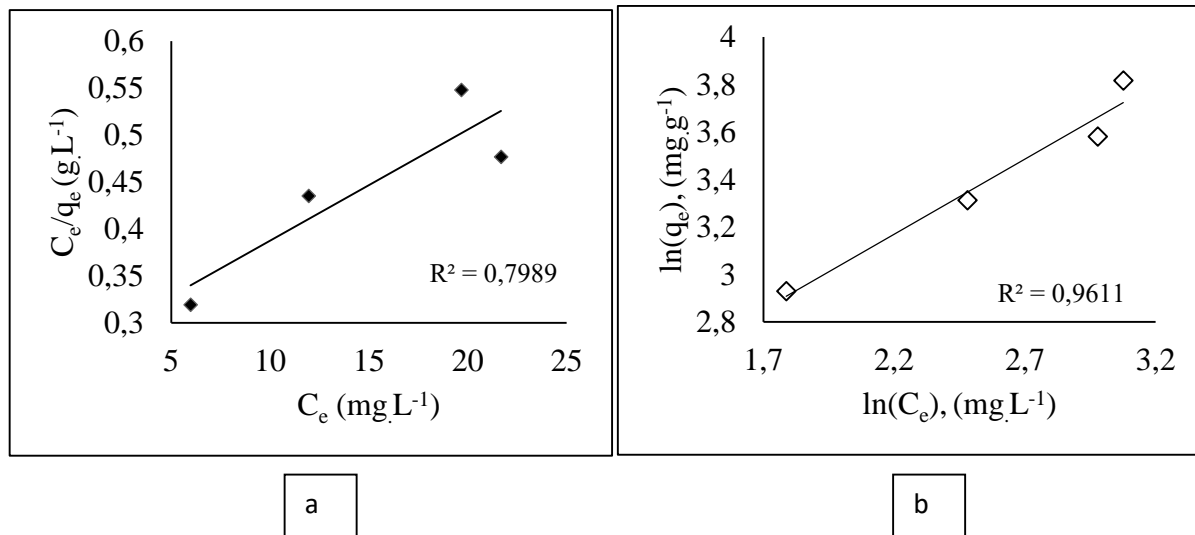
In the present study four isotherm equations namely, Freundlich, Langmuir, Temkin and D–R were fitted to the experimental equilibrium data for MG at 25 °C. From Eq. 3, The Langmuir isotherm constants K_L and q_m were calculated from the slope and intercept of the linear relation between C_e/q_e versus C_e . The other isotherm constants in Eq. 5-7 can be calculated in the same way. The isotherm constants and correlation coefficients (R^2) for the kinetic models are given in Table 6 and Fig. 3.

The experimental adsorption isotherms obtained were compared with the adsorption isotherm models shown in Fig. 3. The values of Langmuir, Freundlich, Temkin and D-R constants and the correlation coefficients (R^2) obtained by the linear regression analysis. The R_L values were in the range of 0–1, indicating that the adsorption process of MG onto the

NRC is favorable. It is also showed that the values of the Freundlich isotherm constant (n) for MG are greater than 1, which indicates that the MG favorably adsorbed onto NRC adsorbent. From the Table 6 and Fig. 3., it can be seen that the Freundlich model fits the data better than the other models, as confirmed by the high value of R^2 in case of Freundlich (0.96). Moreover, the values of n were also found to be greater than 1, indicating the adsorption MG onto NRC is highly favourable. Although the experimental data do not fit well with the Langmuir, yet the q_m value that represents the maximum monolayer adsorption capacity of NRC at equilibrium is 84.75 mg.g^{-1} . Besides, since the value of R_L are in the range of 0–1 (0.085) the adsorption is favorable process. Similar results have also been reported in the literature [10,13,40,41].

Table 6. Parameters and the correlation coefficients of equilibrium isotherm models for the adsorption of the MG onto NRC at 25°C .

Isotherm parameters	MG Dye
Langmuir	
$q_m (\text{mg.g}^{-1})$	84.75
$K_L (\text{L.mg}^{-1})$	0.043
R_L	0.085
R^2	0.89
Freundlich	
$K_f [(\text{mg.g}^{-1})(\text{L.mg}^{-1})^{-1/n}]$	5.9
n	1.58
R^2	0.96
Temkin	
$K_T (\text{L.mg}^{-1})$	15.66
B_T	134.45
R^2	0.90
Dubinin-Radushkevich	
$\beta_{DR} (\times 10^{-6} \text{mol}^2.\text{kJ}^{-2})$	6
$q_m (\text{mg.g}^{-1})$	3.71
R^2	0.85



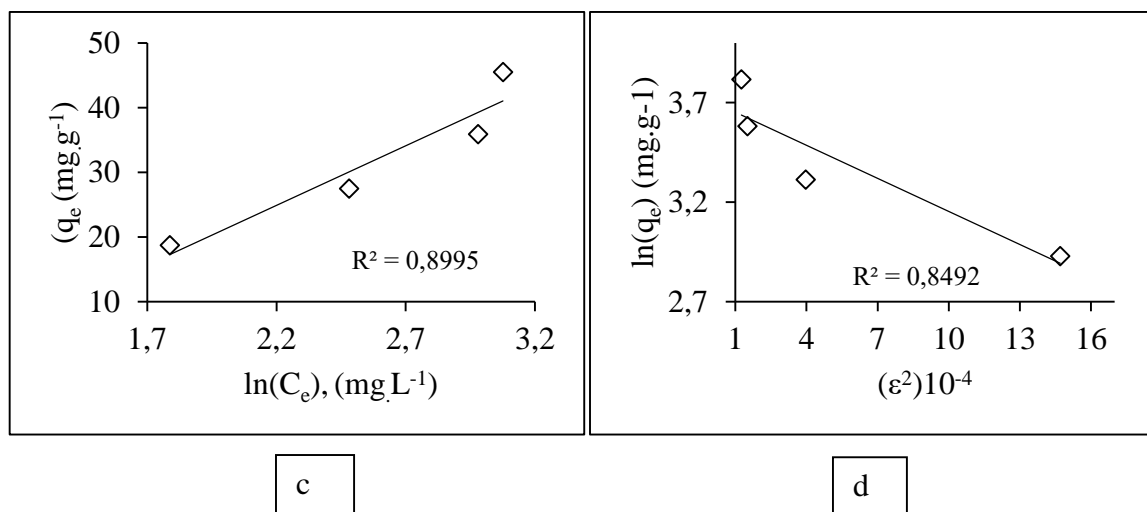


Fig.3 Isotherm curves for different isotherms models (a - Langmuir, b - Freundlich, c - Temkin, d - Dubinin-Radushkevich,) (contact time: 60 min, pH: 5.16, dose of adsorbent: 5.0 g.L⁻¹, temperature: 25 °C).

Adsorption Thermodynamics

When the plot $\ln K_c$ versus $1/T$ is plotted by using Eq. 13 (Fig. 4), the values of ΔH^0 and ΔS^0 were calculated from the slope and intercept of linear relation and then used to calculate ΔG^0 according to Eq. 11. All the calculated parameters are presented in Table 7.

According to Table 7, the value of ΔH^0 was obtained to be 9.37 kJ.mol⁻¹. This positive value indicates that the adsorption process was endothermic in nature which is consistent with the results obtained earlier where the MG dye uptakes increase with increase in solution temperature [40]. According to the presented results, the adsorption process of MG onto the NRC can be said to be carried out by physical adsorption because the value of ΔH^0 is smaller than 20 kJ.mol⁻¹ (see section 2.4.3).

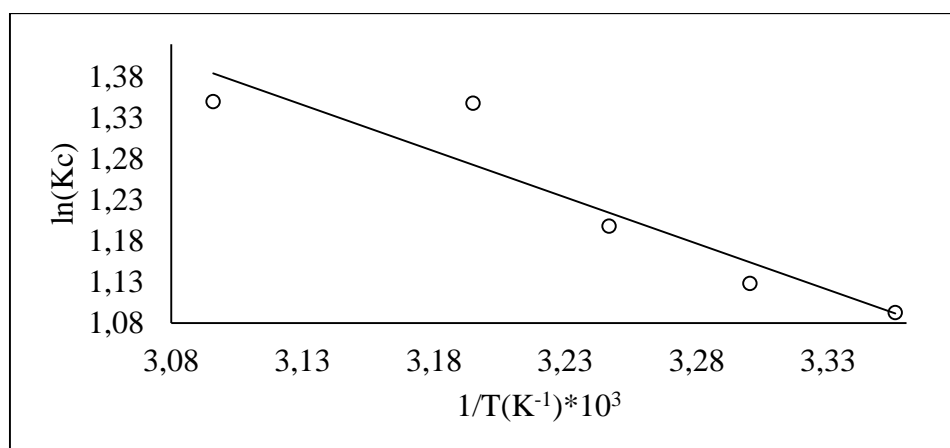


Fig. 4 the plot $\ln K_c$ versus $1/T$

Table 7 Thermodynamic parameters in the adsorption processes of MG onto the NRC.

ΔH^0 (kJ.mol ⁻¹)	ΔS^0 (J.mol ⁻¹)	ΔG^0 (kJ.mol ⁻¹)				
		25 °C	30 °C	35 °C	40 °C	50 °C
9.37	41	-2.7	-2.9	-3.1	-3.3	-3.7

The positive value of ΔS^0 values indicates that the entropy of the universe might increase because the adsorption reaction was not an isolated process [42]. The positive value of ΔS^0 values (41 J.mol⁻¹) for NRC adsorbent shows that the

randomness at the solid-liquid interface during the adsorption of MG dye onto the active sites of the NRC surface is increased. It also proposes good affinity of MG towards the adsorbent.

The negative values of ΔG^0 for the MG showed that the adsorption process was a spontaneous process and thermodynamically favorable processes at all the experimental temperature [41]. The adsorption of MG onto NRC was found to be carried out by physical adsorption, since the values of ΔH^0 and ΔG^0 for MG were in the range of physical adsorption in this study.

The adsorption process was best described by the pseudo second order kinetic model and Freundlich model. Spontaneous, endothermic and physical nature of MG adsorption onto NRC was observed from thermodynamic study. As a result, Natural red clay can be used as efficient low-cost adsorbent for the removal of malachite green from aqueous solutions.

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Experimental Study of the Effect of Thermal Insulation on the Use of Air Curtain in an Open Room on Both Sides

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Abstract: The air curtain is a device that provides heat insulation by preventing heat exchange between an environment and a surrounding area. The air curtain prevents cold air in winter and hot air in summer. They also prevent air from dust, humidity, stench, smoke, toxic gases. They have an important role in ensuring the comfort conditions of the work environment as well as in protecting the hygienic conditions of the environment. In this study, the effect of thermal insulation on the use of air curtains in a room with two sides open to the exterior is experimentally investigated. The room dimensions are 1x1x1 m and the walls are made of polystyrene foam material with a thickness of 7 cm. The room is designed to be heated from the floor and the water pipes pass through the floor at a temperature of 60 °C. Air curtains are placed on the tops of the open sides, each with 75 watts of power. The air velocity of the air curtain blowing air downwards is 5.8 m/s and the nozzle range is 1 cm. In the experimental study, the measurements were taken primarily before the curtains were off. For the outdoor temperature of 21 °C, the average temperature in the room was measured as 24.48 °C. Experimental results revealed that the use of air curtain provides significant increment in thermal insulation

Keywords: Air curtain, Insulation, Air, Airflow, Heat

1. INTRODUCTION

Nowadays, the demand for energy use in buildings and buildings to provide comfort conditions is increasing, while the efficient use of this energy has an important place. Outside doors are opened and closed very often in buildings where human density and circulation are high. This is seriously affecting the energy insulation in that building. In addition, the doors inside moisture, smoke, insect, etc. can produce negative situations. For this reason air curtains are used to minimize these effects. The air curtain is a device that provides heat insulation by preventing heat exchange between an environment and the environment. The air curtain prevents cold air in winter and hot air in summer, preventing air from dust, humidity, stench, smoke, toxic gases. They have an important role in ensuring the comfort conditions of the work environment as well as in protecting the hygienic conditions of the environment. Because of these features, air curtains have application areas in many places today. It serves as a door that provides insulation in spaces where the use of the door is limited, or where the doors are constantly opening and closing the human circulation. Air curtains are most commonly used in hotels, shops, hospitals, grocery stores, restaurants, cafes, health centers, shopping centers, airports, bus terminals, cold rooms, pharmacies and many other places. Air curtains are basically made by installing a radial fan in the case. They are designed and produced to produce high-flow and thin-form airflow. There are different types depending on the place to be applied. The most widely used type with the highest yield is door-top models. Vertical air curtains and hidden ceiling models are used when the mounting of the above door models is not possible or is not architecturally preferable. In addition, air curtains have electric heating and water coil models for the heating area.

In the literature, some studies have been carried out on the air curtain and the effect of air curtain usage has been determined. Yang et al. (2018) reported that the use of air curtains in an environment can reduce heat losses by up to 58%. The researchers have tried two types of air circulation mode in terms of direction of air flow fan rotation and found that the clockwise reverse mode performs better. Giraldez et al. (2016) investigated the effect of air perde on the heat and humidity insulation in the cooled room. Researchers have found that the speed of air curtains at high speeds will not have any effect on yield increase. The researchers reported that the efficiency of insulation increased with the outflow of air perception. Gonçalves et al. (2012) offers a comparative study of aerodynamic sealing of refrigerated chamber doors obtained from vertical and horizontal air curtain devices. In the study carried out, the sealing efficiency of vertical air curtains is over 70% while the productivity of horizontal air curtains is about 55%. Sun et al. (2017) showed that air-guided lanes accelerated the air perimeter vertically as a result of their work. As a result, the environment prevents hot air from penetrating into the cabinet, resulting in a stronger and harder air envelope. The average temperature of the simulated food in the enclosure is 4.9 °C lower compared to the untapped cabinet due to better protection of the stiff air perimeter. The cooling capacity required to store refrigerated food is reduced by 34%.

In this study, the effect of thermal insulation on the use of air curtains in an open heated room with two sides was examined experimentally. It has been found that the use of air curtains significantly increases the thermal insulation after the experimental study.

2. MATERIALS AND METHODS

The experimental setup is shown in figure 2.1. The room dimensions are 1x1x1 m and the walls are made of polystyrene foam material with a thickness of 7 cm. The room is designed to be heated from the floor and water pipes pass through the floor at a temperature of 60 °C. Air curtains are mounted on the tops of the open sides of the oven, each with 75 watts power. Downward air curtains blowing air speed of 5.8 m/s and the nozzle interval is 1 cm. Measurements were taken from 15 different points using K type thermocouple and recorded with a 30 channel data logger for 45 minutes. The first step of experimental study, measurements were taken without first running the curtains. The experiments were conducted at outdoor temperature of 21 °C. In the second step the measurements were taken by running air curtains.

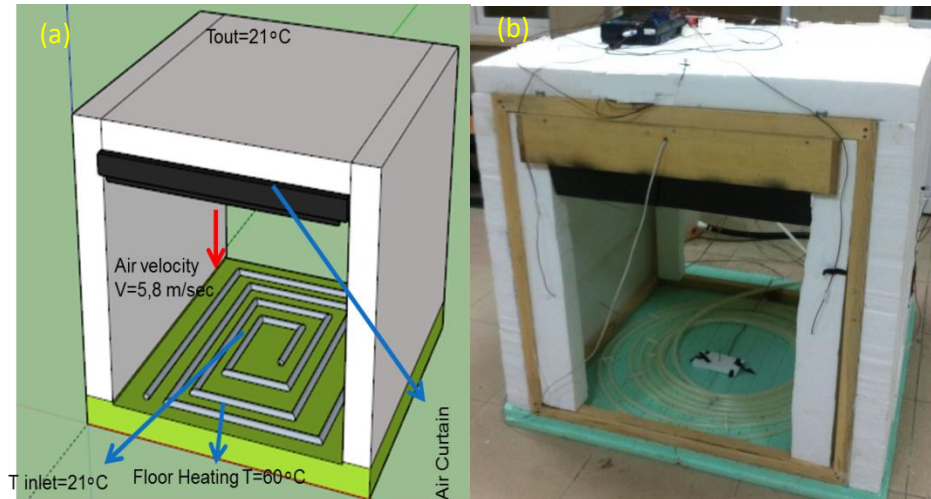


Figure 2.1. 3-D drawing (a) and photograph (b) of experimental design

3. RESULTS AND DISCUSSION

The temperature-time curves obtained from the data recorded in the experimental study are shown in Figure 3.1. For outdoor temperature is 21.22 °C the temperature values are measured in 12 different points of the room and the average values are plotted. Measurements were taken before the air curtain was activated. The average temperature was measured as 24.48 °C when the air curtain was off. Then the air curtain was operated and measurements were taken. In these conditions the average temperature in the room was measured as 27.07 °C

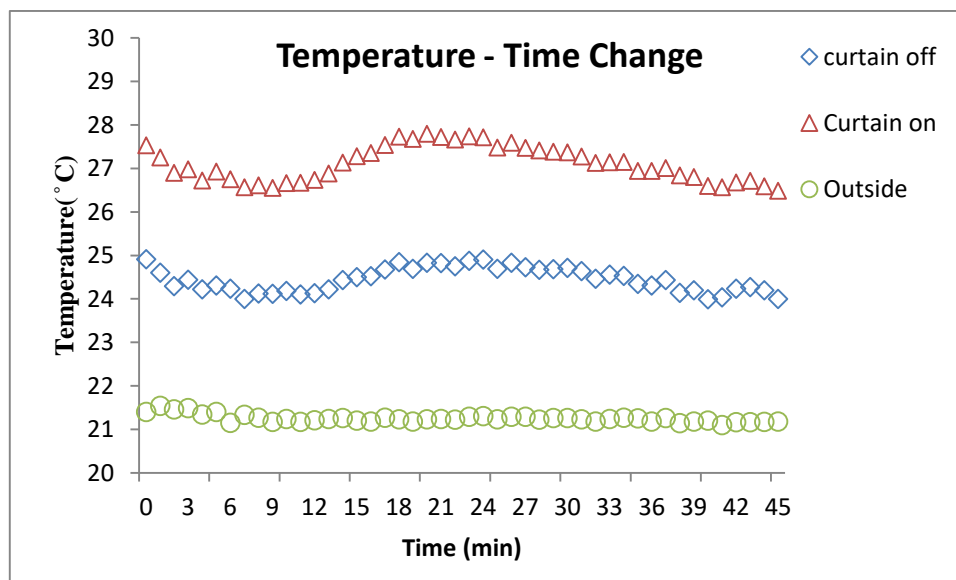


Figure 3.1. Temperature-time curves

Figure 3.2 shows the saved energy-time curve. Using the measured temperature – time data, the heat insulation provided in the room was calculated to determine the thermal insulation effect of the air curtain. As a result of the calculations, approximately 3000 J energy saving was achieved in case the air curtain was active.

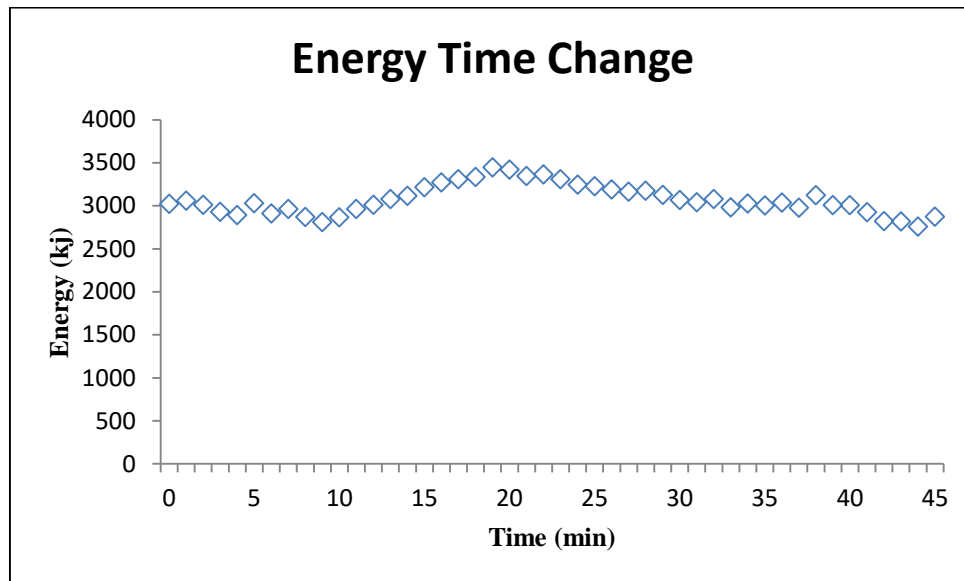


Figure 3.2. Energy-time curve

As a result of this experimental study,

- There is a temperature difference of about 3 °C according to the situation in which the curtain is not used.
- Approximately 3000 j energy saving was provided.
- It has been understood that the use of air curtains significantly increased thermal insulation after experimental work. The calculations show that the resulting heat loss is reduced by 10.58%.

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Determination of the Electrical Resistances of Flame Sprayed Coatings by Different Measurement Methods

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Abstract: In this study, an experimental study has been carried out to investigate the electrical resistance of the flame sprayed coatings on aluminum substrate. Cr_2O_3 powders were deposited onto substrate with and without Ni-5wt. % Al as bond coating layer using a flame-spray technique. Electrical resistance values of Cr_2O_3 specimens coated in three different thicknesses, with or without binder were measured by different electrical resistance measurement methods. Before the coating process substrate specimens manufactured by a lathe from Al 6082 aluminum rods were sand blasted to obtain a better bonding surface. Cr_2O_3 powders were sprayed on Al 6082 aluminum substrate in certain spray parameters. Six different groups were formed. Thermal spraying offers coating processes for parts with many different coating materials in order to yield wear and corrosion-resistant coatings as well as thermal-barrier coatings, or to produce the desired electrical or magnetic properties, etc. Bond coatings are already used widely in many industrial thermal spray applications. They have specific functions; because the substrate and the main coating have different coefficients of thermal expansion, bond coating layer should be used to provide a good thermal expansion match between these two different layers; on the other hand, bond coating layers are always thinner than the main coatings. The produced layers were characterized by optical microscope, scanning electron microscope and microhardness tester. Electrical resistance values of specimens were measured by using zero measurement method, two point measurement method, four point measurement method and four point probe method. Although the measured values for the same samples are close to each other, measurement method related errors are noteworthy. In the end of this study, accuracy of measurement methods were interpreted by considering the obtained data.

Keywords: Flame spray method, coating, bond coat, electrical resistance, electrical resistance measurement methods

1. INTRODUCTION

Coating is an engineering solution that used to prevent corrosion, abrasive and erosive wear events, increase or isolate thermal and electrical conductivity, increase material life. It can also be used for repair, altering the appearance and for decorative purposes (Dorfman 2012). After the Second World War coating technology has developed rapidly depending on the needs (Davis 2004). The thermal spray method is a family of a wide range of coating methods, including flame spraying. It is a coating method which the powder material to be sprayed is melted by a heat source and the molten powders are sprayed onto the surface of the sample by a jet with using air as a carrier (Davis 2004). Chromium (III) oxide (Cr_2O_3) is a hard and brittle material and antiferromagnetics up to 34 ° C. It is used as colorant in paint, ink and glass. Bond coat materials which are used as a binder between substrate and coating must be selected from materials that have thermal property values between the thermal property values of substrate and coating. Electrical resistance measurements can be done using different measurement methods with multimeters in these days. Each measurement method that used to measure electrical resistance differs from the others in terms of accuracy of the measured values.

2. MATERIALS AND METHODS

Al 6082 Aluminum alloy material is machined by a lathe with dimension of Φ 20mm and 20mm in length as seen in Figure 2.1a. After turning, the substrate materials were prepared for coating by following the sandblasting step to roughen and clean the substrate surfaces from foreign materials to provide a better bonding. Firstly, NiAl (95/5) binder was sprayed to the substrate surface of surface roughened samples with bond coat and then Cr_2O_3 powders were sprayed. The SEM image of the sprayed Cr_2O_3 powders is shown in Figure 2.1b. Cr_2O_3 powders were sprayed to the substrate surface in accordance with the determined spray parameters in different thicknesses of 0,3mm - 0,5 mm - 1 mm. Figure 2.1c shows the coated samples.

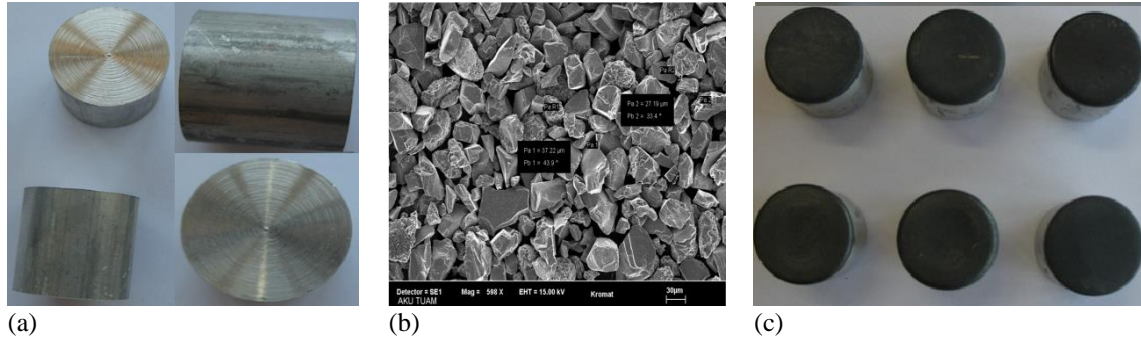


Figure 2.1 (a) Al 6082 substrate material to be coated (b) SEM image of the Cr_2O_3 powders (c) Cr_2O_3 coated specimens

In this study; the electrical resistances of Cr_2O_3 coatings with different thicknesses were investigated and the results obtained by using four different electrical resistance measurement methods.

Electrical resistance measurement methods respectively (Gibilisco 2002, Heaney 2004);

Zero measurement method (1): This method is an electrical resistance measurement method that measures the resistance by using a multimeter.

Two-point measurement method (2): Measurement process is done by a direct current source with certain voltage value which is integrated to the circuit and measuring the current by using a multimeter.

Four point measurement method (3): The current obtained by a direct current generator with a certain potential is measured by using a multimeter and simultaneously voltage value is measured by another multimeter.

Four point probe method (4): This method uses two multimeters simultaneously. All the probes must be connected to the coating surface. Direct current source is serially connected to current measuring multimeter. The outer probes measure the electrical current and the inner ones measure the voltage.

The schematic representation of the electrical resistance measurement methods is respectively given in Figure 2.2.

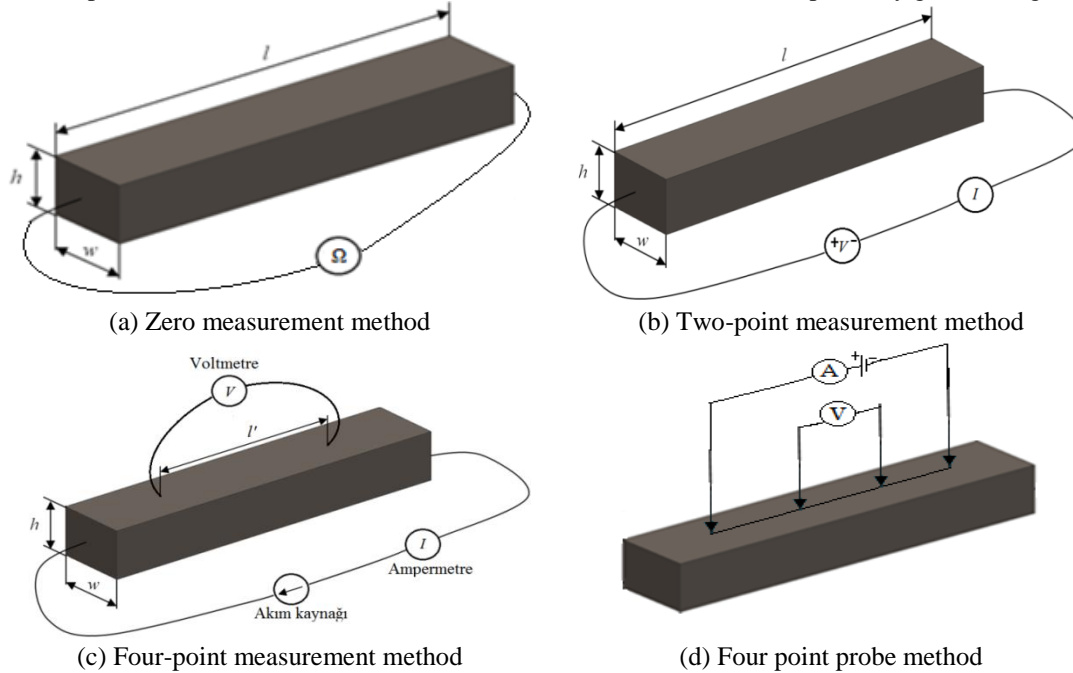


Figure 2.2 Electrical Resistance Measurement Methods

The physical properties of the coatings are influenced by parameters such as adhesion to the substrate, porosity, surface roughness. Using a bond coat improves the adhesion strength of the coating mechanically as well as influences the electrical resistance properties (Bilgin 2009). The microstructure and the bonding condition to the surface of coatings were examined by using Nikon optical microscope and the images are given in Figure 2.3.

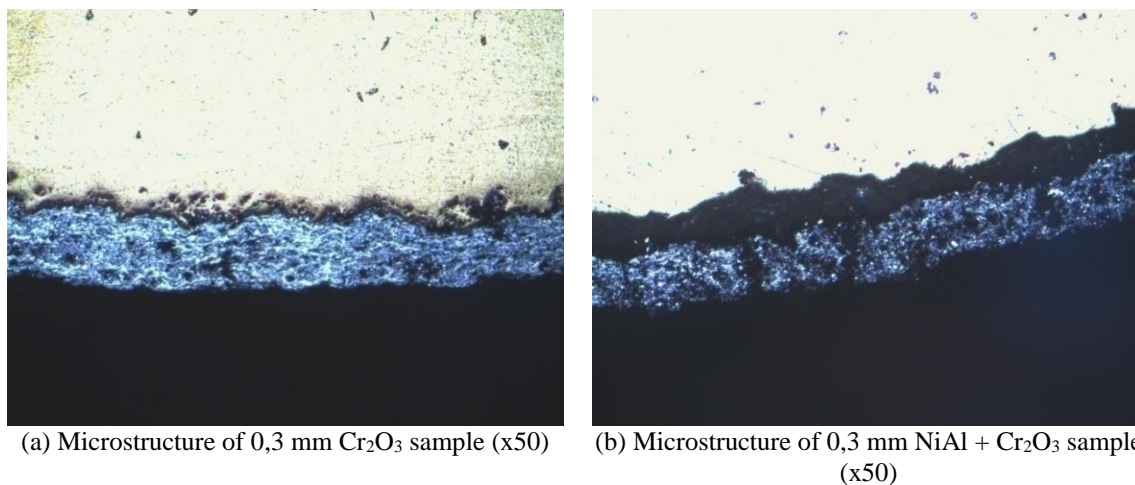


Figure 2.3 Optical Microscope Images

3.RESULTS AND DISCUSSION

Generally, as a result of the measurements made, it was observed that the obtained data with the zero measurement method and the two point measurement method showed higher values than the other two methods. The obtained data by the four-point and four-point probe method showed closer values to each other. The resistance values of the two coated samples with the same thickness were measured and results are given in figure 3.1 and figure 3.2 according to the numbering sequence of the measurement methods. Between the samples with the same thickness NiAl + Cr₂O₃ samples with bond coat showed lower resistance values than the Cr₂O₃ samples without bond coat. It is believed that this is caused by the fact that the bond coat provides the coating better adhesion and low porosity properties.

This situation is seen in the optical microscope image analysis. It was observed that the resistance values increased with increasing the thickness but depending on the characteristic of the coating the increase did not vary linearly. Different resistance values are measured for the same sample depending on the resistance measurement methods and the variation of these values is clearly seen in Figure 3.1 and Figure 3.2. Since the zero measuring method involves the internal resistance of the measuring instrument, it is noted that the measured values are high and the range of change is higher than the others. The variation in the measured resistances are in a smaller range for the NiAl + Cr₂O₃ samples with bond coat which have better porosity and adhesion properties. Especially, it has been observed that the measured values obtained from the four point measurement method are closer to each other for the same specimens. Four point measurement gives more accurate results than the two-point measurement method. It is convinced that measuring the potential and current separately, remove the measurement instrument faults.

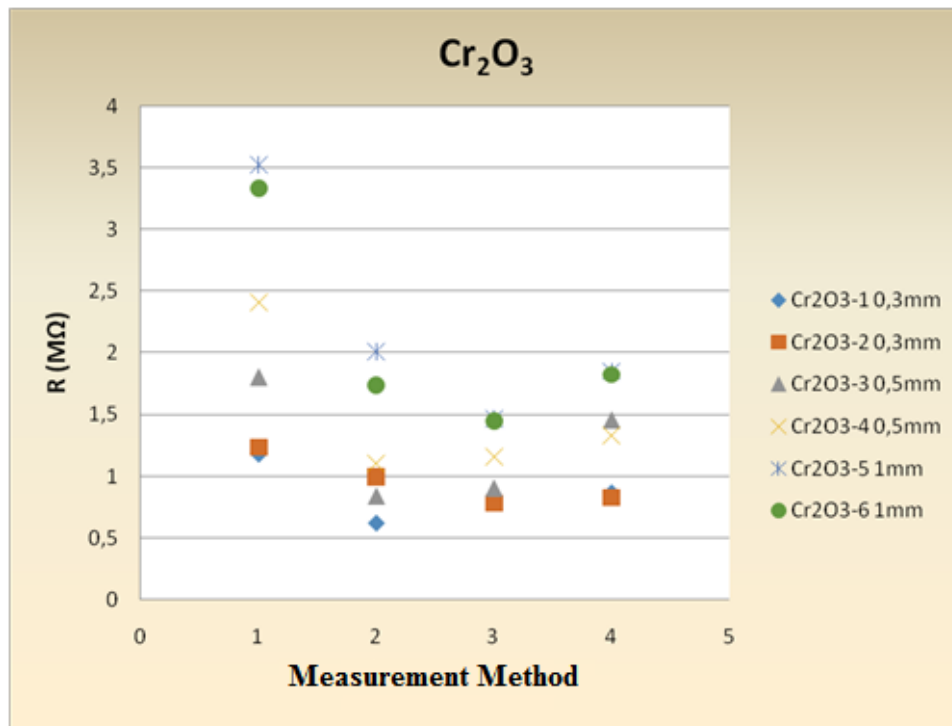


Figure 3.1 Variation of resistance values of Cr₂O₃ samples according to different measurement methods

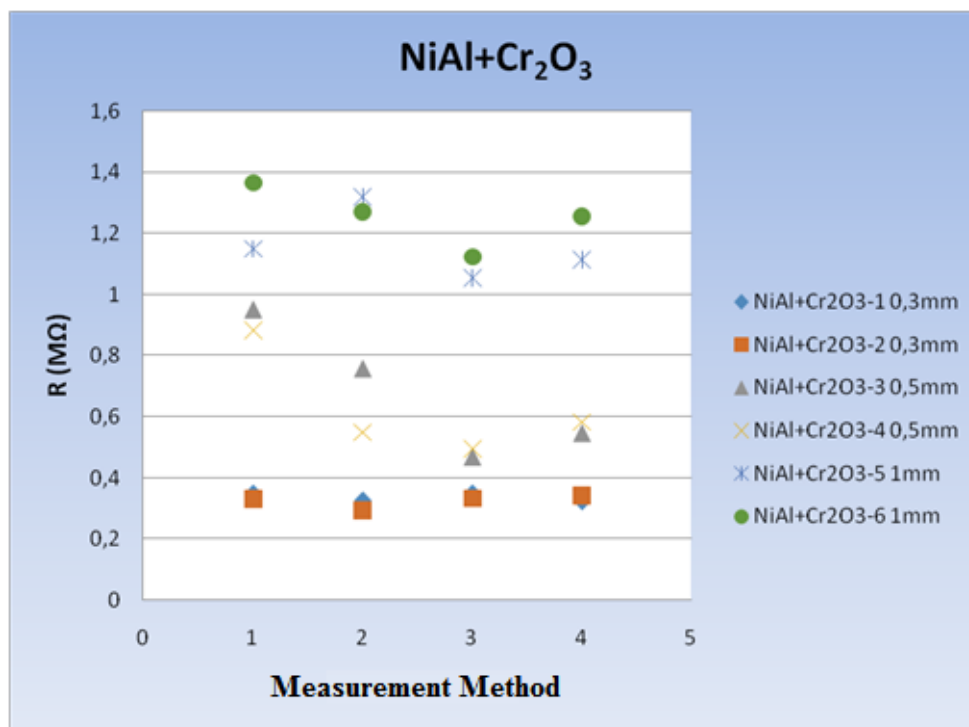


Figure 3.2 Variation of resistance values of NiAl+Cr₂O₃ samples according to different measurement methods

- Resistance values increase with increasing coating thickness but this increase shows a non-linear variation according to the characteristic (porosity, bond coat) of the coating.
- The measurements methods generally show similar results. When the values of the measurement methods for the same samples are interpreted in terms of the accuracy of the measurements and graphics are examined, It is seen that measurement accuracy of the methods respectively; four point, four point probe, two point and zero measurement method.
- When the zero and two point measurement method is considered, it is clearly seen in the graphics that the deviations of the resistance values of the samples with bond coat are in a lower range than the others.

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A Real Options Approach to Renewable Electricity from Hydropower in Turkey

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Abstract: Growing populations and modern technologies require vast amounts of electricity for creating, building, and expanding. Hydroelectric power is the most clean, reliable, efficient and economical of all renewable energy sources. Hydropower is energy derived from falling or moving water. Hydropower sources include impounded water sources, natural river elevation changes, river flows, tides, ocean currents, and waves. Suitable Turkish sites for large dams have been used. Smaller impoundments are now under consideration. Analysts estimate that new hydropower in Turkey could provide around 20% of current electricity production. Turkey has a total gross hydropower potential of 433 GWh/year, but only 125 GWh/year of the total hydroelectric potential of Turkey can be economically used. By the commissioning of new hydropower plants, which are under construction, 36% of the economically usable potential of the country would be tapped. This paper discusses the hydropower situation in Turkey.

Keywords: Hydropower; Renewable electricity; Electric generation; Turkey

1. INTRODUCTION

Energy can be used to generate and generate energy in the hydrological cycle of water evaporation, sedimentation and surface flow. A simple schematic diagram of a hydroelectric power plant is shown in Figure 1. Generally, the water stored behind a dam falls to a height (or head) distance. The water potential energy is converted into kinetic energy and the flowing water becomes a water turbine. The turbine turns the electric generator, which gives the rotating shaft electrical [1,2].

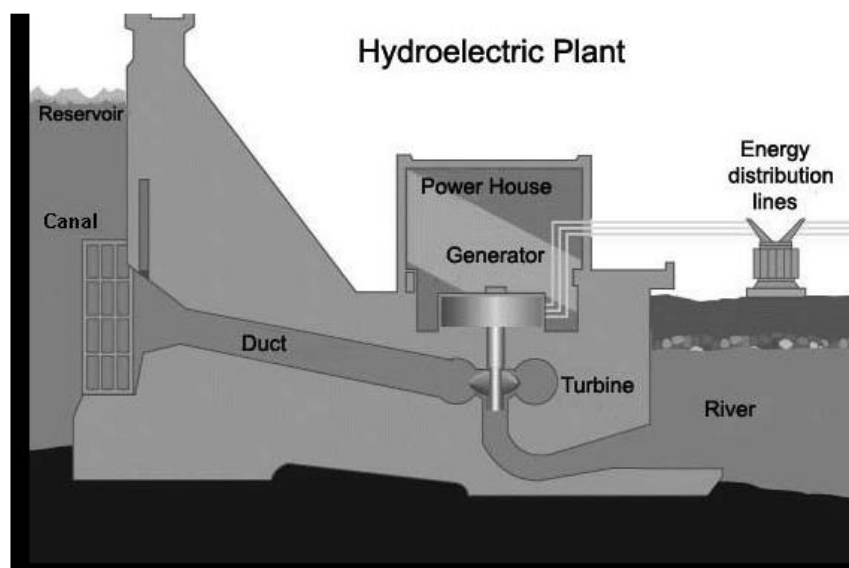


Figure 1. A schematic overview of the hydroelectric dam

The river water may pass through the regions where it is possible to hold water with the dams as the water eventually flows to the sea. It is often desirable to build dams in areas where there is a minimum of submerged land behind the dam and where the height of the dam can be maximized.

Hydroelectric energy is a form of renewable energy because it uses the power of the flowing water, whether or not the energy is obtained or consumed. Because they are clean energy production facilities, hydroelectricity can contribute to reducing air pollution and slowing global warming. No other air pollutant or toxic waste is produced and increases energy security independence and price stability. Hydropower is an electrical source with long life and low operating and maintenance cost. Figure 2 shows the global historical growth of hydroelectric power since 1980. The blue arrow represents a general historical increase in hydropower in response to the increase of electricity demand worldwide.

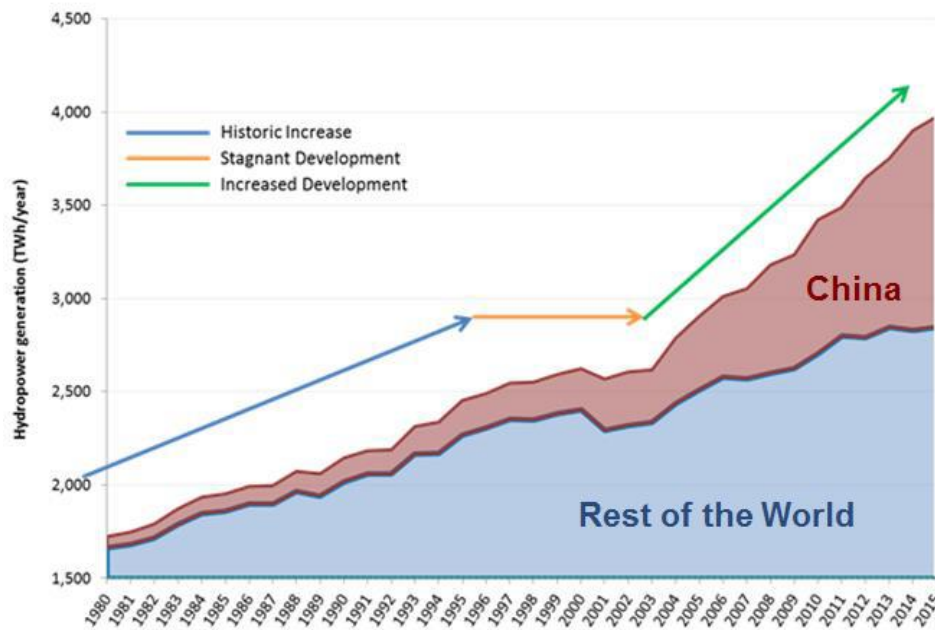


Figure 2. Global total hydropower generation

In rivers, oceans and estuaries, there is water movement and therefore kinetic energy that can be captured to generate electricity. River flow rates vary, but some flows are usually continuous. Water causes periodic changes in water depth and flow of water currents into and out of estuaries. Waves cause periodic increases and decrease in water depths. Ocean currents such as the gulf stream have an energy that can be consumed to produce electricity that will be transferred to the shore one day [3].

There is a hydro potential of Turkey's total annual potential of 433,000 GWh gross annual accounts for approximately 1%. Turkey's share of total hydropower capacity in Europe is about 14%. Almost half of the gross potential is technically feasible and 28% (122,322 GWh/year) can be used economically. By November 2017, there were 160 hydro plants in operation.

Their total installed capacity is 16,588 MW and their annual average production capacity is 62,015 GWh, corresponding to approximately 34% of the total available potential, which accounts for approximately 35% of the total electric potential. 30 hydroelectric power plants with 4305 MW installed capacity and an annual production capacity of 13.981 GWh, about 9% of the total potential, are under construction [4].

Hydropower for Electricity Generation in Turkey

The first hydropower plant was built in Tarsus in Turkey in 1902. This plant only produced 60 kW, but it was still a major technical success for the country. In the following years, there were many more projects such as Seyhan, Sarıyer, Hirfanlı, Kesikköprü, Demirköprü and Kemer. These projects were either dams or hydroelectric power plants had a total of 28 hydropower plants in Turkey and 1940 when the bridge. After the establishment of the State Hydraulic Works (DSİ) in 1954, the projects were financed better and the annual.

The country has 186 km³ / year of water volume flowing through the 177,000 km of rivers. Only after the measures to privatize the national electricity system initiated in 2003, it seems that the exploitation of this great source has started to accelerate. Today, about 60% of the hydroelectric potential of the country is underdeveloped. Referring to the situation in this country, which is contrary to the general perception of Turkey, is neither a rich nor the richest country in the region with fresh water source country. Turkey is located in a semi-arid region and North America, and the per capita water in water rich areas such as Western Europe is only about one fifth. Countries rich in water are countries with 10,000 cubic meters of water per capita per year. This is well above the 2,000 m³ per capita in Turkey. On the other hand, Turkey is no water at the right time at the right time to meet the current and anticipated needs. abundant in some regions such as the Black Sea region of Turkey, but can not be used while fresh water, a portion of the Marmara and Aegean regions such as the more heavily populated and industrialized.

Take advantage of the mountainous landscape and the location between the three seas. Turkey, worth a total of 433 TWh per year, the annual 176 twh'lik considered to be economically viable, has a significant hydroelectric capacity. At an altitude of 1100 meters above sea level, there is abundant head for development in many regions, including the Black Sea, Mediterranean and Eastern Anatolia regions. Geography offers an important opportunity for hydropower development.

Turkey, which corresponds to 25.6% of total energy production, annually produces more than 67 billion kWh of hydroelectric power. Turkey's energy consumption, on average, an increase of 5.7 percent due to rapid urbanization and industrialization. Electricity consumption in 2002 was 126.9 billion kWh, but in 2016 it was 274 billion kWh. It is estimated that in 2020 it will reach 528 billion kWh.

Total gross hydropower potential and total energy production capacity is 50 000 MW and 112 TWh / year. Also, 26% can be used economically. At present, only 14% of the total hydroelectric energy potential is utilized. The national development plan aims to harvest up to 2030 of the entire hydroelectric energy potential. It is estimated that the contribution of small hydropower plants to total electricity generation is 4%. Maybe the rivers are leaving the small hydropower potential not being reassessed. Since the total energy losses in hydropower generation are about 3.6 TWh in 1985, it also improves the electricity production of the electric power plant [5-10].

An efficient, energy sector is an important component of a Turkish economy. Achieving energy efficiency, better payment equilibrium and the number of people worked by the Turkish industry. More energy independence, internal renewable energy source. Climate change and a famous and leading a proactive, faith and talent that will increase Turkey's leadership in the worldwide project. On the other hand, Turkey is using about 30% of the hydropower potential and untapped potential of small hydro üretd occurs. The year 2017 was 13.393 MW. Small hydropower projects have become one of the most attractive options for alternative private investors. It is expected that the capacity of small hydropower plants to serve in the current five years will be about 44 000 GW, which is 22% of the current electricity generation. It can be concluded from this exercise:

Hydropower is a fusion that is already in use. Again, there are potentials for new programs and reorganization of existing sites. It is likely that during water-related periods there will be a little more potential for hydropower, along with the maintenance of water supply during dry periods. Sustainable hydroelectricity is benefiting from integrating ecology with an economic energy source, integrating plants into the river ecosystem.

energy supervision in Turkey, large and small hydropower projects needed to, for large and small hydropower projects, has been neglected by using appropriate and river ecosystems. Hydropower is an important energy source for Turkey because it is renewable, clean, and less impactful on the environment. Plus it is a cheap and domestic energy source.

Turkey's hydroelectric potential of electric energy in 2030 can meet the needs of 40-60%. Turkey, evaluating the small hydroelectric power plants, a significant portion of the total electricity demand will provide their own hydropower resources.

Only 5% of the economically viable small hydroelectric potential has been developed. Turkey fully benefit from all the rest into small hydropower potential, which constitutes approximately 10 percent of the annual electricity production of about 20 TWh / year of electricity production will take place.

In Turkey, only 30 per cent of the economic hydropower potential is currently available. Turkey, 100 TWh / year can use the remaining hydropower potential hydroelectric capacity with an efficient manner.

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Preliminary Estimates Part 1: Statistical Analysis of Earthquake Catalogue with the Geographic Information Systems (Cbs) in the Aegean Sea and Surrounding, Western Turkey

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Abstract: The aim of this study, we investigated statistical analysis to Kriging method compliance of earthquake catalogue with the Geographic Information Systems (CBS) in the Aegean Sea and surrounding. So, earthquake occurrences and depth information at catalogue used. First of all, the Aegean Sea divided into 10 different seismic zone based on tectonic, fault, epicenter distribution etc. All analysis estimated for $M_s \geq 3.0$ earthquake occurrences taking into account variables of cutoff magnitudes (M_c) of the catalogue. After that, we investigated changes at graphs of Histogram (standart deviation, skewness, kurtosis variables etc.), Normal QQ plot (normal distribution suitability), Voronoi maps (when viewing the Voronoi map, check whether at any vicinity there are polygons with the colors symbolizing very different categories of values), Trend analysis (it tool provided a three-dimensional perspective of the data), Semivariogram/Covariance Clouds (it tool showed the empirical semivariogram and covariance values for all pairs of locations within a dataset and plots them as a function of the distance that separates the two locations) for magnitudes and depth distributions. Then, the map of Buffer analysis of faults plotted at 10 km to investigated coincide with faults of earthquake occurrences. The earthquake occurrences and depths showed normal distribution. As a result, The database can be used to Kriging method in the Aegean Sea and surrounding.

Keywords: Geographic Information Systems (CBS), The Aegean Sea and Surrounding, Kriging method

1.INTRODUCTION

The Anatolia region contained the most areas of Turkey, also as the relationship the Aegean Sea and Southern Greece displayed active tectonics. Tectonic evidence proposed that belonging to Eurasia, most of Turkey acted westward and most of the Aegean Sea and Southern Greece acted southwest. The causes for these motions cleared to comment. But, two distinct sights of the regional tectonics extensive: Firstly, the entire region was the section of an only microplate turning about an Euler pole located on or close the Arabian peninsula. Secondly, the region was in fact 2 distinct microplates—the Anatolian, moving west notional to Europe, and the Aegean, which acted. So, the Aegean Sea, and surrounding coastal areas of Greece and western Turkey was one of the most seismically active and quickly deforming regions on the continents (Taymaz et. al. 1991). The Aegean Sea observed a lot of earthquakes in the past years. Bayrak and Türker (2016) investigated earthquake hazard analysis in the Western Anatolia region. So, we investigated earthquake hazard analysis in the Aegean Sea and surroundings. The Aegean Sea and surrounding map plotted that associated with tectonic and epicenter distribution and it divided into 10 different seismogenic zones (Fig. 1 and 2).

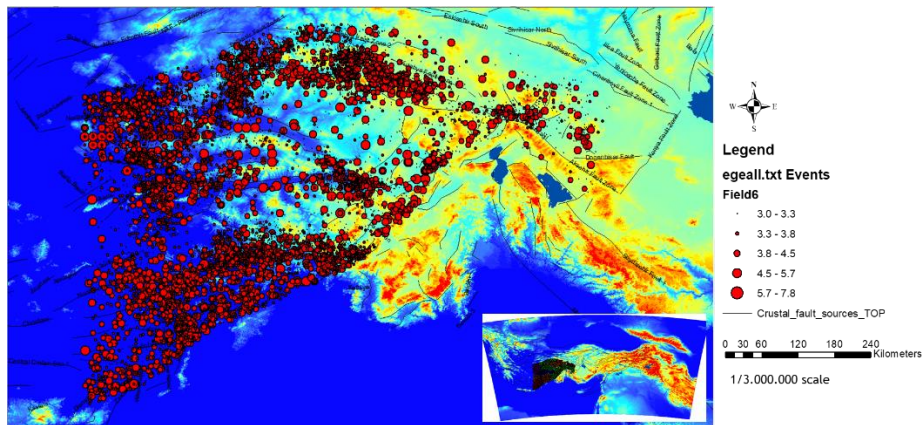


Figure 1. Aegean Sea and surroundings plotted to tectonic map and earthquake epicenter distributions with 1/3.000.000 scale

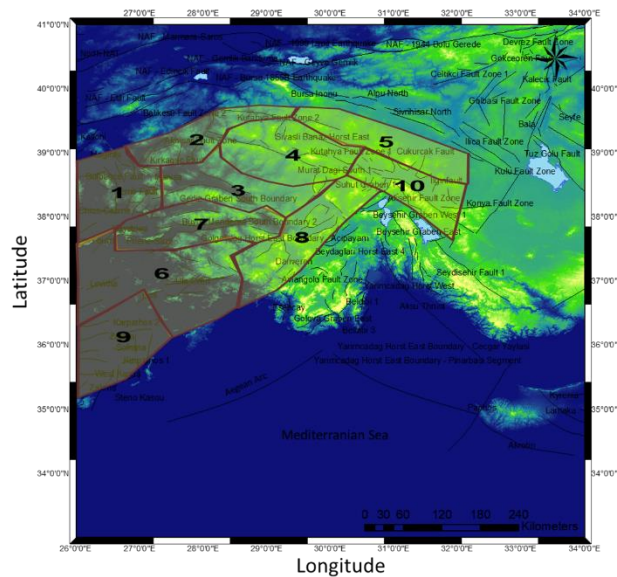


Figure 2. 10 different seismic source zone plotted on tectonic map in Aegean Sea and surroundings

2.MATERIALS AND METHODS

We used some statistical features (Frequency distribution, Normal QQ plot graphs, Trend Analysis, Semivariogram/Covariance Clouds, Measuring Geographic Distributions, Buffer Analysis, Mapping Clusters, Density Analysis).

Frequency Distribution

The frequency distribution is a bar graph that displays how often observed values fall within certain intervals or classes. You can specify the number of classes of equal width that are used in the histogram. The relative proportion of data that falls in each class is represented by the height of each bar. For example, the histogram below shows as the frequency distribution for a dataset (Fig. 3).

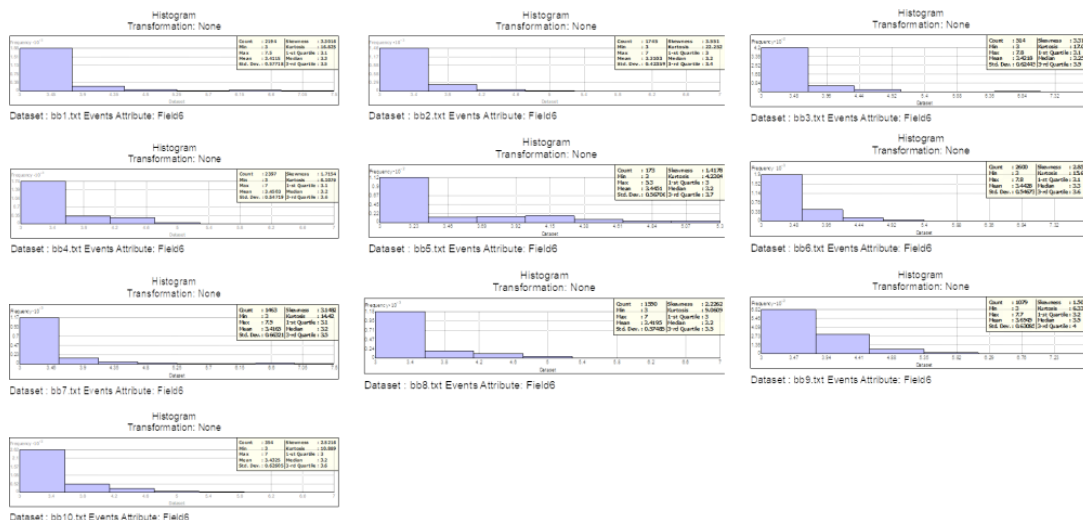


Figure 3. Histograms (frequency distributions of magnitudes) graphs estimated 10 different seismicogenic zones.

How the Normal QQ Plot is Constructed

First, the data values are ordered and cumulative distribution values are calculated as $(i-0.5)/n$ for the i th ordered value out of n total values (this gives the proportion of the data that falls below a certain value). A cumulative distribution graph is produced by plotting the ordered data versus the cumulative distribution values (graph on the top left in the figure below). The same process is done for a standard normal distribution (a Gaussian distribution with a mean of 0 and a

standard deviation of 1). Once these two cumulative distribution graphs have been generated, data values corresponding to specific quantiles are paired and plotted in a QQ plot (Fig. 4).

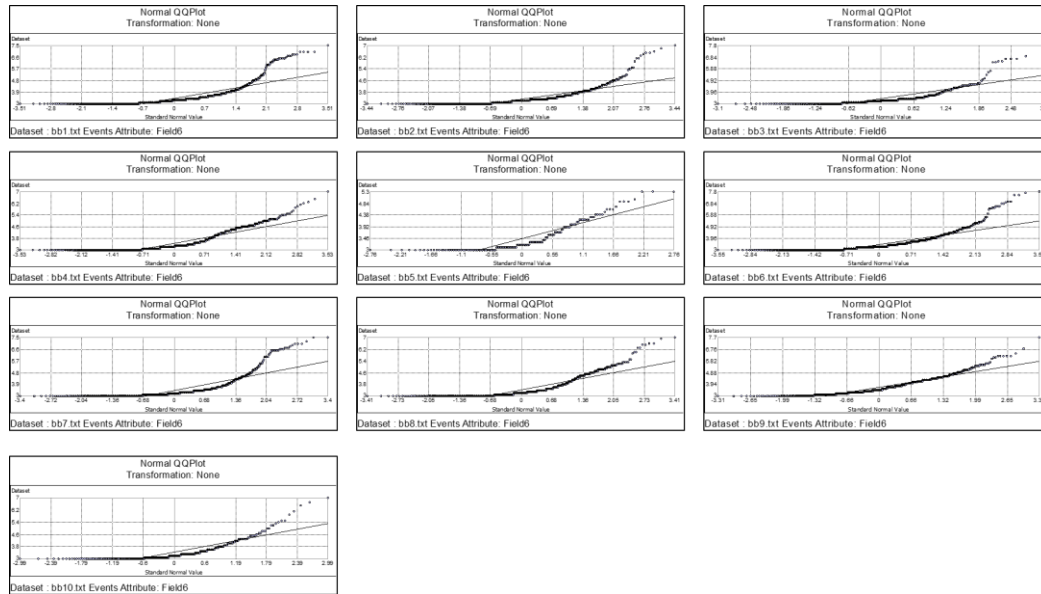


Figure 4. Normal QQ plot graphs plotted for 10 different zones of the Aegean Sea and surroundings

Trend Analysis

The Trend Analysis tool provides a three-dimensional perspective of the data. The locations of sample points are plotted on the x, y plane. Above each sample point, the value is given by the height of a stick in the z-dimension. A unique feature of the Trend Analysis tool is that the values are then projected onto the x, z plane and the y, z plane as scatterplots. This can be thought of as sideways views through the three-dimensional data. We have shown the results of trend analysis for only 6 different zones (Fig. 5).

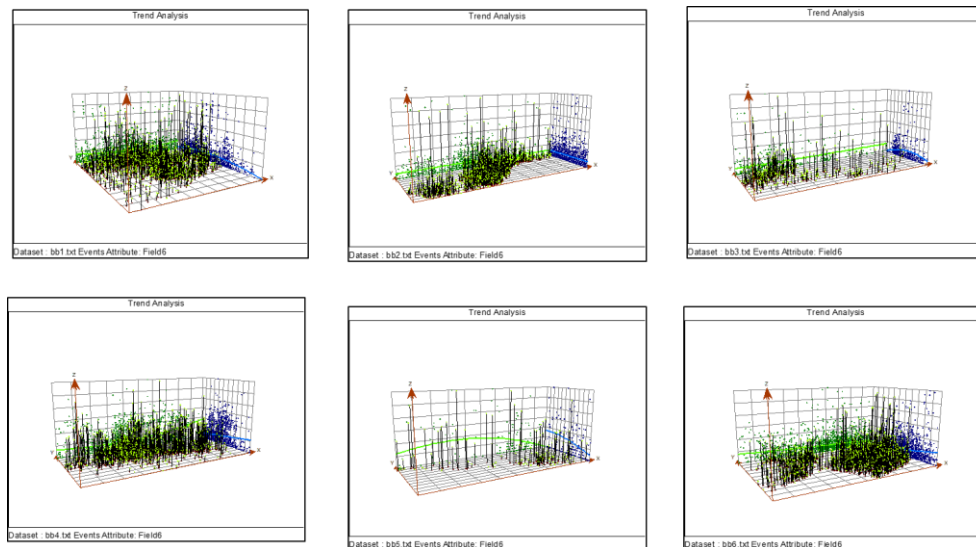


Figure 5. Trend analysis graphs plotted for 6 different seismogenic zones

Semivariogram/Covariance Clouds

The Semivariogram/Covariance Cloud tool shows the empirical semivariogram and covariance values for all pairs of locations within a dataset and plots them as a function of the distance that separates the two locations (Fig. 7 for only 4 different zones).

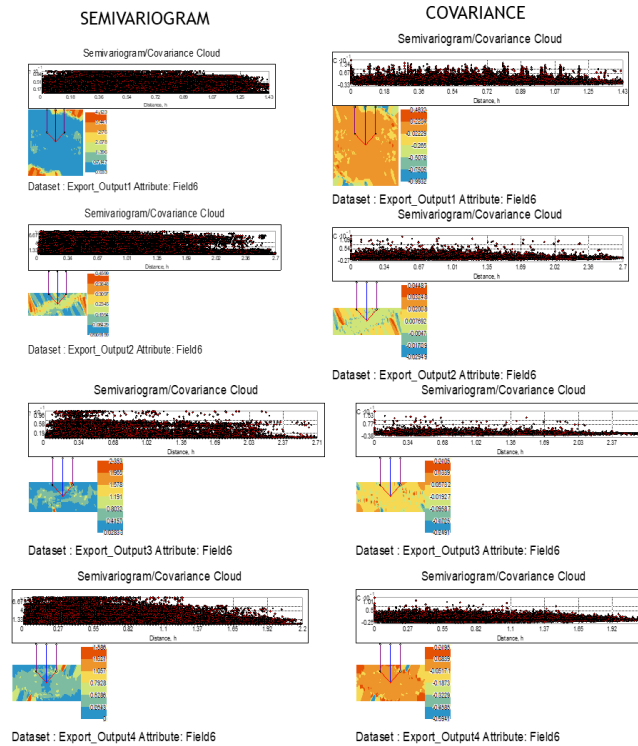


Figure 6. Semivariogram/Covariance clouds graphs plotted to 4 different seismogenic zones

Measuring Geographic Distributions

Measuring the distribution of a set of features (Fig. 7 and 8) applied to calculate a value that represents a characteristic of the distribution, such as the center, compactness, or orientation. This value used to track changes in the distribution over time or compare distributions of different features. The Measuring Geographic Distributions toolset addresses questions such as:

- Where's the center?
- What's the shape and orientation of the data?
- How dispersed are the features?

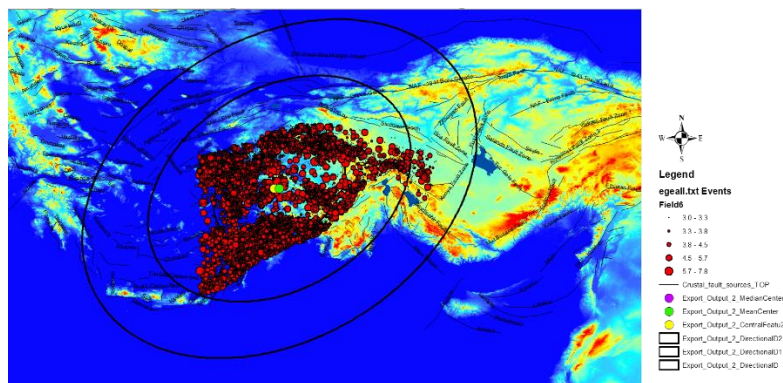


Figure 7. Directional distribution (Standard deviational ellipse) graph

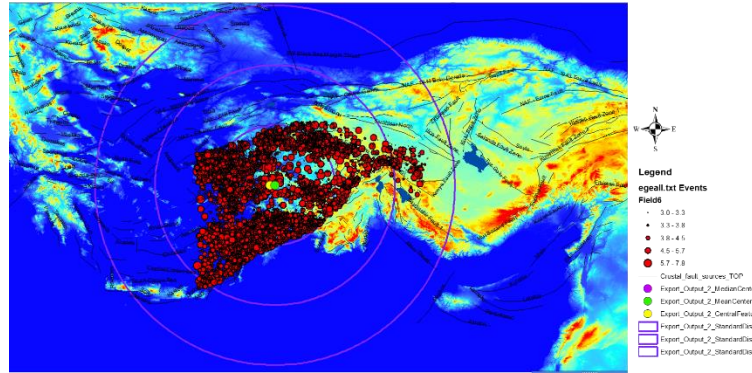


Figure 8. Standard distance graph

Buffer Analysis

As described in How Buffer works, an important feature of the Buffer tool is the Method parameter which determines how buffers are constructed. There are two basic methods for constructing buffers: Euclidean and geodesic. Euclidean buffers measure distance in a two-dimensional Cartesian plane, where straight-line or Euclidean distances are calculated between two points on a flat surface (the Cartesian plane). Euclidean buffers are the more common type of buffer and work well when analyzing distances around features in a projected coordinate system, which are concentrated in a relatively small area (such as one UTM zone). Geodesic buffers are those that account for the actual shape of the earth (an ellipsoid, or more properly, a geoid). Distances are calculated between two points on a curved surface (the geoid) as opposed to two points on a flat surface (the Cartesian plane). The spatial reference (map projection) of your input features distorts distances in order to preserve other properties such as area. Geodesic buffers may appear unusual on a flat map, but when displayed on a globe, these buffers will look correct. We applied geodetic buffers to both 5 km and 15 km in the Aegean Sea and surroundings (Fig. 9).

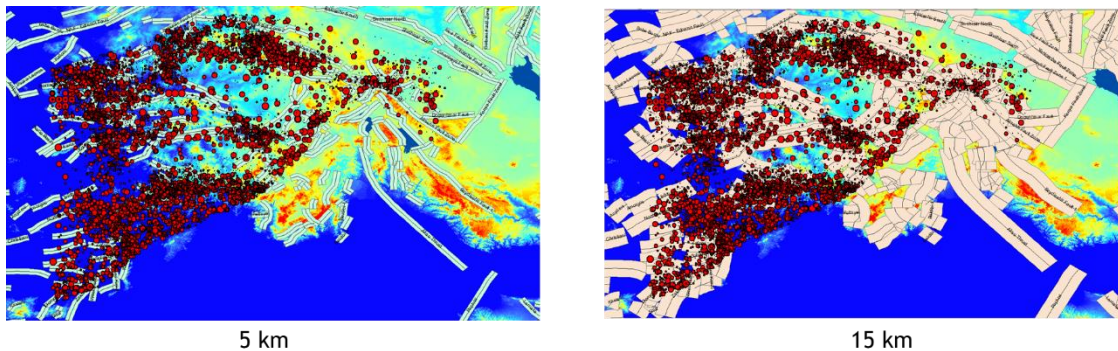


Figure 9. Buffer zones maps plotted for 5km-15km.

Voronoi Maps

When viewing the Voronoi Map, check whether at any vicinity there are polygons with the colors symbolizing very different categories of values (Fig. 10).

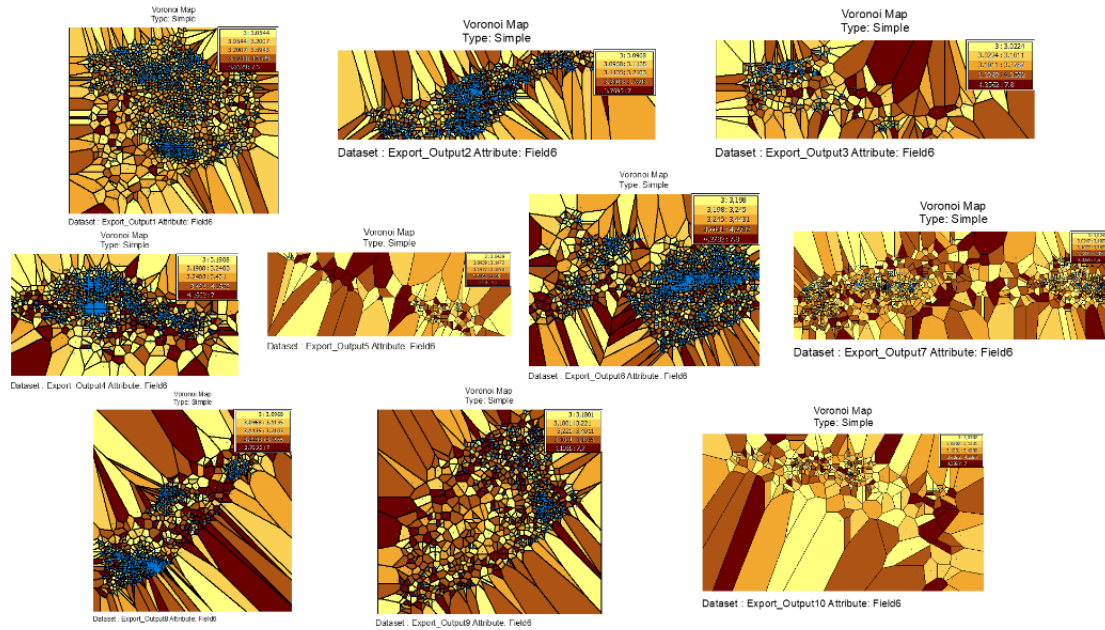


Figure 10. Voronoi maps plotted for 10 different zones

Mapping Clusters

The Mapping Clusters tools perform cluster analysis to identify the locations of statistically significant hot spots, cold spots, spatial outliers, and similar features. The Mapping Clusters toolset is particularly useful when action is needed based on the location of one or more clusters (Fig. 11 and 12).

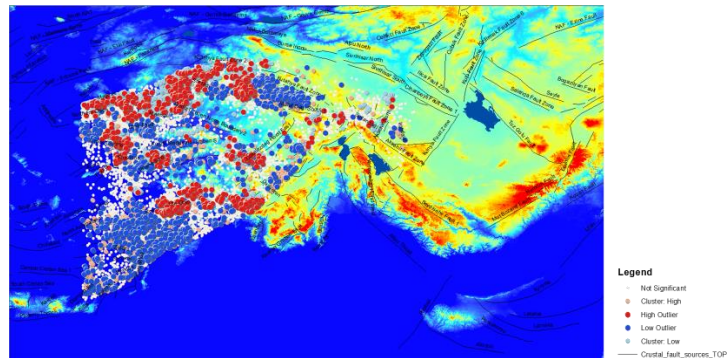


Figure 11. Cluster analysis

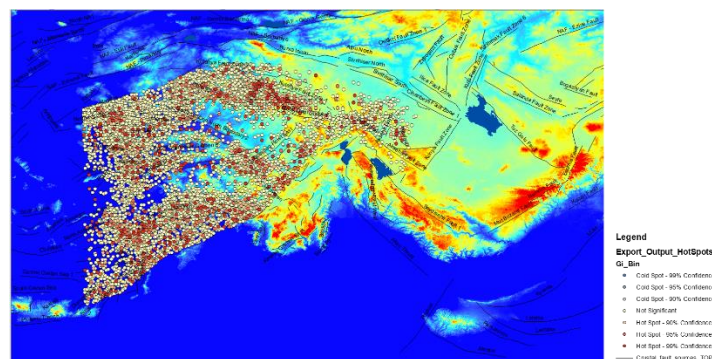


Figure 12. Hotspots analysis

Density Analysis

Density analysis used for effective areas. We applied density analysis. We investigated results to the Point density, Kernel density analysis and Line density analysis for fault structures in the Aegean Sea and surroundings (Fig. 13 and 14).

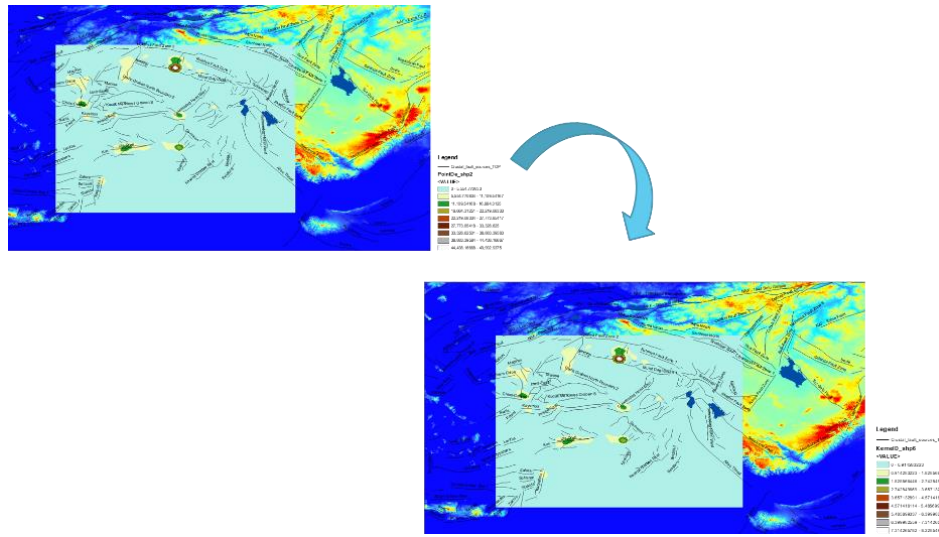


Figure 13. Point and Kernel density analysis

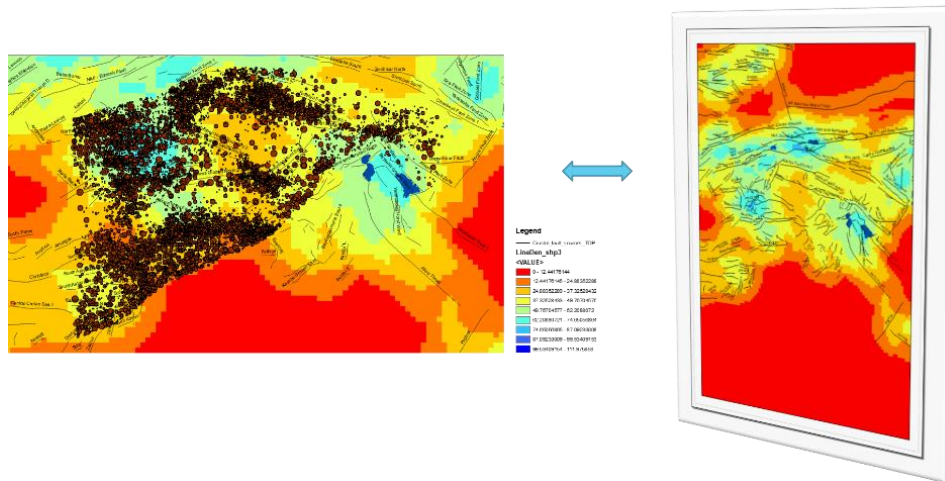


Figure 14. Line density analysis

3. RESULTS AND DISCUSSION

We predicted statistical analysis of earthquake catalog to use the Kriging method with the Geographic Information Systems (GIS) for 10 different seismogenic zones in the Aegean Sea and surroundings. Also, we determined changes at graphs of Histograms-Frequency distributions (standard deviation, skewness, kurtosis variables etc.), Normal QQ plots (normal distribution suitability), Voronoi maps (when viewing the Voronoi map, check whether at any vicinity there are polygons with the colors symbolizing very different categories of values), Trend analysis (it tool provided a three-dimensional perspective of the data) for both magnitudes and depth, Semivariogram/Covariance clouds (it tool showed the empirical Semivariogram and Covariance values for all pairs of locations within a dataset and plots them as a function of the distance that separates the two locations) for the investigated area. Subsequently, we determined changes at graphs of Histograms (standard deviation, skewness, kurtosis variables etc.), Normal QQ plots (normal distribution suitability), Measuring Geographic distributions, Voronoi maps (when viewing the Voronoi map, check whether at any vicinity there are polygons with the colors symbolizing very different categories of values), Trend analysis (it tool provided a three-dimensional perspective of the data), Semivariogram/Covariance clouds (it tool showed the empirical Semivariogram and Covariance values for all pairs of locations within a dataset and plots them as a function of the distance that separates the two locations), Mapping clusters, Density analysis in the Aegean Sea and surroundings. After that, the maps of Buffer analysis of faults plotted at 5 and 15 km to investigate coincide with faults of earthquake occurrences. We determined the

most suitable for normal distribution at 10 zones. Consequently, earthquake catalog can be used to assessment with the Kriging method for 10 different seismogenic zone in the Aegean Sea and surroundings.

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The Freezing-Thawing Behavior of Clayey (Red Clay) Soils Reinforced with Waste Pine Tree Sawdust

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Abstract: In cold climatic regions where seasonal freezing-thawing is frequently experienced engineering constructions (such as roads, railways, foundations, sub-bases and pipelines) are adversely affected. A wide variety of studies have been carried out to reduce this effect with fine grained soils with a wide variety of residual materials. In this study, the changes in strength of clayey soil (red clay) reinforced with pine tree sawdust was investigated under freezing-thawing conditions. Experiments were conducted on clay samples prepared by compression under standard proctor energy. Unconfined compressive strength (UCS) values of red clayey soil sample with 0.5%, 1% and 1.5% addition of pine tree sawdust were determined at studied temperature (+21°C) on days 1, 7, 28 and 90. The highest strength values were obtained with 28 and 90 days of curing and 1% pine tree sawdust. The results showed that 14.81% of 28 days curing and 10.54% of 90 days curing increased in the UCS of red clayey sample reinforced with pine tree sawdust. These samples (-21°C, +21°C) and 12 cycles were frozen-thawed. The results showed that 11.01% of 28 days curing and 7.7% of 90 days curing increased in the UCS of red clayey sample reinforced with pine tree sawdust. From the results obtained, it was concluded that pine tree sawdust can potentially strengthen clayey soil alone or together with other wastes.

Keywords: Pine tree sawdust, clay, unconfined compressive strength, freeze-thawing, basınç mukavemeti, donma-çözülme.

1. INTRODUCTION

Engineering structures (such as roads, railways, foundations, sub-bases and pipelines) are adversely affected by climate change. Today, a variety of studies have been carried out in order to reduce this effect with the participation of a wide variety of wastes or residues in fine and coarse grained soils. The method of improving soil with additives is widely used in recent times because it is more economical than other methods of remediation. In the process of improving ground with additives, it is essential that the additive to be added to the ground to be improved is a cheap and easily available material. Today, the use of waste materials as additives is a matter of concern. While this gives the desired properties to the soils, it can be evaluated in waste materials. The availability of alternative uses of waste materials has become increasingly important in recent years. The use of industrial wastes in different areas of the construction industry will prevent rapid consumption of natural resources, provide economic benefits and solve some environmental problems caused by wastes. Natural or synthetic materials can be used as additive materials. Natural materials such as lime, fly ash, marble dust, scrap car tire fragments, asphalt derivatives, coconut fiber, bamboo fiber, Indian hemp and chicken hair, and various chemicals are used.

2. MATERIALS AND METHODS

Red Clayey

The red clayey sample which constitutes an important component of this work is from the Oligocene sedimentary unit in the western part of Oltu (Erzurum) district, 0.75 m. (Fig 1). The red clay soil brought to the laboratory environment was dried at $105 \pm 5^\circ\text{C}$ for 24 hours and then subjected to Los Angeles device at 3000 rotations in order to grind hardened granules. The physical and mechanical properties of the red clayey soil, resulting from experimental studies, are shown in Table 1.



Figure 1. Red clay outcrops (Oltu-Erzurum 5 km northwest).

Table 1. The physical and mechanical properties of the red clayey soil.

Property	Value
Specific gravity, G_s	2.62
Sand (75-2000 μm) (%)	14.0
Silty (2-75 μm) (%)	52.0
Clay (<2 μm) (%)	34.0
Liquid limit (%)	43.5
Plastic limit (%)	22.0
Plasticity index, (%)	21.5
¹ Optimum moisture content, $\%w_{\text{opt}}$ (%)	22.0
¹ Max. dry unit volume weight, γ_{kmax} (kN/m^3)	15.9
² Soil class (USCS)	CL

¹ Obtained from Standard Proctor Test.

² Soil class according to Unified Soil Classification System (USCS).

Pine Tree Sawdust

The second most important member of this study, pine tree sawdust was obtained from the carpenters in the industrial zone Oltu (Erzurum)(Fig 2). As a waste from these carpenters, about 140 tonnes of blackberry tree shale are emerging every year. The yellow pine (*Pinus silvestris* L.) tree located worldwide is a species of *Pinus* (*Pinus*) family of the *Pinaceae* family from the *Gymnospermae* class in the system.



Figure 2. Red clay and pine tree sawdust materials.

Yellow pine is naturally widespread at the mountainous areas of Turkey where long, snowy and cold winters prevail. As a matter of fact, the average number of days covered with snow is generally more than 45 days in a year. This value is above 75 days in Erzurum-Kars platos. The annual average temperature is always below 8°C and the frosty days are over

two months of the year. There are three major macro climatic types in the spreading region of yellow pine trees in our country which can be listed as Black Sea climate, Central Anatolian step climate and Eastern Anatolia climate. (Elicin, G., 1980, Atalay et al., 1985).

Among the various building materials used by people, wood is one of the oldest and most common materials in terms of usage. Theoretically, it is a natural material that can be obtained from all the trees and has its own specific quantity and quality characteristics in the context of the different uses of social life and technological applications. (Bozkurt, 1986). The widespread yellow pine forests (*Pinus silvestris* L.) covers 1,961,660 hectares and the total forest area is 9% in the North Eastern Anatolia Region. (CABI, 2002).

3.RESULTS AND DISCUSSION

This work was carried out in three stages. In the first step, the optimum water content (w_{opt}) and the maximum dry unit volume weight (γ_{kmax}) were found by performing a standard compaction test. The cylindrical samples, having a diameter of 38 mm and a height of 76 mm, were obtained from standard compaction container. In order to determine the mixture ratio and curing time(s), three (3) samples were prepared and the average of the results was taken.

In the second step, 0.5, 1 and 1.5% pine tree sawdust were added to the red clay samples prepared in the laboratory and UCS values were determined after curing (drying and hardening) at 1, 7, 28 and 90 days at a room temperature of (+21°C) (Fig 3).

In the third stage, the mixing ratio and the cure time at which the highest UCS values obtained were determined, which corresponds to the mixture of red clay+1% pine tree sawdust at the end of 28 and 90 days of curing. This mixture was subjected to freeze-thaw test (-21°C, + 21°C, 24h and 12 cycles) at 28 and 90 days of curing to determine in the UCS (Fig 4).

The freeze-thaw cabinet, which can be programmed for the freeze-thaw experiment, is used. The loading speed of the digital uniaxial compression device, in which the UCS are determined, is 0.8 mm / min.

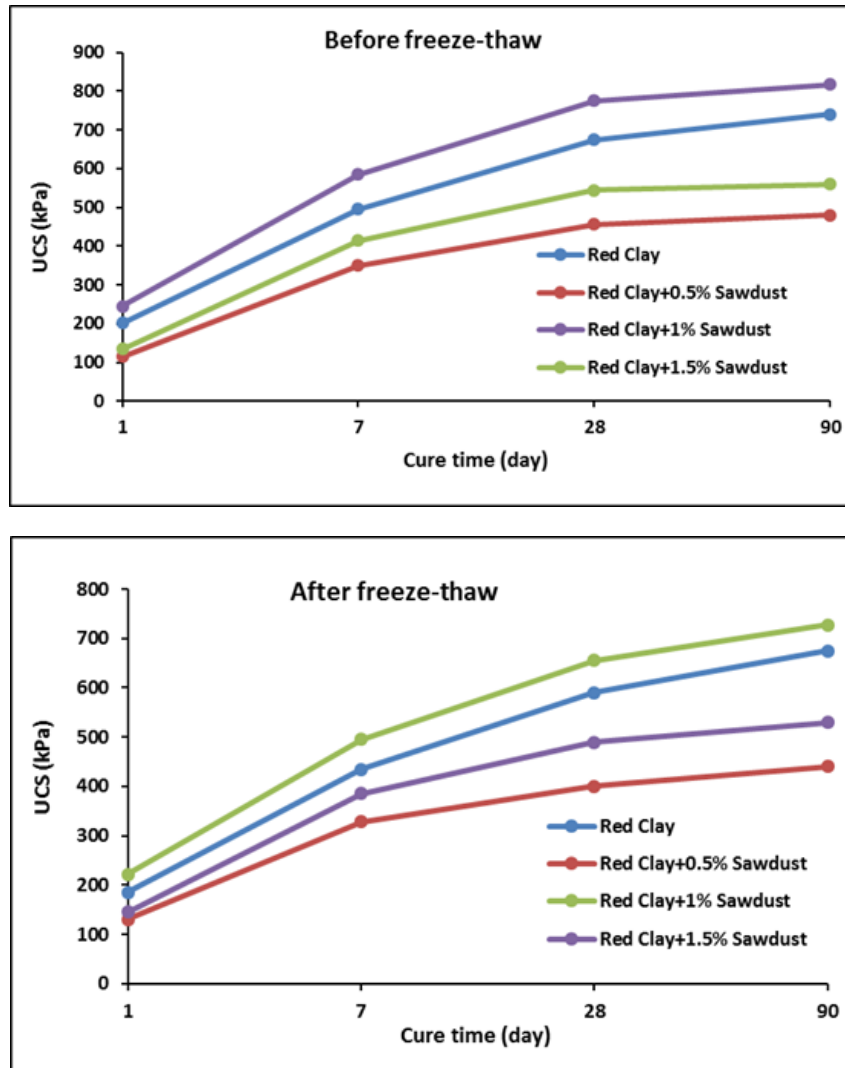


Figure 3. Change in the UCS value before and after freeze-thaw.

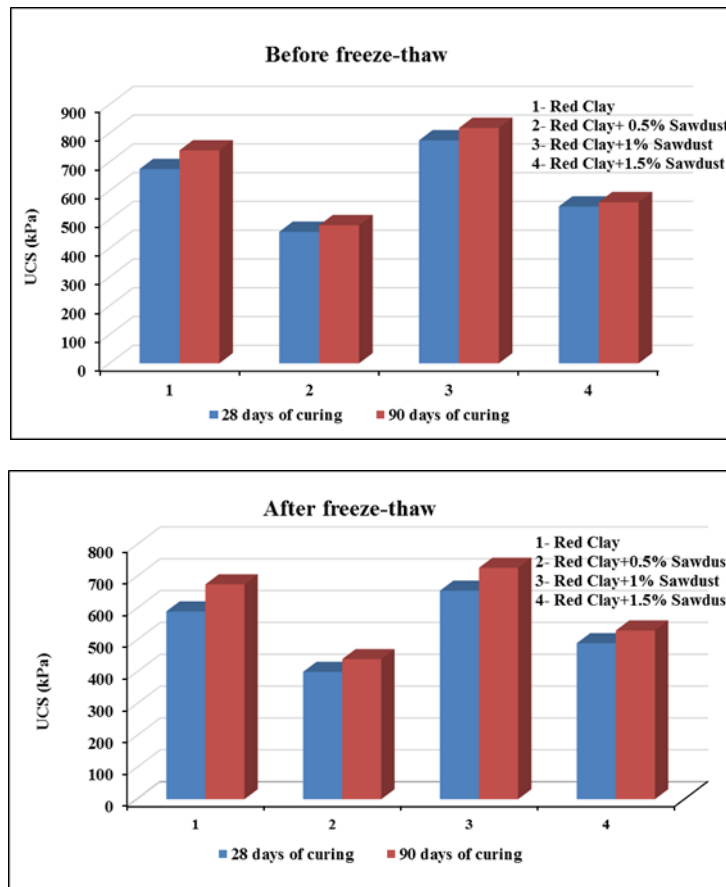


Figure 4. Changes in the UCS value before and after freeze-thawing after 28 and 90 days of curing.

In this study, the change in the UCS values before and after freeze-thawing of red clayey soils modified with pine tree sawdust was determined and the results obtained are given below.

UCS values were determined after curing (drying and curing) at 1, 7, 28 and 90 days at room temperature (+21°C) by adding pine tree sawdust of 0.5, 1 and 1.5% to red clayey samples.

The highest UCS values were obtained from the mixture which was subjected to 28 and 90 days curing with addition of 1% pine tree sawdust.

The UCS of red clayey soil reinforced with pine tree sawdust increased in 14.81% after 28 days and 10.54% after 90 days.

At the end of freeze-thaw processes, increase in the UCS values of the red clayey soils re-inforced with pine sawdust, which is recorded as 11.01% in 28 days and 7.7% in 90 days, were determined.

From the results obtained, pine tree sawdust could potentially strengthen clayey soils alone or with other wastes.

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Wear and Corrosion Properties of MgAl-Cnt Composites Produced by Using Hot Pressing Method

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Abstract: Magnesium and its alloys are now considered to be an important material for modern lightweight structures and therefore have a wide range of applications, especially in the electronics, aircraft and automotive industries. Its popularity is further increased when it is produced as a composite material. In this study, MgAl matrix carbon nanotube (CNT) reinforced composite materials were produced by hot pressing method. Composites designed by matrix addition of CNT at ratios of 0.25%, 0.50, 0.75 and 1.00% were produced by hot pressing at 550 ° C. The effects of CNT amount on the wear, microstructure and corrosion properties of composites were investigated. Microstructure and phase composition of the materials were investigated by optical microscope (OM), scanning electron microscopy (SEM), X-ray diffractogram (XRD), X-ray energy spectrometry (EDS). The stiffness of the composites is measured in Brinell. The relative intensities of the materials have been determined according to the Archimedes principle. A structure with dense and very small porosity was obtained according to both SEM photographs and density measurements. This increase in hardness was caused by the free distribution of CNT in the matrix. Wear properties of composites have been tried to be determined in ball on disc wear method and linear mode. MgAl-CNT composites have a pH of 3 for the potentiostatic and corrosion rate. Immersed in 3.5% NaCl solution. Surfaces of worn and corroded samples were analyzed by SEM-EDS. It has been found that the wear resistance of MgAl matrix composites produced by CNT addition is significantly higher than the MgAl matrix without additive. There are differences in corrosion resistance depending on the amount of CNT in the composite.

Keywords: Wear, corrosion, MgAl, CNT, MMCs

1.INTRODUCTION

Magnesium alloys have a specific importance in defense industry and transportation sector due to their properties of lightness and high specific strength (strength/density) [1-3]. Its unalloyed form has low strength and toughness values; therefore, it is used as alloyed. Magnesium also has high thermal conductivity, high dimensional stability, good electromagnetic protection, high damping, high workability, and easy recycling properties [4, 5]. These properties make Mg alloys valuable in numerous industries such as automotive, computer, aviation, mobile phones, and sports materials. Mg is also used as an implant material due to low weight and compatibility to metabolism [6, 7]. In addition, number of studies conducted on using energy resources more efficiently has increased in recent years. In this context, studies have been conducted on making vehicles lighter in order to reduce fuel consumption in automotive industry [8].

The use of magnesium alloys may substantially decrease weights of structures without compensating their structural properties. Among alloy elements, Al, Zn, and Mn increase strength, toughness, and corrosion resistance, respectively. However, the increase in amount of Zn causes to red shortness. As alloy elements; rare earth elements are added for reducing microporosity, Zr for grain refining, Ag or Cu for improving high temperature properties, and Th for improving friction properties at the present time [9, 10]. In this study, MgAl alloys were produced by the powder metallurgy method adding carbon nanotubes. In this way, strengths of MgAl alloys were increased with both formation of phases and external addition of particles. Thus, the effect of production parameters and material addition on some properties of composites was experimentally examined.

2.MATERIALS AND METHODS

In this study, carbon nanotube reinforced (CNT) MgAl matrix composite materials were produced. Alloy of the mixture (95 %Mg + 5% Al) containing magnesium (Alfa Aesar) with 99.8% purity and -325 mesh grain size and also aluminum powder (Alfa Aesar) with 99.5% purity and -325 mesh grain size was used as matrix material in all experiments. The multi-walled CNT was chosen as 9.5 nm in diameter and 1 micron in size (Sigma-Aldrich). 0.25 wt%, 0.50 wt%, 0.75 wt%, and 1.00 wt% CNT were added into matrix in order to determine its effect on properties.

Powders blended were transformed into bulks in sizes of 10 x 10 x 40 mm by using a PLC controlled vacuum hot press machine (Zhengzhou Golden Highway, SMVB 80, China), which was operating according to principle of direct resistance heating, 550 °C for 4 minutes and under 35 MPa. Actual densities were measured using Archimedes principle. Wear tests were performed by ball-on-disc method according to ASTM G133 standard. Wear parameters are 20 N load, sliding speed

of 5 cm/s and 1000 m slip distance. Balls Ø6 mm 100Cr6 steel material is used as counter material. Corrosion measurements were obtained by using a system consisting of a Reference 3000 Potentiostat / Galvanostat / ZRA corrosion system. Corrosion experiments were carried out after the samples were left waiting for 1 h at room temperature in a 3.5 wt.% NaCl solution (pH 3). A conventional three-electrode cell was used for all the electrochemical measurements. The sanded and polished samples were etched for 10-30 seconds using HNO_3 (40 pct.) + $\text{C}_2\text{H}_5\text{OH}$ (60 pct.) solution. For optical examinations, Olympus GX41 inverted metal microscope (Olympus Co., Ltd., Japan) were used. FEI QUANTA 250 FEG brand scanning electron microscope (FEI Inc., OR, USA) was used for microstructure examination. X-ray analysis was performed to determine the phases formed in the microstructure. X-ray analyses were performed by using a Bruker D8 Advance brand device (Bruker Optik GmbH, Ettlingen, Germany).

3.RESULTS AND DISCUSSION

Figure 1 shows optical images of the composites. It was clearly seen from the images that Mg and Al powders were mixed homogeneously. However, carbon nanotube particles were observed to have a partially homogeneous distribution. They were observed to coagulate in clusters at some points. CNTs were generally located at points where powder particles joined.

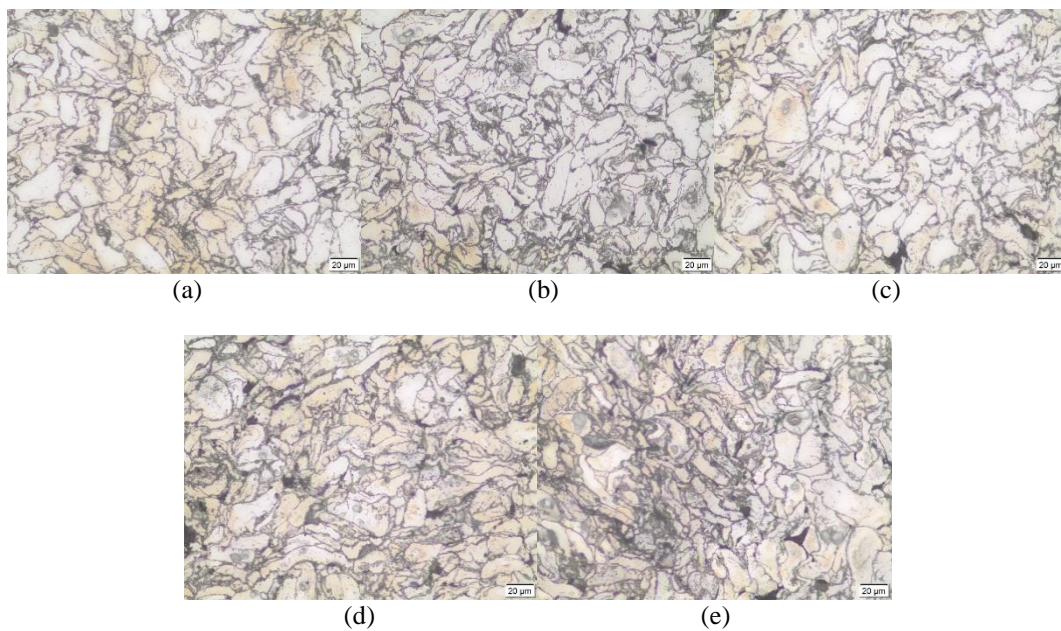


Figure 1. Optical images; (a) MgAl, (b) MgAl- 0.25% CNT, (c) MgAl- 0.50% CNT, (d) MgAl- 0.75% CNT and (e) MgAl- 1.00% CNT

In addition, locations of carbon nanotubes were seen more evidently from fracture surfaces (Figure 2). As we mentioned above, CNTs were located in clusters.

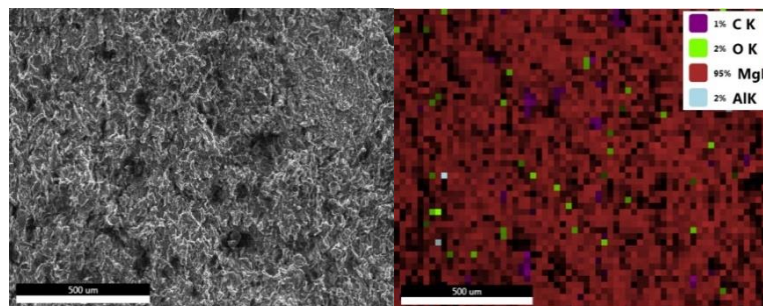


Figure 2. MAP analysis of fracture surface for MgAl- 1.00% CNT

Generally, Mg, $\text{Mg}_{17}\text{Al}_{12}$ and MgO phases were observed in graphics (Fig. 3). The reason for absence of Al in graphics was that Al formed the solid solution by being dissolved in Mg. Also, the C peak could not be determined for CNT. This

is because it is difficult to detect the CNT. $Mg_{17}Al_{12}$ phase occurred between Mg and Al. The content of this phase was detected approximately 3%. Matrix of the composite consisted of Mg+ $Mg_{17}Al_{12}$.

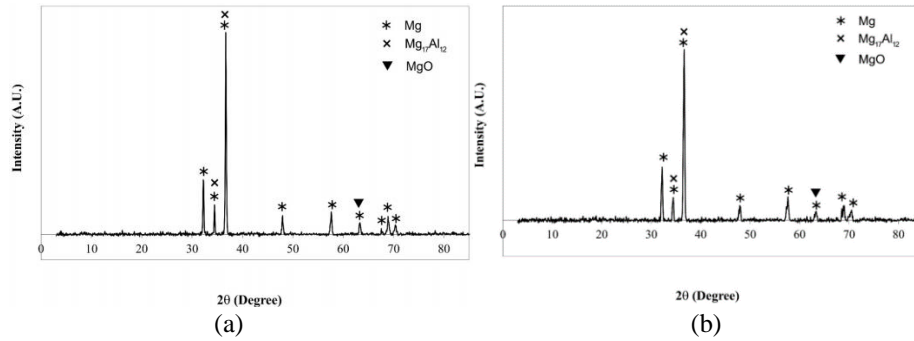


Figure 3. XRD graphics; (a) MgAl and (b) MgAl-1.00% CNT

According to Fig. 4a, addition of CNT increased density of the composite, which was caused by the fact that density of CNT was higher than Mg. Relative densities also increased with increasing addition of CNT and relatively decreased in addition of 1.00% CNT (Fig. 4b). This might be explained by the fact that CNTs filled micro pores.

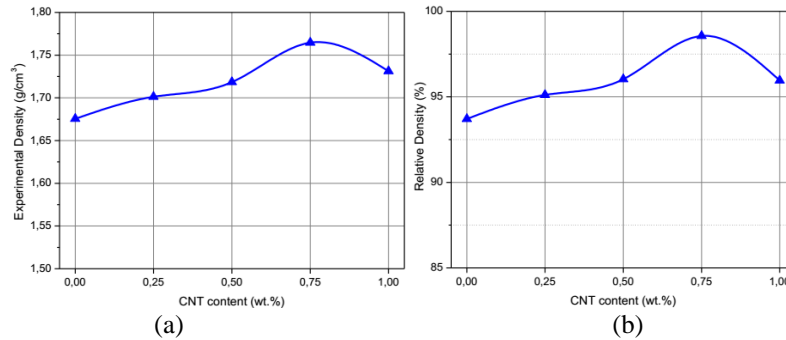


Figure 4. Density graphics of composites; (a) experimental density and (b) relative density

The coefficients of friction (COF) composites are given in Fig. 5. As the CNT addition increases, the friction coefficients of the composites decrease. CNT composites gave strength by dispersion resistance. In addition, tribo film affects oxides such as MgO, reducing the friction coefficient. The morphology of the worn surfaces of the composites is shown in Fig. 6. It is seen that abrasive wear mechanism dominates the wear surfaces. Traces of plowing were formed on the surfaces. Very few areas have an adhesive wear mechanism. Wear residues (debris) located on the surface after abrasion also show abrasive effect on the surface.

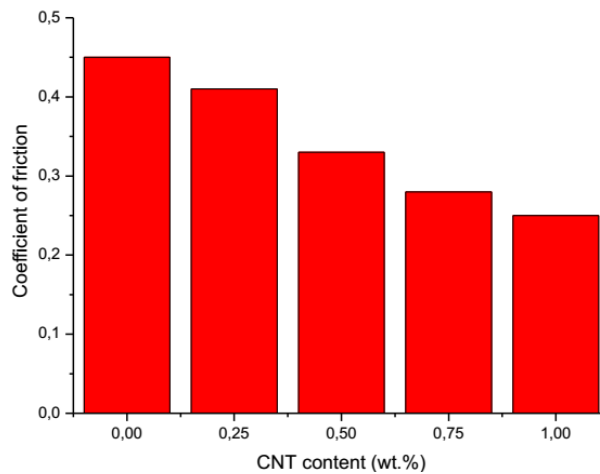


Figure 5. Coefficient of friction depending on the amount of CNT

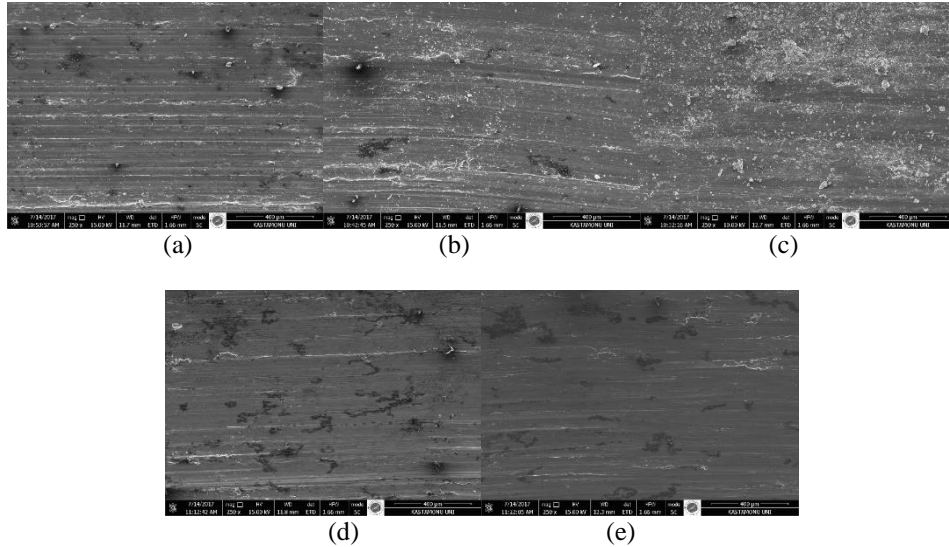


Figure 6. SEM images of worn surfaces: (a) MgAl, (b) MgAl- 0.25% CNT, (c) MgAl- 0.50% CNT, (d) MgAl- 0.75% CNT and (e) MgAl- 1.00% CNT

The potentiodynamic polarization curves of the samples are illustrated in Fig. 7. Corrosion potential (E_{corr}), anodic and cathodic Tafel slopes (β_a and β_c), corrosion resistance (R_p), corrosion rate and corrosion current (I_{corr}) were found from Tafel curves. 5. The corrosion potentials of the composites are slightly different. It has been found that MgAl is the best corrosion resistant MgAl-1.00 wt.% CNT for the lowest corrosion resistance.

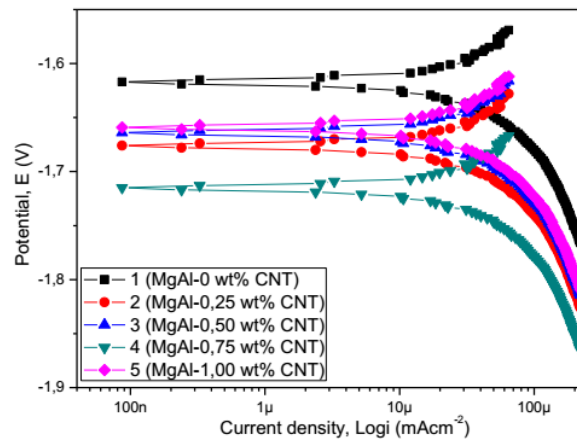


Figure 7. Potentiodynamic polarization curves

1. CNT was observed to distribute relatively homogeneously within matrix in produced samples based on SEM and optical studies.
2. According to XRD analyses, Mg, $\text{Mg}_{17}\text{Al}_{12}$ and MgO phases were observed in composites.
3. As the amount of CNT increased, there were increases in experimental densities and relative densities.
4. The corrosion potentials of the composites are slightly different. It has been found that MgAl is the best corrosion resistant MgAl-1.00 wt.% CNT for the lowest corrosion resistance.
5. As the amount of CNT increases, the friction coefficients of the composites decrease. Compared to the wear surfaces, abrasive wear is the greatest amount of wear mechanism.

Acknowledgements

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Final Estimates Part 2: Probability Models of Earthquake Occurrences using Kriging Method with the Geographic Information Systems (Cbs) in the Aegean Sea and Surrounding, Western Turkey

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Abstract: In this study, Kriging method from Geostatistical techniques used to probability models of earthquake occurrences using Kriging method with the Geographic Information Systems (CBS) in the Aegean Sea and surrounding, Western Turkey. Geostatistical techniques not only had the capability of producing a prediction surface but also provide some measure of the certainty or accuracy of the predictions. Kriging was an advanced geostatistical procedure that generates an estimated surface from a scattered set of earthquakes. Also, Kriging assumes that the distance or direction between sample points reflected a spatial correlation that can be used to explain variation in the surface. The Kriging method fitted a mathematical function to a specified number of earthquakes, or all earthquakes within a specified radius, to determine the output value for each region. We have used $Z(\mathbf{s}) = \mu(\mathbf{s}) + \varepsilon(\mathbf{s})$ basis formula for all the different types of Kriging method. We applied cell declustering method for the database. We used probability Kriging type for estimations of probability output surface. We selected Multiplicative Skewing type with base distributions Log Empirical and Gamma for approximations methods and Exponential method for covariance variable to determined probability models. Consequently, maps of probability models plotted with Kriging method. The high and low probability estimates of earthquakes for 10 different seismic zones determined with Kriging method and compared different distributions for $M_s \geq 3.0$ earthquakes in the next 100 year. Kriging was most appropriate when knowing a spatially correlated distance or directional bias in the data. It can be used often for earthquake occurrences in seismology. Also, this study, the scientists will be lead for investigated earthquake estimates.

Keywords: Kriging method, The Aegean Sea and Surrounding

1.INTRODUCTION

The Aegean Sea observed large earthquakes in the past years, so it attention of a lot of scientist humans, that especially in the seismic hazard works. The Aegean Sea and surrounding was a region defined by common seismicity and complex tectonics self-controlled by the interaction of acting plates in the more extensive region. The Aegean Arc and Western Anatolian Extension Zone was significance for the geodynamic assessment of the Aegean region and Western Anatolia. The structures in Western Anatolia advanced in the directions of NW–SE, NE–SW, N–S, and E–W. They were directional in the form of four distinct block faults; these structures are called “crossgraben” formations (Şengör 1987). We divided into 10 different seismogenic zone (Zone 1. Aliağa fault, Zone 2. Akhisar fault, Zone 3. Gediz Graben, Zone 4. Simav, Gediz-Dumlupınar faults, Zone 5. Eskişehir, İnönü-Dondurga fault zones, Zone 6. Karova-Milas, Muğla-Yatağan faults, Aegean Arc, Marmaris-Köyceğiz faults, Fethiye faults, Zone 7. Büyük Menderes Graben, Zone 8. Gölhisar-Çameli, Acıgöl, Tatarlı-Kumdanlı faults, Dinar Graben, Kaş and Beyşehirgölü faults, Zone 9. Aegean Islands, Zone 10. Sultandağı fault). We plotted tectonic map and epicenter distributions with 1/3.000.000 scale in the Aegean Sea and surroundings (Fig.1).

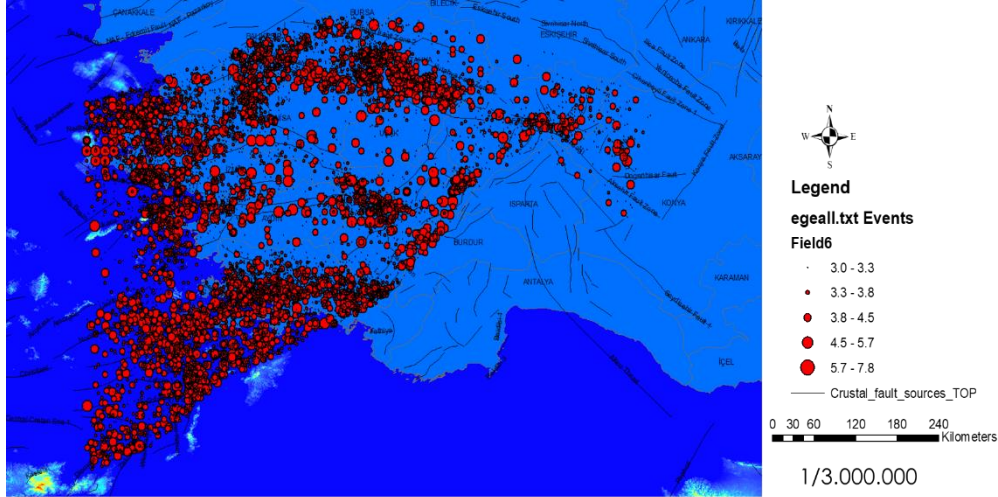


Figure 1. The Aegean Sea and surroundings plotted map of the tectonic structure and epicenter distributions

Kriging Method

The kriging method of interpolation was one of from geostatistical technique. It considered both the distance and the degree of variation among known data points when predicting values in undetermine areas. In kriging, the first step determined the data with identify the spatial structure. Also, it often represented by the empirical semivariogram (Isaaks and Srivastava, 1989). The BLUE of unknown realization U_n' denoted as U_n , is constructed linearly in terms of $(n - 1)$ known realizations Journel and Huijbregts (1989). This process of evaluating BLUE is the original meaning of kriging. Eq. (1) may also be presented in the estimator form involving corresponding stochastic variates:

$$U_n' = \sum_{i=1}^{n-1} \lambda_{in} U_i \quad (1)$$

The kriging weights (Eq.2) are determined based on the unbiased condition:

$$E(U_n' - U_n) = E\left(\sum_{i=1}^{n-1} \lambda_{in} U_i - U_n\right) = \sum_{i=1}^{n-1} \lambda_{in} \mu - \mu = 0 \quad (2)$$

and on the minimum estimation variance (Eq.3):

$$\begin{aligned} E[(U_n' - U_n)^2] &= E\left[\left(\sum_{i=1}^{n-1} \lambda_{in} U_i - U_n\right)^2\right] \\ &= \sum_{i=1}^{n-1} \sum_{j=1}^{n-1} \lambda_{in} \lambda_{jn} R_{ij} - 2 \sum_{i=1}^{n-1} \lambda_{in} R_{in} + R_{nn} \end{aligned} \quad (3)$$

where = denotes "by definition;" and $[K]$ =kriging matrix. When the stochastic process has zero mean (Eq.4):

$$\begin{aligned} \begin{Bmatrix} \lambda_{1n} \\ \lambda_{2n} \\ \vdots \\ \lambda_{(n-1)n} \\ \gamma_n/2 \end{Bmatrix} &= [K]^{-1} \begin{Bmatrix} R_{1n} \\ R_{2n} \\ \vdots \\ R_{(n-1)n} \\ 1 \end{Bmatrix} \\ &= \begin{bmatrix} R_{11} & R_{12} & \cdots & R_{1(n-1)} & 1 \\ R_{12} & R_{22} & \cdots & R_{2(n-1)} & 1 \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ R_{1(n-1)} & R_{2(n-1)} & \cdots & R_{(n-1)(n-1)} & 1 \\ 1 & 1 & \cdots & 1 & 0 \end{bmatrix}^{-1} \begin{Bmatrix} R_{1n} \\ R_{2n} \\ \vdots \\ R_{(n-1)n} \\ 1 \end{Bmatrix} \end{aligned} \quad (4)$$

Minimum estimation variance known as the kriging variance, for the nonzero mean stochastic process (Eq.5):

$$\sigma_k^2 = \min\{E[(U_n' - U_n)^2]\} = R_{nn} - \sum_{i=1}^{n-1} \lambda_{in} R_{in} - \frac{1}{2} \gamma_n \quad (5)$$

and for the zero mean stochastic process (Eq.6):

$$\sigma_k^2 = \min\{E[(U_n' - U_n)^2]\} = R_{nn} - \sum_{i=1}^{n-1} \lambda_{in} R_{in} \quad (6)$$

We used cell decluster method (Fig 2.) and applied two different distribution (Log empirical and Gamma) (Fig 2, 3, 4, 5, 6, 7, 8, 9, 10) based on the Kriging method.

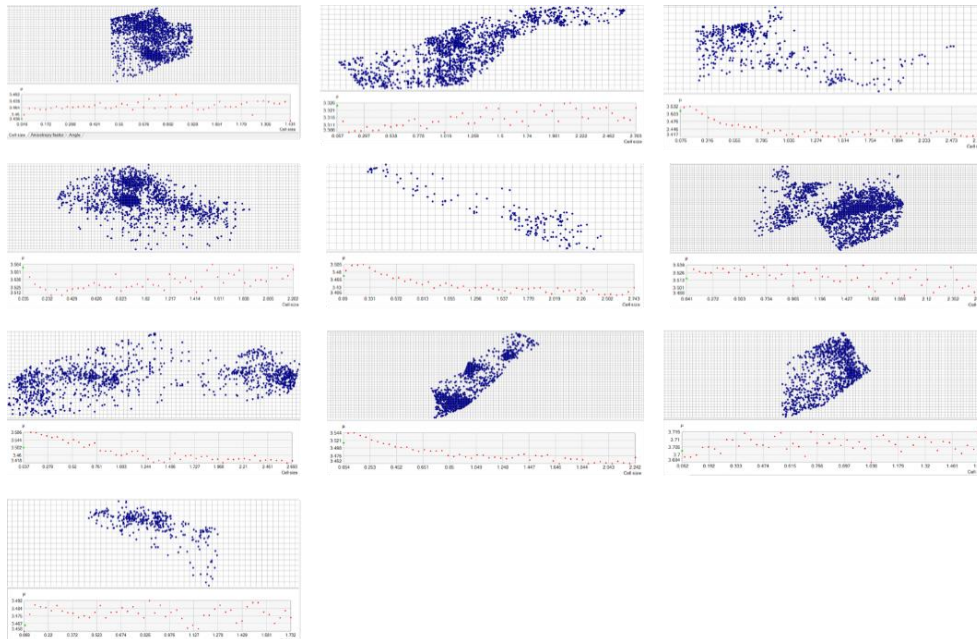


Figure 2. Cell decluster method figures plotted for 10 different seismogenic zones in the Aegean Sea and surroundings

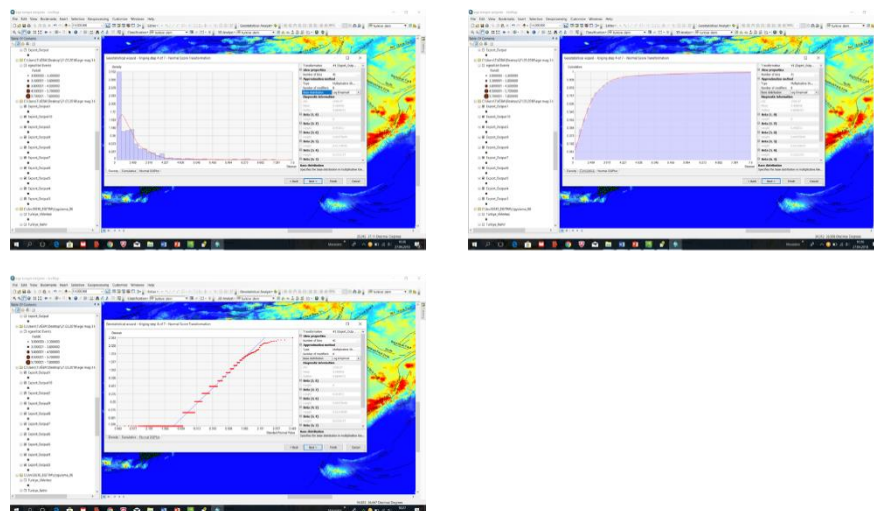


Figure 3. Log empirical distribution graphs (probability density function (PDF), cumulative density function (CDF) and Normal-QQ plot) plotted for Zone 1.

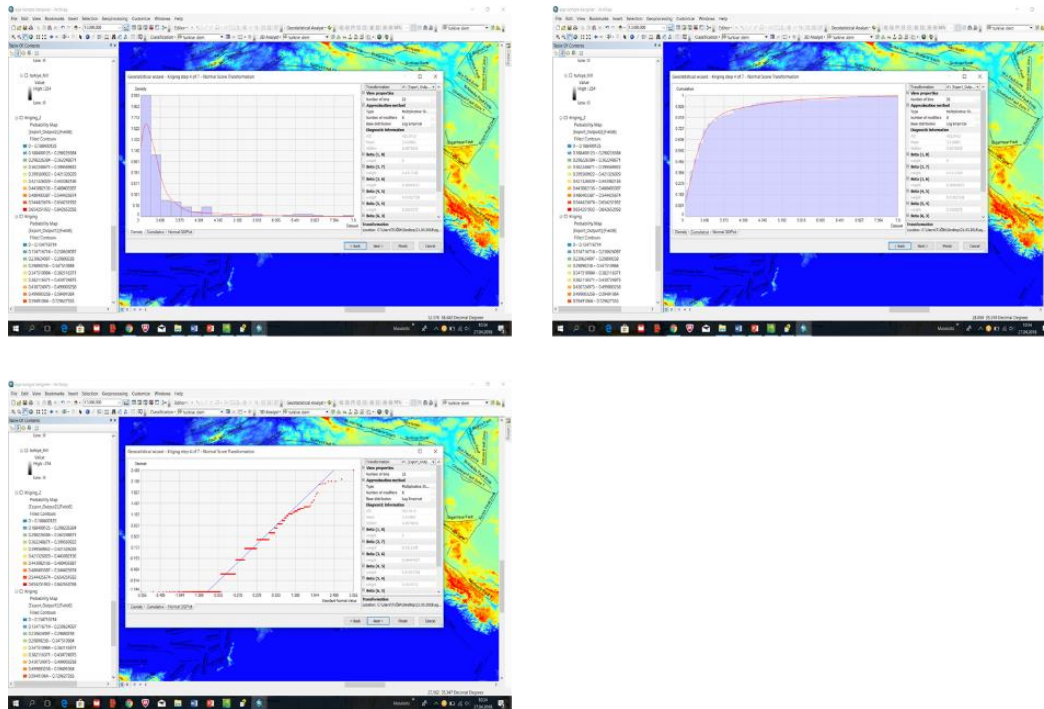


Figure 4. Log empirical distribution graphs (probability density function (PDF), cumulative density function (CDF) and Normal-QQ plot) plotted for Zone 2.

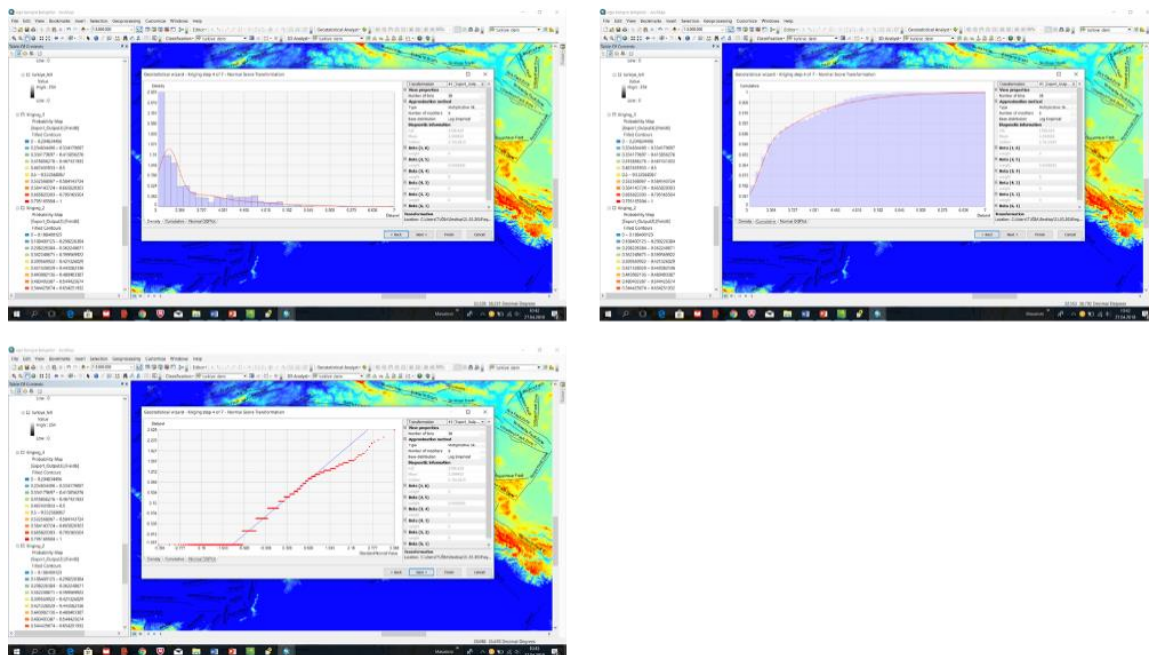


Figure 5. Log empirical distribution graphs (probability density function (PDF), cumulative density function (CDF) and Normal-QQ plot) plotted for Zone 3.

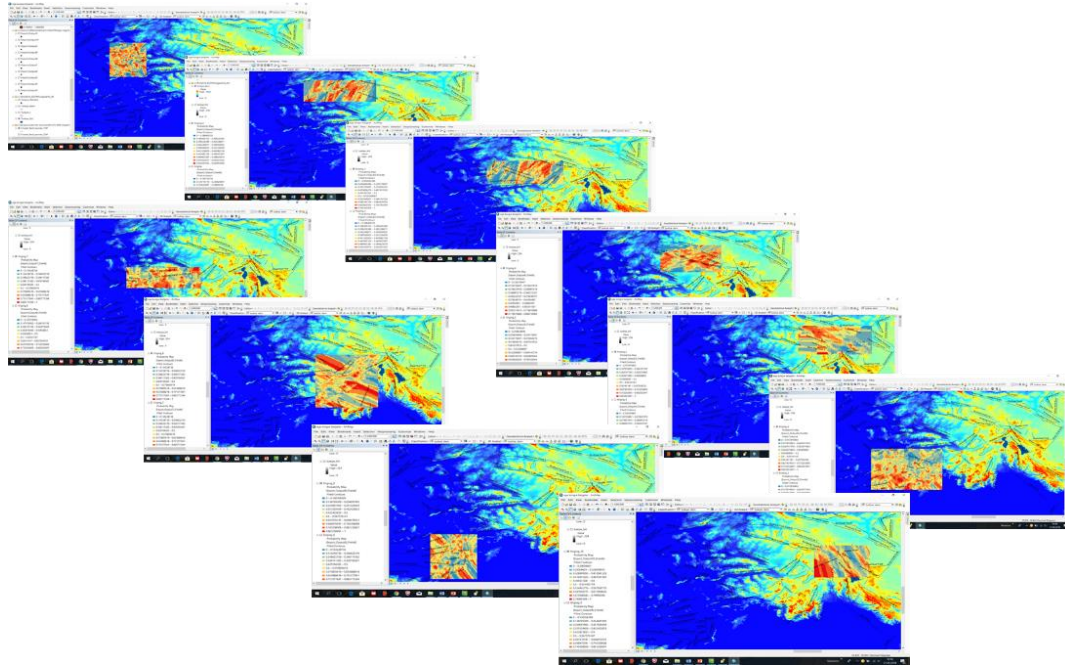


Figure 6. Log empirical distribution graphs plotted maps of results 10 different seismogenic zones.

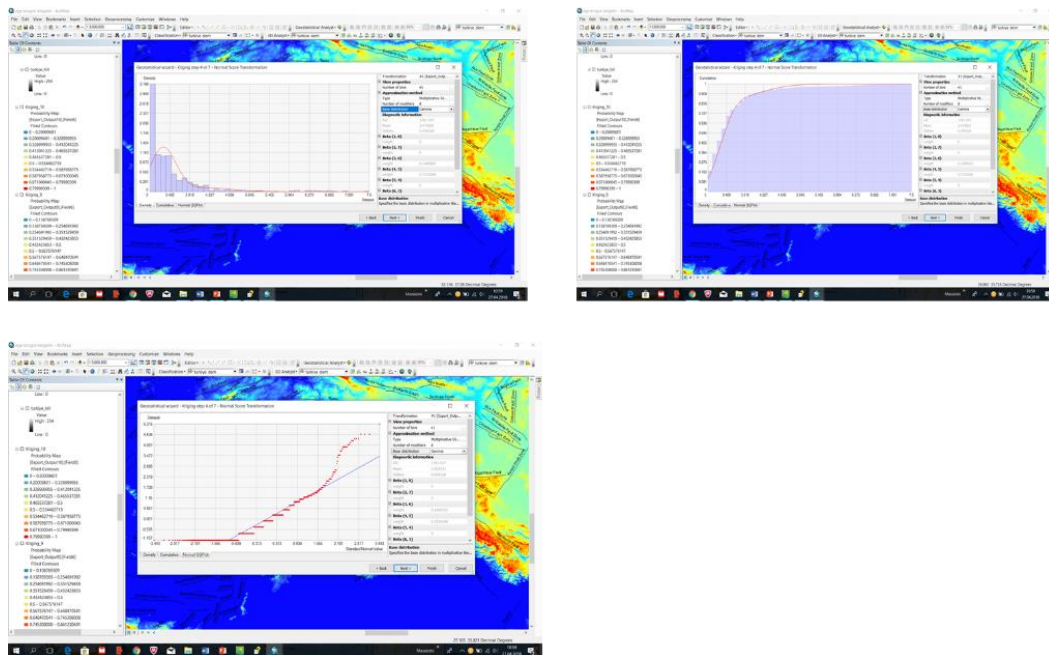


Figure 7. Gamma distribution graphs (probability density function (PDF), cumulative density function (CDF) and Normal-QQ plot) plotted for Zone1.

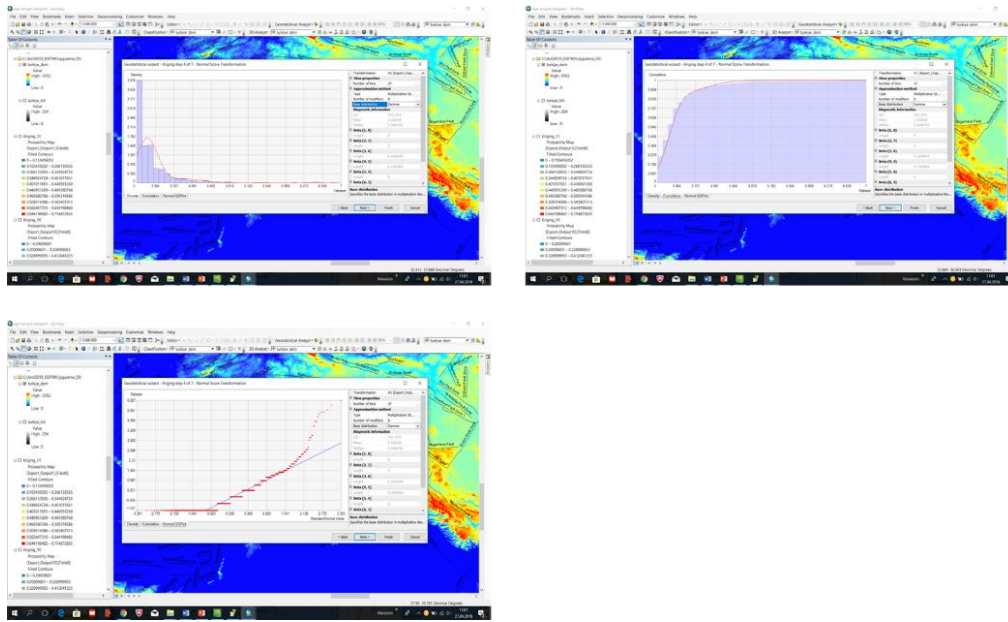


Figure 8. Gamma distribution graphs (probability density function (PDF), cumulative density function (CDF) and Normal-QQ plot) plotted for Zone 2.

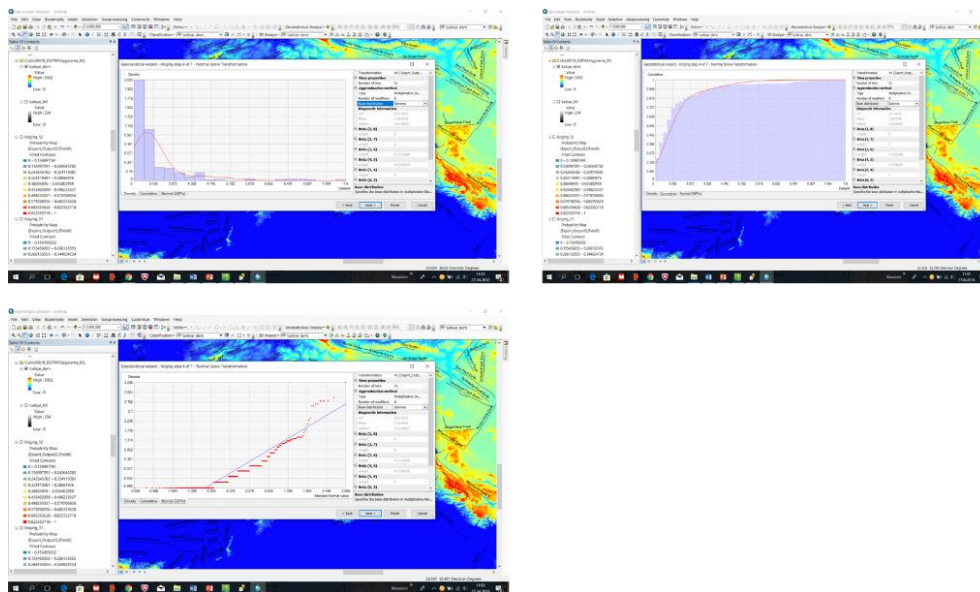


Figure 9. Gamma distribution graphs (probability density function (PDF), cumulative density function (CDF) and Normal-QQ plot) plotted for Zone 3.

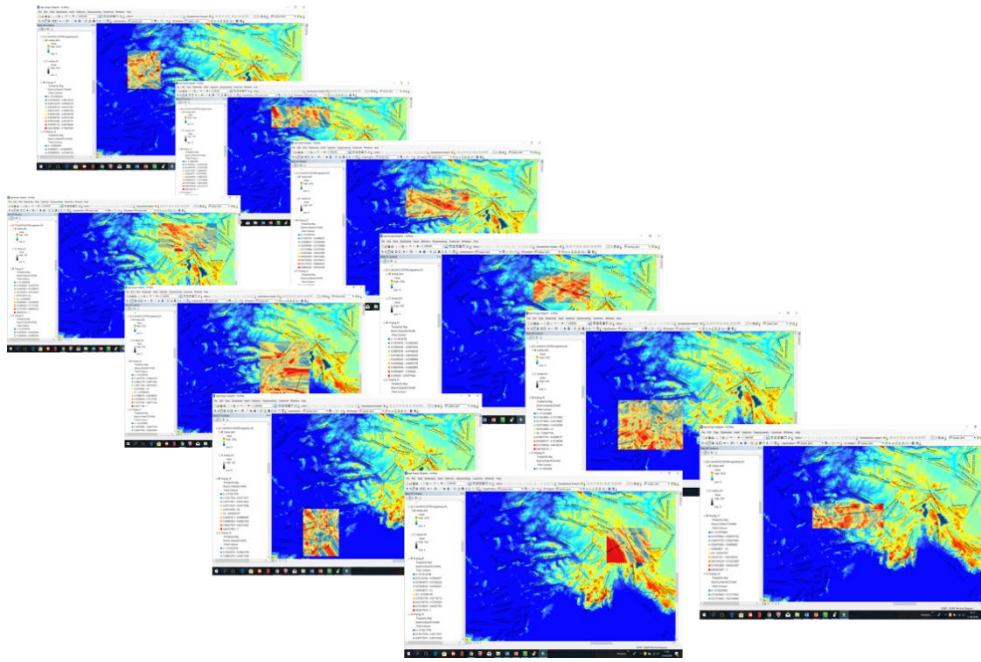


Figure 10. Gamma distribution graphs plotted maps of results 10 different seismogenic zones.

2.RESULTS AND DISCUSSION

We determined probability Kriging type for estimations of probability output surface. Then, we estimated with the Multiplicative Skewing type of two different base distributions. Two different distributions (Log empirical and Gamma) used to probability estimates of all seismogenic zones. Addition, significant cell declustering method applied to all earthquake dataset. We determined the Exponential method for covariance variable to determined probability models. Consequently, maps of probability models plotted with Kriging method. The high and low probability estimates of earthquakes for 10 different seismic zones determined with the Kriging method and compared different distributions for $M_s \geq 3.0$ earthquakes in the next 100 year. So, we determined the most dangerous areas for 10 different seismogenic zones with two different distribution of the Kriging method. Maybe, this study, science humans can be reference seismic risk and hazard researches.

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The Planning in Terms of Natural Hazard Sensitivity of Tekirdag City

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Abstract: Nearly half of the world's population lives in urban areas. This situation has added a global dimension to the concept city. The rapid urbanization across the world, however, has caused many problems in the natural environment. As cities continuously consume natural resources, urban development trends all over the world are centered on the idea of sustainable cities. These trends in urban development have demonstrated that it is important to plan urban spaces predominantly full of man-made elements considering natural disaster risk. Indeed, natural disasters play a significant role in settlement area selection and subsequent enlargement of cities and are thus considered an important factor in the development and management of cities. Under today's conditions, particular emphasis should be placed on the determination of the spatial sensitivity of cities to do urban planning in line with their dominant natural disaster pattern or patterns. This study on the case of Tekirdag aimed to carry out a sensitivity analysis for potential natural disasters. Thus, areas sensitive to natural disasters that are likely to affect the city were identified. What natural disasters occurred in the area? How is the spatial sensitivity of these disasters distributed? What are the factors that affect this distribution? In order to answer the research questions, the domestic and foreign literature were reviewed and relevant research was interpreted on the basis of critical and analytical thinking. The study employed Geographic Information System (GIS) techniques for map analysis and thematic mapping. The study results demonstrated that disasters including earthquakes, landslides, floods, flash floods and tsunami are likely to occur in Tekirdag. The results also showed that the coastal areas of the city are the most sensitive areas to these kinds of disasters. Thus, urban planning should consider natural disasters for resilient and sustainable urbanization. Especially local authorities should undertake relevant work on urban planning. Thus, they can achieve the most efficient use of land, which is the basic philosophy of urban planning.

Keywords: Tekirdag, Natural hazards, Spatial sensitivity, Analysis multi-criteria weights, GIS.

1. INTRODUCTION

The rapid urbanization occurring in the world in the last century has caused many problems to emerge in the natural environment. Thus, urban development trends all over the world focus on sustainable city due to the fact that cities consume natural resources at an increasing speed. This phenomenon of orientation acquired by urbanization has shown that it is important to plan urban areas containing mostly human made elements in terms of natural disaster risks (Ozsahin, 2015a; Ozsahin and Kaymaz, 2015). That is because natural disasters play a critical role in location selection and future growth of settlements and are considered a significant factor in development and administration of cities (Ozsahin, 2016a).

Due to current conditions, attention must be focused on determining spatial sensitivity in order to plan cities in accordance with the dominant natural disaster type/s. This study, including Tekirdag city as the research sample, aims to perform sensitivity analyses regarding potential natural disasters. This way, areas sensitive to natural disasters that might affect the city were determined. In fact, some studies regarding earthquake (Ozsahin, 2014) and landslide (Ozsahin, 2015b) or natural disasters in general (Ozsahin, 2016b) were conducted in this area and in its vicinity before. However, it was not possible to draw a multi risk map of the urban area as those studies were not assessed together with all the natural disasters that might affect the city. This study aims to share preliminary research findings aimed at drawing the multi risk map of Tekirdag city.

2. MATERIALS AND METHODS

Geological survey reports and drilling results as well as topographic data obtained directly from the land were used as the main material in this study using different types of large scale thematic maps provided by the Tekirdag Governorate. The sensitivity maps drawn during the study using different methods depending on the type of disaster were first created separately for each natural disaster and then combined. Thus, both the relationship between the sensitivity of each natural disaster and other spatial factors was determined, and multi risk maps showing the collective effects of these disasters were created. Consequently, both individual and collective impact areas of natural disasters were identified. Thematic map drawing and spatial analyses were supported with Geographic Information Systems (GIS) techniques. Also, sensitivity analyses were shaped in a detail of 5x5 resolution and classified in an equally spaced manner.

3.RESULTS AND DISCUSSION

In light of the previous studies conducted in the study area and the current information, the main natural disasters that may take place are earthquake, landslide, flood, overflow, and tsunami. There are some factors that affect the spatial sensitivity of these natural disasters. Some of these factors do not have any effect on the emergence of certain natural disasters, whereas some play an effective role in all the natural disasters. The main factors affecting the sensitivity of all the natural disasters in the area are slope, exposure, altitude, slope formations, and geographical formations. The main factors affecting certain natural disasters are lithology, underground water level, distance to running water, distance to roads, distance to fault lines, rainfall, distance to sea, and coast types.

All these factors determined and classified through literature and field studies, interviews with or opinions of experts have gained levels of sensitivity in proportion to the effect of natural disasters on spatial damage. Therefore, it was made sure that all the points assigned to each factor had an actual value on the area (Figure 1).

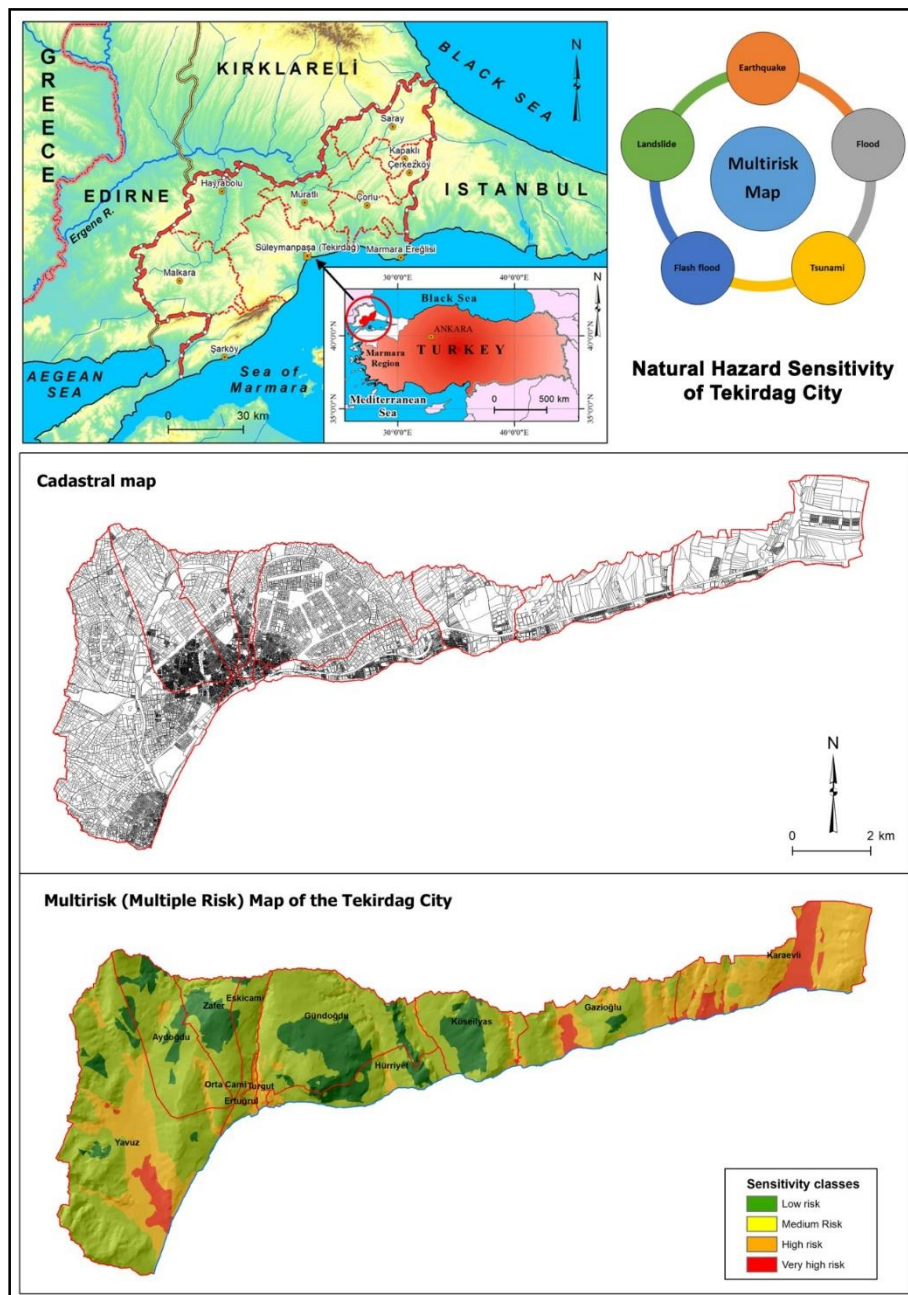


Figure 1. Location map and multirisk map of the Tekirdag City

The study findings showed that many natural disasters that took place in Tekirdag in the past may recur in the near future. Many incidents that were included in the historical records or those that took place in more recent times support this view. According to the multi risk map created at the end of the study, it was determined that the areas that were most sensitive to natural disasters were mostly the coastal parts of the urban area or the outfalls of river valleys located in this area. Conducted with the aim of determining new urban areas planned as part of the 2023 objectives of Turkey, this study shows that it is absolutely necessary to do planning regarding natural disasters for a healthier and sustainable urban planning. Furthermore, the findings of this study can be easily used in all kinds of practices planned for urban transformation. Especially local administrations must carry out studies in this respect during urban planning activities. In this way, the most efficient usage of land, which is the basic philosophy of urban planning, may be achieved.

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Dynamic Performance of Historical Bayburt Ulu Mosque Minaret According to Turkish Earthquake Code (2007)

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Abstract: In this study, the dynamic performance of the Historical Bayburt Ulu Mosque minaret built in the 12th century in Turkey is investigated according to Turkish Earthquake Code (2007). Macro modeling of historical minaret is done in the SAP2000 program for dynamic analysis. In addition, the ground features of the historic minaret and the earthquake zone information are included into the program. In the literature survey, it is seen that the historical minaret located in Bayburt having geometric properties are different from the other historical minarets built in its period. This minaret is square on the base, eight on the body and circular on the top. The minaret has 60 steps and its total height is 29 m. The historic minaret is modeled with 7156 solid elements in the SAP2000 program. According to TEC2007, the soil group is class C and the local site class is Z2. Accordingly, it is aimed to determine the areas where the risk of damage on the historical minaret.

Keywords: Bayburt Ulu Mosque Minaret, Dynamic Performance, Finite Element Model, Macro Modeling, Turkish Earthquake Code (TEC) 2007

1. INTRODUCTION

History buildings inherit from past to current is important value of our culture. The restoration of these historical buildings, which are exposed to natural or man-made destruction, is an important issue in terms of our cultural heritage. These structures should be able to survive by resisting the earthquake which is one of the natural disasters. It is necessary to know how these structures behave in the earthquake ground motion.

Studies carried out to determine the earthquake performance of historical structures are available in the literature. The Malatya Ulu Camii, built as an agglomeration structure in 1224, was performed linear and nonlinear dynamic analyzes using records of 1 May 2003 Bingöl earthquake by Akdeniz (2011). This historical structure is modeled by macro modeling method in ANSYS program. In the study, the distribution of the maximum and minimum principal stresses occurring in the structure and the damage state were given and the results were evaluated. In the nonlinear analyses, the damage caused by the cracks was observed to be concentrated in the regions where the tensile stresses were higher in the glass. The structural behavior of the historical Erzurum Lala Paşa Mosque has been studied by means of finite element model by Şeker (2013). In order to obtain information about the general behavior of the structures in their studies, they performed analyses using the material properties given in the literature and the formulas given in the earthquake regulations. In the results of the analysis, they determined the location of the damage that occurred in the mosque. Bursa Ulu Mosque was built by Yıldırım Beyazıt in 1399 and Bursa Green Mosque was built by Mehmet was numerical modelled by Mutlu (2015). The author made modal analyses with the aim of evaluating the structural behaviour of these structures. As a result of his analysis, he found the sections and regions of Bursa Ulu Mosque which are the most difficult under earthquake. The numerical model of Ortaköy Büyük Mecidiye Mosque built by Abdülmecid in 1853 was modelled by Çal (2015) and performed static and dynamic analyses with the purpose of evaluating structural behaviour. In the study, seismic records were used for ground structure of the region as strong earthquake-induced ground motion. After the analysis phase, it was obtained the general behaviour of the structure and identified the sections and zones that are most difficult under current loads and earthquake effects. As a result of the work, he has made general evaluations of the behaviour of the building and evaluations of the difficult areas. Static and dynamic analyses of the Sheikh Su-üleyman Masjid in Istanbul were made by Tetik (2015). The finite element model was built on the SAP2000 program. Weak sections were identified and strengthening suggestions were made in the analyses results. The earthquake behaviour of the Elekçi Bridge and Yozgat Clock Tower in Yozgat have been studied by Anadut (2016). These historical structures were modelled in the SAP2000 program. In dynamic analyses, 13 March 1992 Erzincan records was used. In the analysis results, the mode shapes of the structures, natural frequency values, maximum displacement values in building elements, displacement time graphs, maximum pressure and tensile stress values were determined. Also earthquake performances of historical buildings were evaluated. Dabanlı (2016) examined the earthquake performance of Nur-u Osmaniye Mosque and stated the measures to be taken against the damages. In the study, operational modal analysis experiments are examined on the structure to determine the correct dynamic characteristics of the structure. He determined the material properties from the samples he provided from the structure. By modelling the finite element model of the historical structure, three dimensional static and dynamic analyses were examined in detail and the results of the analysis and the earthquake performance of the structure were evaluated.

The objective of this project is to determine how a historical building, Bayburt Ulu Mosque, that has never been investigated will behave in an earthquake that is one of the natural disasters. For this purpose, the dynamic performance of the Historical Ulu Mosque minaret in Bayburt is investigated according to Turkish Earthquake Code (2007) in this study.

2.MATERIALS AND METHODS

In this study, the dynamic performance of the Historical Ulu Mosque minaret built in the 12th century in Bayburt is investigated according to Turkish Earthquake Code (2007). Macro modelling of historical minaret is done in the SAP2000 program for response spectrum analysis. In addition, the ground features of the historical minaret and the earthquake zone information are included into the program. In the literature survey, it is seen that the historical minaret located in Bayburt having geometric properties are different from the other historical minarets built in its period. The minaret is square on the base, eight on the body and circular on the top. The minaret has 60 steps and its total height is 29 m. The historical minaret is modeled with 7156 solid elements in the SAP2000 program. According to TEC2007, the soil group is class C and the local site class is Z2. Extreme stress values of the minaret are determined in the dynamic analyses carried out according to the earthquake specifications. Accordingly, it is aimed to determine the areas where the risk of damage on the historical minaret. The minaret is modeled with 9434 points, 24 areas and 7156 solid elements by using SAP2000 software. The exact connection of the points is very important for the 3D model of structures having different geometric sections to transfer of compression loads. Three dimensional FEM model of the historical minaret is presented figure 1. The eight-node and six-sided elements used in the modeling with solid elements are shown figure 2 with stress components. S33 represents vertical stress, S11 and S22 represent horizontal normal stresses. S33 stresses usually be examined as it is greater than S11 and S22 stresses in a stone element in a historical structure under seismic influences.

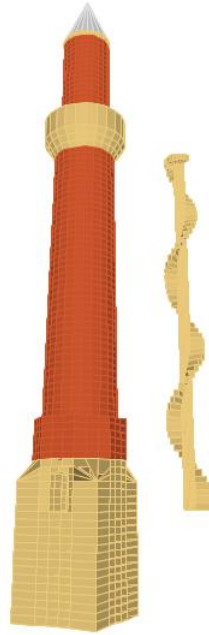


Figure 1. 3D FEM model of the historical minaret

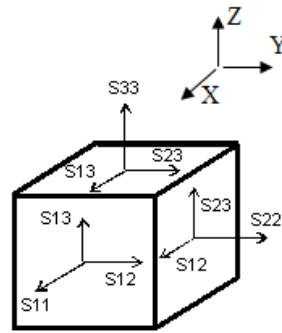


Figure 2. The eight-node and six-sided elements used in the modeling

The material properties of soil underneath the historical minaret are obtained from the drilling wells opened earlier in the locations that best represent the geological construction in the study area (Archives of Bayburt Municipality) according to the unified soil classification method, the soil type is determined as clayey sand (CS). Underground water of up to 10 m depth was not encountered in this soil foundation. There is no danger of liquefaction around the mosque. As seen Table 3, 4 and 5; according to TEC2007, soil group of study area is C and local site class is Z2.

The test setup used in determining the mechanical properties of the yellow stone of Bayburt is presented in figure 3. The mechanical properties of the Bayburt stone and bricks are presented in table 1.



Figure 3. Test setup

Table 1. Mechanical properties of stone and bricks

		Seker vd. (2014)	Test Results
Stone	E (MPa)	-	16649
	ν	-	0.12
	γ (kg/m ³)	-	1820
	Compression strength (MPa)	-	25.97
Bricks	E (MPa)	3490	-
	ν	0,15	-
	γ (kg/m ³)	2037	-
	Compression strength (MPa)	17.49	-
	Tension strength (MPa)	2.69	

3.RESULTS AND DISCUSSION

In this study, response spectrum analyse of Bayburt Ulu mosque's minaret is performed according to Turkish Earthquake Code (2007). S33 compression stresses in X direction are given figure 4. The maximum S33 compression stress is seen on the column of interior stairs as 1270 kN/m². S33 compression stresses in Y direction are given figure 5. The maximum S33 compression stress is seen on the column of interior stairs as 1331 kN/m². S33 tensile stresses in X direction are given figure 6. The maximum S33 tension stress is seen on the body of minaret as 527 kN/m². S33 tensile stresses in X direction are given figure 7. The maximum S33 tension stresses in Y direction are seen on the body of minaret as 538 kN/m². Maximum stresses of minaret of Ulu Mosque is given table 2.

Table 2. Maximum stresses of minaret

Stress (kN/m ²)		Dead load+TEC 2007 in X direction	Dead load+TEC 2007 in Y direction
S11	Max Tension	92	93
	Max. Compression	-140	-180
S22	Max Tension	81	90
	Max. Compression	-135	-157
S33	Max Tension	527	538
	Max. Compression	-1270	-1331

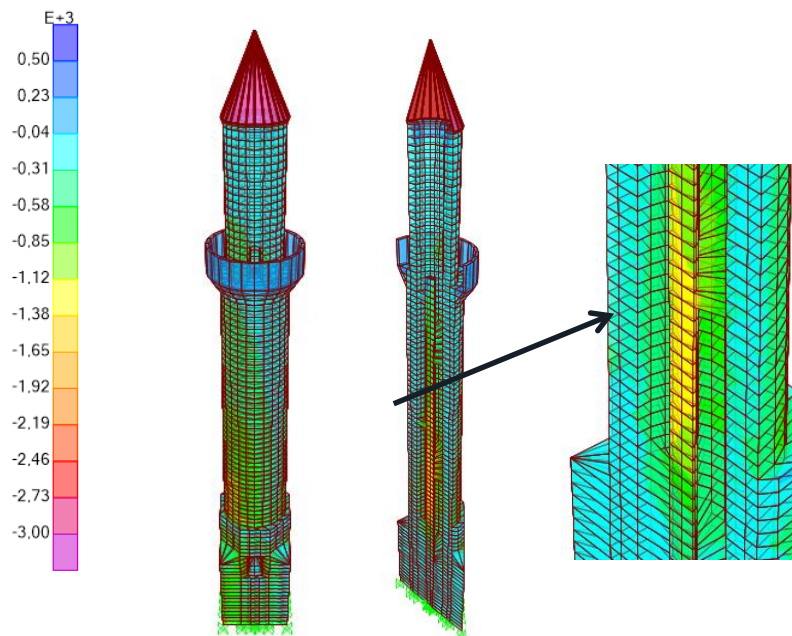


Figure 4. S33 compression stress in X direction

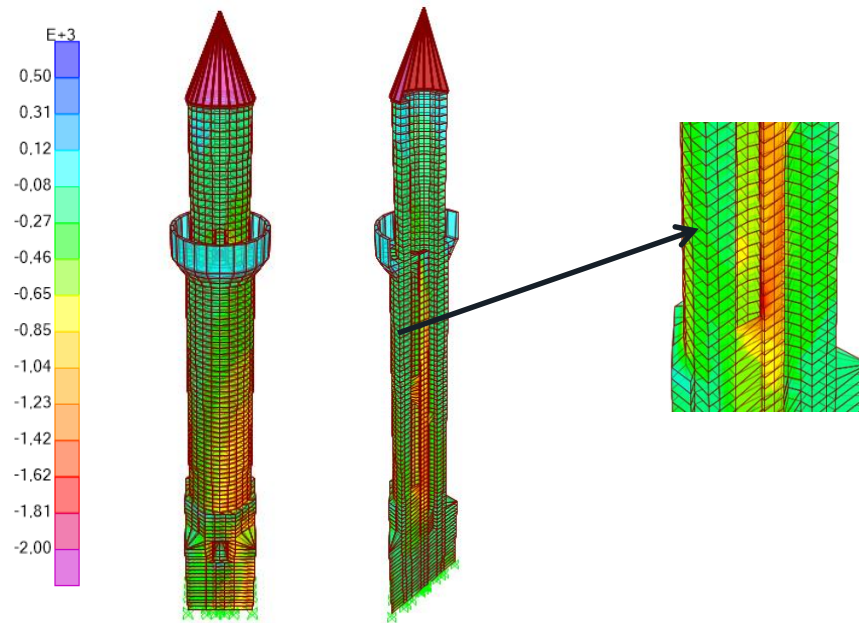


Figure 5. S33 compression stress in Y direction

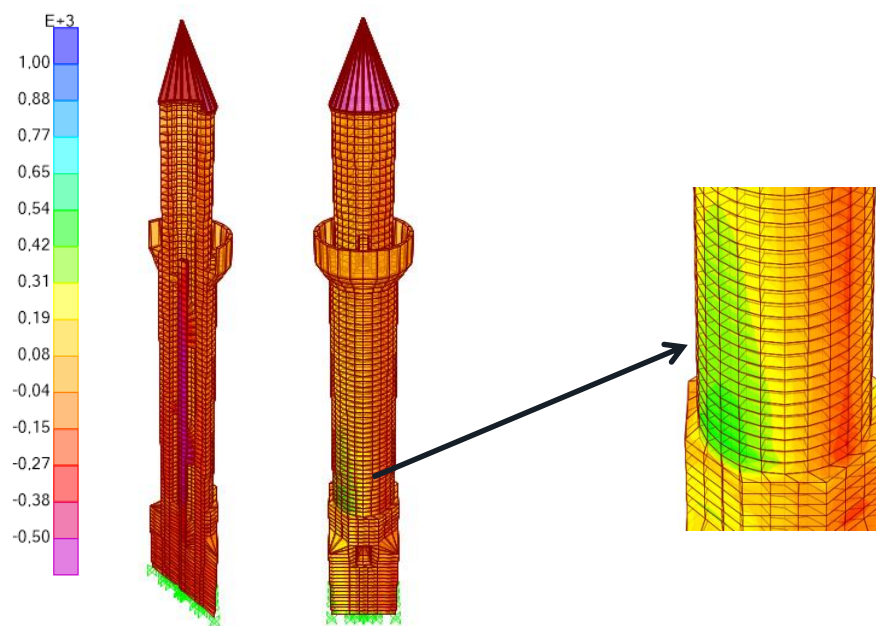


Figure 6. S33 tensile stresses in X direction

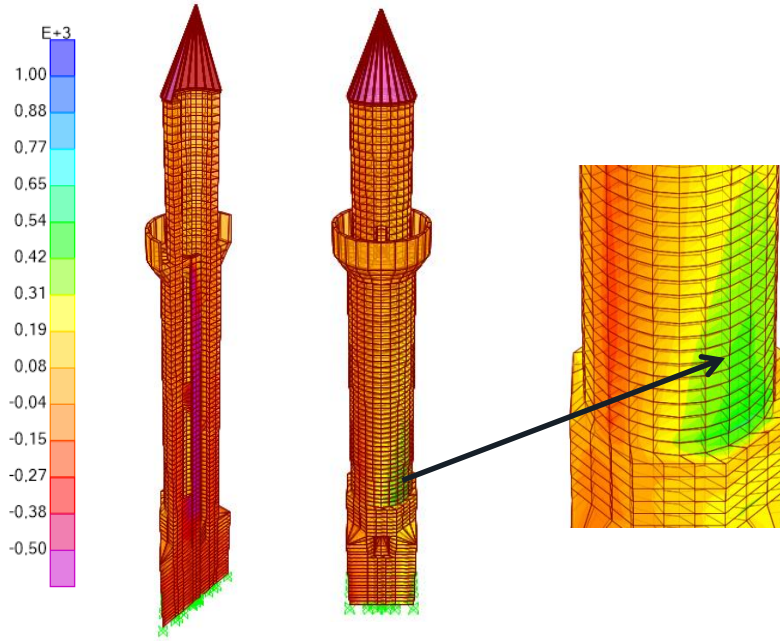


Figure 7. S33 tensile stresses in Y direction

In this paper, dynamic performance of historical Ulu Camii minaret located in Bayburt city in Turkey is investigated. Dynamic analyses carried out accordingly to Turkish Earthquake Code (2007). The results obtained from this study can be written as:

- It is observed that the stresses in y direction are greater than x direction.
- S33 stresses are mostly greater than S11 and S22 stresses.
- The maximum compression stress is seen on the stone as nearly 1.331 MPa. This value is smaller than the strength value of 25.97 MPa. Therefore, there is not any damage on the minaret due to compression stresses.
- The maximum tension stress is observed on the bricks of the body of minaret as about 0.538 MPa. This value is smaller than the strength value of 2.69 MPa. So, there is no any damage on the minaret because of the tension stresses.

Acknowledgements

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Ground Characterization of Çanakkale Province from Acceleration Data Set

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Abstract: In addition to microtremors, strong motion data is also used to estimate the ground resonance period. HVSR (Horizontal Vertical Spectral Ratio) technique is the ratio of the average of horizontal components to the vertical component of acceleration in the frequency domain. The aim of this study is to investigate the ground characteristics of Çanakkale Province by means of HVSR and strong motion data. For the study, acceleration data sets are provided by 17 of 23 stations located at Çanakkale Province, which are owned to Republic of Turkey Prime Ministry Disaster and Emergency Management Presidency (AFAD)-Strong Ground Motion Database of Turkey. The data set of 2423 digital three-component acceleration seismograms from 707 events, occurring in date range from 1998 to 2018, magnitude range from 3.0 to 7.4, distance range from 20km to 550km, are used in the scope of the study. Of sampling interval is 0.01sec. Statistically, min number of events is 30, max number of is 304 and average of is 143 for the stations. The S-wave coda, pre of the S-wave coda, post of the S-wave coda or all long of records are used to process the data set. All long of them are assessed in the study. According to maximum recording time, all long of are equalized and united in a file at any station. The program GEOPSY is used during data processing steps. These data processing steps are to apply of trend removing, FFT (Fast Fourier Transform), 5% cosine windowing, band-pass filtering between 0.2 and 20Hz, 40% H/V spectrum amplitude-rounding with Konno-Ohmachi. According to the SESAME (Site Effects Assessment Using Ambient Excitations) criteria, the reliability of the H/V curves and the reliability of the dominant peaks are tested. The sites are classified by NEHRP (National Earthquake Hazard Reduction Program) criteria. Most of the stations are mostly located on the geological formation of the Quaternary Undifferentiated and Miocene Terrigenous-Clastics. A few of them are positioned on Neogene Volcanites, Eocene Clastics-Carbonates, Miocene Neritic-Limestone, Lower-Middle Miocene Pyroclastics. As a result, the ground classification of the stations sites by the NEHRP criteria are predominantly type C, D and E. The ground resonance periods range from 0.16 to 1.18sec and the magnifications range from 1 to 3.5 in Çanakkale Province. It is also shown that the site characterization is mostly formed with soft clay, hard soil and partly with soft rock limited around locations of the stations.

Keywords: Acceleration, HVSR, FFT, GEOPSY, SESAME, NEHRP

1.INTRODUCTION

The study area is located at Çanakkale Province in the NW of Turkey. In the study area, a few major tectonic belts recognized in the Gelibolu and Biga peninsulas are the Gelibolu, the Ezine, the Ayvacık-Karabiga and Sakarya Zones (Okay et al. 1991). Geological formation consists of Neogene Sediments, Neogene Magmatics, Triassic-Eocene Sequences and Kazdağ Metamorphic Complex (Okay & Satır 2000). The HVSR (Horizontal Vertical Spectral Ratio) method firstly proposed by Nakamura(1989) was for dynamic characteristic estimation of subsurface using microtremors on the ground surface. Then, some theoretical studies have been conducted on H/V ratio (Field & Jacob 1993; Lachet & Bard 1994; Konno & Ohmachi 1998; Bard 1998). HVSR method was first used to estimate the local ground characteristics from strong motion data by Yamazaki & Ansary (1997). Atkinson & Cassidy (2000) studied on the integrated use of seismograph and strong motion data to determine soil amplification. Verification of the technique for estimation of site response using borehole seismographs was carried out (Tsuboi et al. 2001). Later, Zhao et al. (2006) developed an empirical classification scheme based on the f-peak values derived from the HVSR method using strong motion data. This method was very popular after these studies to estimate soil characteristics. It is a stable method regardless of the ground shaking level, epicentral distance, soil layer depth. The aim of this study is to investigate the ground characteristics of Çanakkale Province by means of HVSR technique and strong motion data set from Republic of Turkey Prime Ministry Disaster and Emergency Management Presidency (AFAD)-Strong Ground Motion Database of Turkey.

2.MATERIALS AND METHODS

Firstly, the method was studied by Nogoshi & Igarashi (1971) and Nakamura (1989). Nakamura has suggested a simple way for estimating the amplification factor. HVSR technique is the ratio of horizontal component to vertical component of ground motion in the frequency domain. This is written with the following equation for two-component recorder.

$$HV(w) = \frac{H_s(w)}{V_s(w)} \quad (1)$$

Herein, H_s horizontal and V_s vertical ground motion on the surface for w frequency. For three-component recorder, the technique can be applied by the ratio of average of horizontal components to vertical component of acceleration in the frequency domain. In this study, acceleration data set is provided by 17 of 23 stations located at Çanakkale Province

belonging to AFAD-Strong Ground Motion Database (Figure 1). 2423 digital three-component acceleration seismograms of 707 events, occurring in date range from 1998 to 2018, magnitude range from 3.0 to 7.4, distance range from 20km to 550km, are used. Of sampling interval is 0.01sec. Statistically, min number of events is 30, max number of is 304 and average of is 143 for the stations.

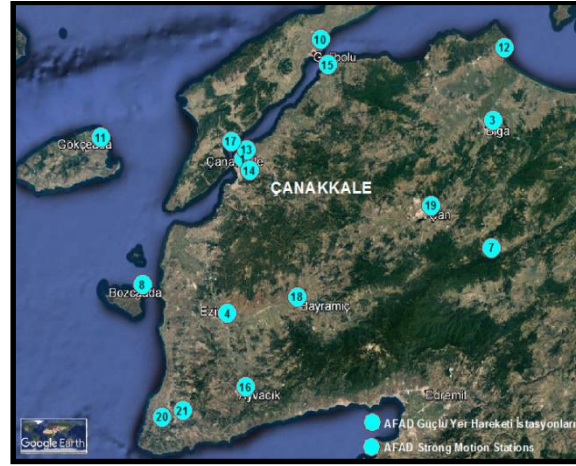


Figure 1. AFAD stations locations in this study.

The program GEOPSY is used in the data processing steps (GEOPSY 2018). The S-wave coda, pre of the S-wave coda, post of the S-wave coda or all long of record is used to process the data set. To estimate ground magnification and predominant frequency, all record length is assessed in the study. For all data set at any station according to maximum recording time are equalized and united in a file to GEOPSY input. The data processing steps are to apply FFT(Fast Fourier Transform), 5% cosine windowing, band-pass filtering between 0.2 and 20 Hz, 20-40% H/V amplitude spectrum rounding with Konno-Ohmachi (Figure 2). Furthermore, according to the SESAME (Site Effects Assessment Using Ambient Excitations) criteria, the reliability of the H/V curves and the reliability of the dominant peaks are tested (SESAME 2004). The sites are classified by NEHRP (National Earthquake Hazard Reduction Program) criteria (BSSC 2003).

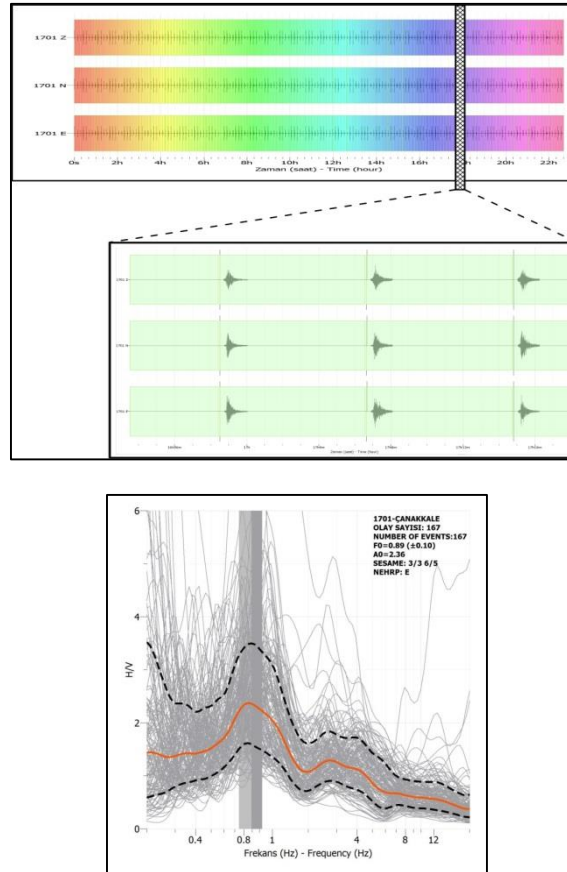


Figure 2. A sample of strong motion station data set and it's H/V ratio.

3.RESULTS AND DISCUSSION

Results

In this study, 17 from 23 strong motion stations are evaluated due to not having enough records. Although the number of stations and it's density is not enough, GEOPSY outputs of the data set prepared for each station are mapped because of the visual presentation superiority (Figure 3). Ground magnification and predominant frequency contour maps reflect only the ground characteristics of the stations locations rather than the ground features of Çanakkale Province. Çanakkale city center is also contoured(center of maps). The blue shades is to well-ground, the green shades is to moderately good-ground, and the brown shades is to bad-ground characteristics relatively.

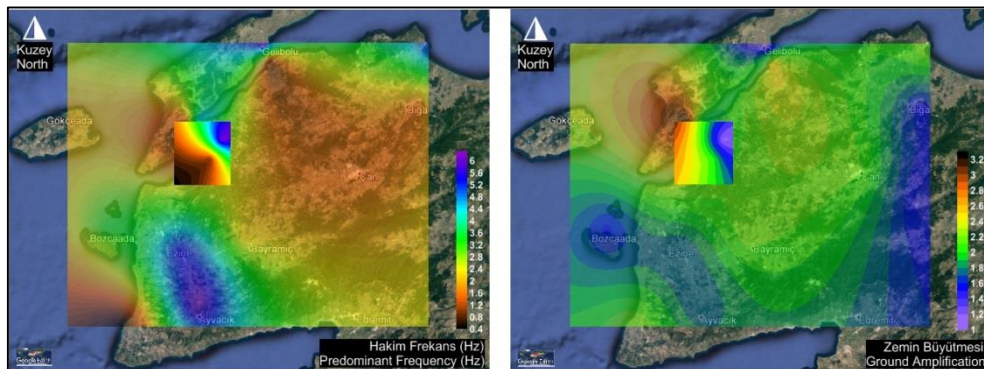


Figure 3. A map of predominant frequency(left-side) and ground amplification(right-side).

Discussion

Most of the stations are mostly located on the geological formation of the Quaternary Undifferentiated and Miocene Terrigenous-Clastics. A few of them are positioned on Neogene Volcanites, Eocene Clastics-Carbonates, Miocene Neritic-Limestone, Lower-Middle Miocene Pyroclastics. It is also shown that the site characterization is mostly formed with soft clay, hard soil and partly with soft rock limited around locations of the stations.

As a result, the ground classification of the stations sites by the NEHRP criteria are predominantly type C, D and E. The ground resonance periods range from 0.16 to 1.18sec and the magnifications range from 1 to 3.5 in Çanakkale Province.

Acknowledgements

Thanks to AFAD-Strong Ground Motion Database for the data set used in this study.

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Ground Characterization of Comu Campus from Microtremor Data Set

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Abstract: The use of microtremors to estimate the ground resonance period at the regional scale has many advantages in terms of time, labor-force and money saving. For these reasons, three-component microtremor data sets are widely preferred to estimate the ground resonance period in geotechnical studies. HVSR (Horizontal Vertical Spectral Ratio) method, which is called the ratio of the average of horizontal components to the vertical component of microtremors in the frequency domain, is often used in the analysis of the collected data sets. The aim of this study is to investigate the ground characteristics of the Terzioğlu Campus area of the COMU (Çanakkale Onsekiz Mart University) using HVSR and microtremor measurements from a few graduation projects. For this purpose, the data set was collected at 40 points in the study area. The measurement system consists of three-component broad-band GEOSPACE seismometer, REFTEK-130 digitizer and GPS instrument. As much as possible to avoid from ambient noise, the process was performed between 24a.m. and 6a.m. as the data acquisition system installed in a small pit at each point. The average length of records and of the sampling interval are about 30 minutes and 0.02 sec, respectively. The program GEOPSY is used to data processing. These are to apply of FFT(Fast Fourier Transform), 5% cosine windowing, band-pass filtering between 0.2 and 20 Hz, 40% H/V amplitude spectrum-rounding with Konno-Ohmachi. According to the SESAME (Site Effects Assessment Using Ambient Excitations) criteria the reliability of the H/V curves and the reliability of the dominant peaks are tested. The sites are classified by the NEHRP (National Earthquake Hazard Reduction Program) criteria. It is used to evaluate the H/V curves obtained from 18 points providing the SESAME criteria among to 40 points. As a result, the ground classification of the campus area is predominantly type E. The ground resonance periods range from 0.2 to 2.5sec and the magnifications range from 1 to 4 in the area. The Campus is located on the geological formation of the Quaternary Undifferentiated and Miocene Terrigenous-Clastics. It is also shown that the ground characterization of COMU Terzioğlu Campus is mostly formed with soft clay, hard soil and partly with soft rock limited at the measuring points.

Keywords: Microtremors, HVSR, FFT, GEOPSY, SESAME, NEHRP

1.INTRODUCTION

The study area is located at COMU Terzioğlu Campus in Çanakkale City Center in the NW of Turkey. Around the study area, a few major tectonic belts recognized in the Gelibolu and Biga peninsulas are the Gelibolu, the Ezine, the Ayvacık-Karabiga and Sakarya Zones (Okay et al. 1991). Regional geological formation consists of Neogene Sediments, Neogene Magmatics, Triassic-Eocene Sequences and Kazdag Metamorphic complex (Okay & Satır 2000). The Terzioğlu Campus (the study area) is also located on the geological formation of the Quaternary Undifferentiated and Miocene Terrigenous-Clastics. The HVSR (Horizontal Vertical Spectral Ratio) method firstly proposed by Nakamura (1989) was for dynamic characteristic estimation of subsurface using microtremors on the ground surface. Then, some theoretical and practical studies have been conducted on H/V ratio (Field & Jacob 1993; Lachet & Bard 1994; Nakamura & Saita 1994; Field & Jacob 1995; Konno & Ohmachi 1998; Bard 1998; Nakamura 2000; Satoh et al. 2001; Tsuboi et al. 2001; Okada 2003). This method was very popular after these studies to estimate soil characteristics. The aim of this study is to investigate the ground characteristics of the Terzioğlu Campus area of the COMU (Çanakkale Onsekiz Mart University) using HVSR and microtremor measurements from a few graduation projects.

2.MATERIALS AND METHODS

Firstly, the method was studied by Nogoshi & Igarashi (1971) and Nakamura (1989). Nakamura has suggested a simple way for estimating the amplification factor. HVSR technique, is the ratio of horizontal component to vertical component of ground motion in the frequency domain. This is written with the following equation for two components recorder.

$$HV(w) = \frac{H_s(w)}{V_s(w)} \quad (1)$$

Herein, H_s horizontal and V_s vertical ground motion on the surface for w frequency. For three component recorder, the technique can be applied by the ratio of average of horizontal components to vertical component of microtremors in the frequency domain. In this study, the data set was collected at 40 points in the study area (Figure 1). The measurement system consists of three-component broad-band GEOSPACE seismometer, REFTEK-130 digitizer and GPS instrument. As much as possible, to avoid from ambient noise, the process was performed between 24a.m. and 6a.m. as the data acquisition system installed in a small pit at each point. The average length of records and of the sampling interval are about 30 minutes and 0.02 sec, respectively.

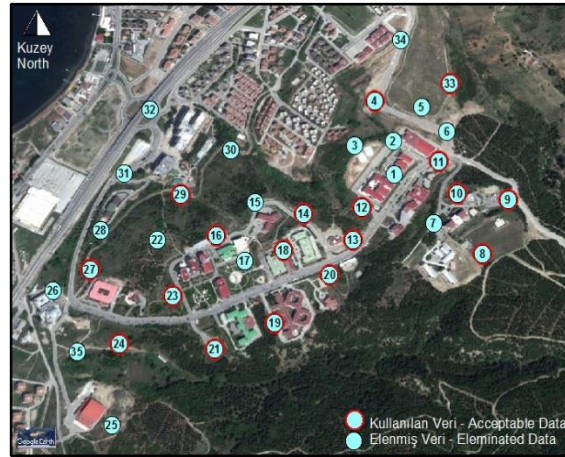


Figure 1. Mikrotremor stations locations in this study.

The average length of records and of the sampling interval are about 30 minutes and 0.02 sec, respectively. The program GEOPSY is used to data processing (GEOPSY 2018). The data processing steps are to apply of FFT(Fast Fourier Transform), 5% cosine windowing, band-pass filtering between 0.2 and 20 Hz, 40% H/V amplitude spectrum-rounding with Konno-Ohmachi (Figure 2). According to the SESAME (Site Effects Assessment Using Ambient Excitations) criteria the reliability of the H/V curves and the reliability of the dominant peaks are tested (SESAME 2004). The sites are classified by the NEHRP (National Earthquake Hazard Reduction Program) criteria (BSSC 2003). It is used to evaluate the H/V curves obtained from 18 points providing the SESAME criteria among to 40 points.

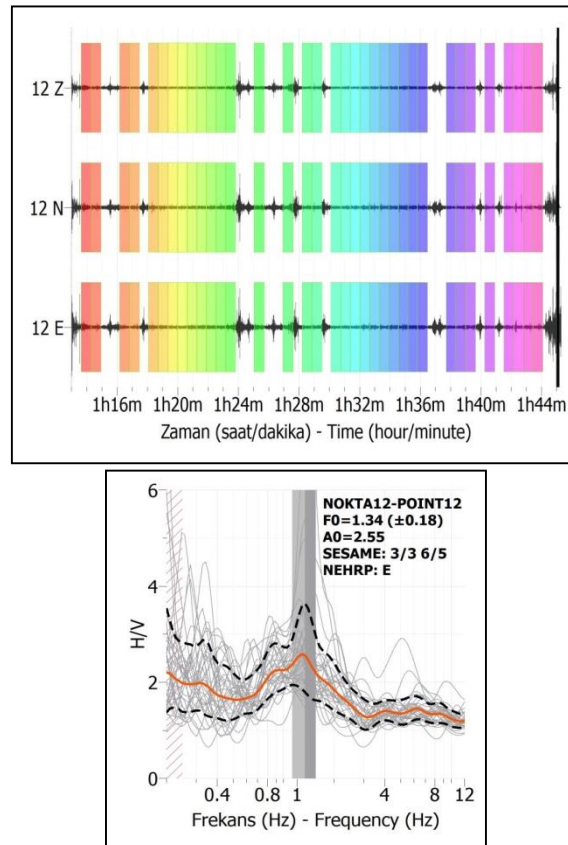


Figure 2. A sample of microtremor data set and its H/V ratio.

3.RESULTS AND DISCUSSION

Results

In this study, 18 from 40 microtremor stations are evaluated due to not holding with SESAME criteria. The number of stations and it's density is not enough, but GEOPSY outputs of the data set prepared for each station are mapped because of the visual presentation superiority (Figure 3). Ground magnification and predominant frequency contour maps reflect particularly the ground characteristics of the station locations rather than all the campus. The blue shades is to well-ground, the green shades is to moderately good-ground, and the brown shades is to bad-ground characteristics relatively.

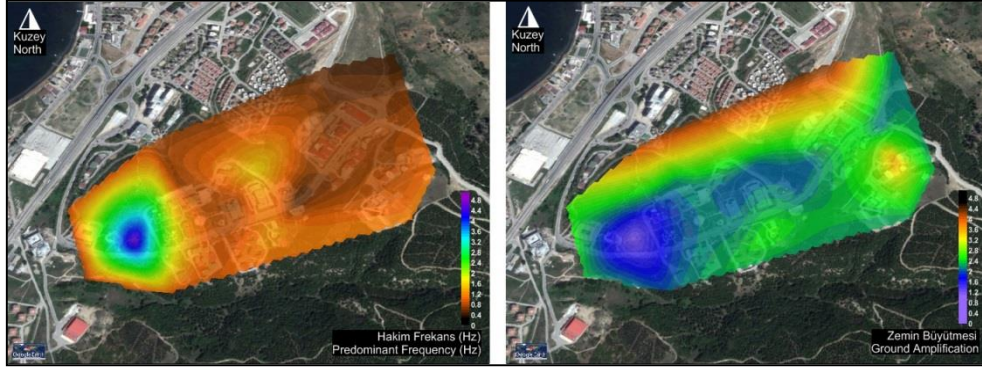


Figure 3. A map of predominant frequency(left-side) and ground amplification(right-side).

Discussion

The Campus is located on the geological formation of the Quaternary Undifferentiated and Miocene Terrigenous-Clastics. It is also shown that the ground characterization of COMU Terzioğlu Campus is mostly formed with soft clay, hard soil and partly with soft rock limited at the measuring points.

As a result, the ground classification of the campus area is predominantly type E. The ground resonance periods range from 0.2 to 2.5sec and the magnifications range from 1 to 4 in the area.

Acknowledgements

Thanks to COMU-Department of Geophysical Engineering for instrumentations providing the data set used in this study.

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Morphological Characteristics of Blue Crab (*Callinectes sapidus* Rathbun, 1896) and Relationship with their Fishery in the Aegean Sea

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Abstract: This study aimed at examining fishing method used for the catching blue crab (*Callinectes sapidus* Rathbun, 1896) in Aegean Sea. Blue crab is a crab species of primary commercial value in Turkey with increasing importance and consumption among the inhabitants Aegean and Mediterranean regions, particularly. Until 1980s, there were no commercial catching methods for this species. This species was usually discarded by the fishermen. Minimum catch size ratio were found 39% in trammel net and 27% in without escape vent traps, respectively. When the traps modification made, this ratio decreased to 6%. Average length was found 16,3 cm in traps with escape vent while this average length was 15 cm in regular traps. Because of trammel nets were not selective for this species we did focused on traps for the sustainable crab fisheries. Escape vents were prepared based on carapace length (CL) of blue crab and was used in length 6 cm as soft escape vent. The aim of the study is to examine actual situation of the blue crab fishery in the Turkish water of the Aegean Sea by the different fishing methods to better understand the catch amount by the fishermen and to propose some recommendations for sustainable blue crab fishing activities in the Aegean Sea.

Keywords: Blue crab, *Callinectes sapidus*, trap, morphology, Aegean Sea

1.INTRODUCTION

Blue crab (*Callinectes sapidus* RATHBUN, 1896) is a crab species of primarily commercial value in Turkey with increasing importance and consumption among the inhabitants of particularly Aegean and Mediterranean regions. Blue crabs have a commercial importance in the menus of tourist restaurants in the summer months particularly. Since crabs have high prices, the industry regarding to kind of blue crab products was established. Three types of products; crab meat, whole crab and crab wastes are mainly processing as a industrial product. For example, the chitin present in the carapace is also used in a variety of industries such as textiles, glue, ink and cosmetics (Paul and Haefner, 1985) Özellikle Ege ve Akdeniz bölgesinde önemi giderek artmakta, bölge halkı tarafından tüketimi yaygınlaşmaktadır (Türel, 1999). Blue crab both Europe and the world market has an important place with it's meat quality and high protein content. Blue crab is one of the highest species of commercial value and China, France, Indonesia, Japan, the Philippines, Spain, Thailand and the US are the most consuming countries.

Blue crab is quite big in size and has high commercial value in North America and Canada where it originates. It was firstly brought to the brackish waters of North Aegean lagoons, especially the lakes in Enez region and later to Köyceğiz and Güllük lagoons along the Aegean coast (Zaitsev & Öztürk, 2001). Currently it is abundant in Yumurtalık, Beymelek and the Taşucu Karadeniz lagoons (Rield, 1983).

Blue crab *Callinectes sapidus* (Rathbun 1896) is abundant in southern and western coasts of Turkey and in lagoons has an increasing economic value. Especially in the recent years, the growing demand in touristic summer seasons, it holds greater part in the coastal and lagoon fisheries. Blue crabs are primarily caught by traps, gill and trammel nets, pots and fishing lines but they are a bycatch in trawling and coastal towing methods. Blue crab *Callinectes sapidus* (Rathbun 1896) is abundant in southern and western coasts of Turkey and in lagoons has an increasing economic value. Especially in the recent years, the growing demand in touristic summer seasons, it holds greater part in the coastal and lagoon fisheries.

Blue crabs are primarily caught by traps, gill and trammel nets, pots and fishing lines but they are a bycatch in trawling and coastal towing methods. Lagoons where fresh water and sea water meet are convenient zones for most of marine species for feeding, mating and sheltering. During the glut period when the species rush back to the sea, blue crabs are caught in a fixed trap set by barring the openings of the weir, known as lagoon traps. Besides target species such as sea bass, sea bream etc., blue crabs are also caught and actively collected by landing nets. Fyke nets are fixed traps composed of two intertwined conical nets and metal or wooden frames attached to them. They can have single or double openings. Used with a fence, fyke nets can be useful to increase efficiency. Fyke nets can also be laid successively and left in the sea bed overnight. Fyke nets have proven to be a better method in terms of collection amount than traps (Atar et al., 2002). Pots are passive gears with single-opening. Baits can also be used at the bottom of the pot to which the crab is attracted and entrapped. Since this method is known to cause eutrophication, baitless pots are preferred in lagoon areas. In this study, blue crab which has found its place among the commercial species of the waters of Turkey, protecting this valuable species and therefore it was intended to ensure the sustainable contribution to the country's economy. Meanwhile the investigation of the relationship between the morphological characteristics of blue crab and fishing gears and the

research on sustainable fisheries is examined. Thus, the lack of information that could constitute a basis for the conservation of stocks and the interpretation of fisheries management principles for sustainable fisheries will be addressed.

Taxonomy of Blue Crab (Rathbun 1896)

The taxonomy of Blue Crab (Fig. 1) (*Callinectes sapidus*) is as shown below according to Alvarez (1968).

Filum	: Arthropoda
Classis	: Crustacea
Subclassis	: Malacostraca
Ordo	: Eumalacostraca
Supersection	: Reptantia
Section	: Brachyura
Superfamilya	: Brachyrhyncha
Familya	: Portunidae
Genus	: Callinectes
Species	: <i>C.sapidus</i> (RATHBUN, 1896)



Figure 1. General view of Blue Crab (*Callinectes sapidus* RATHBUN, 1896)

2.MATERIALS AND METHODS

The study used a collapsible trap with 2 inlet compartments equipped with green net with small mesh size (Fig. 2). The float and the pet bottles are connected as a float so that the traps do not get lost. The length of the jets attached to the pet bottles is 2 m. A total of 30 traps (with 15 escape holes) were released independently from each other.

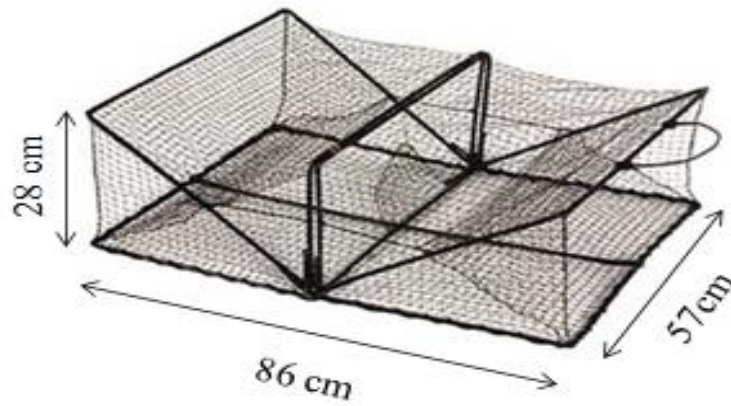


Figure 2. Trap used in the study (Square fyke net)

Another fishing gear used in the study is the traditional trammel gill net (Fig. 3). In the study, trammel net for sea bass which has in length of 50 m and mesh size 40 mm was used.



Figure 3. Trammel gill net used in the study

Escape Ring-ER using

Atar et al. (2002) investigated the width-to-height-weight relationships and condition factors by sex of blue crab populations in Beymelek Lagoon. They reported an allometric relationship between carapace width, length and weight. Ağbaş 2006 reported that there was a linear relationship between carapace length and other body measurements. In this study, a linear relationship was also found between carapace length and other body measurements. Carapace width is not a consistent index for carapace length because the structure at the lateral margin may vary. The legal catch size was found to be an average of 6 cm of carapace length for individuals with an average of 13 cm CW.

The escape vents were applied to the lower corners of the square pinter one by one in total 15 pinter (Fig. 4). The net with small mesh size of the traps covered with the small mesh size net were cut to obtain escape vents with a height of 6.5 cm and a height of 3 cm.

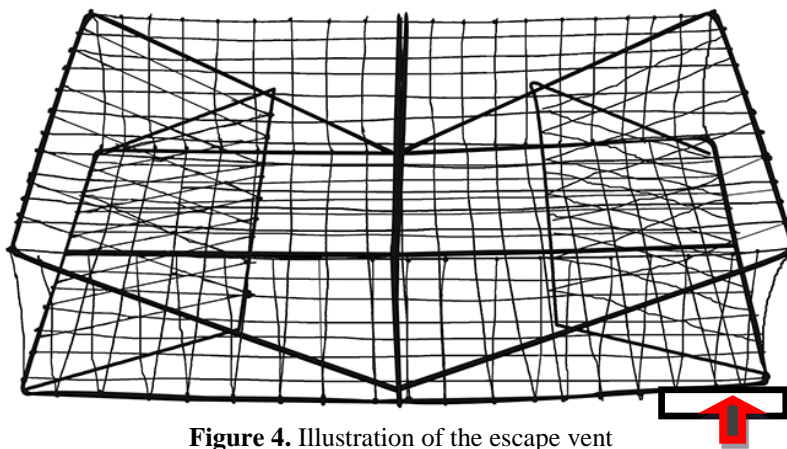


Figure 4. Illustration of the escape vent

Methods Used in the Experiments

Studies were conducted using the pond of Egeberk Fisheries Products Company in Aydın. 30 foldable traps (square pinter), and 1 trammel gill net were used in the study. 15 traps were created with escape vent. Traps were baited with whole fish, fish internal organs and fish waste. The baits of the traps renewed with 2 repetitions a day and 6 hours of waiting time at the end of each operation. The depth at which the traps are varied ranges from 1.5 m to 2.5 m.

Measurements

The male and female individuals of the blue crabs obtained from the fishing operations were separated by sex and weighed with a 0,01 g precision scales. Morphometric measurements of the samples were then made. These are carapace width (CW) containing the lateral ray based on minimum length, carapace length (CL) containing frontal ray, and carapace height (CH). Digital calipers were used and measured in cm for these measurements.

A morphometer was used to determine the body forms of the crabs and evaluate them with the 'FISHSELECT' software. Morphometer body shape was scanned with the aid of a scanner and saved as a picture file on the computer. In the computer, the software is simulated with the shapes found in its own database and the most suitable shape is determined for the blue crab body form. This shape is recorded for use in selectivity studies.

3.RESULTS AND DISCUSSION

Length and Weight Distribution

A total of 277 blue crabs were caught in total 20 fishing operations. The height and weight values of the individuals were given in Table 1.

Table 1. Minimum, Maximum, Length and Weight Values of Captured Blue Crabs

n=277	Minimum	Maksimum	Mean	se (±)
Length(cm)	7,5	20,7	15,2	0,15
Weight (g)	59,3	600,7	263,37	0,79

Sex Ratio

149 individuals are male and 128 are female of the 277 individuals caught in the 20 operations. A total of 5 female with egg individuals were caught.

Body Shape

Body morphology was determined with a morphometer in accordance with the escape vents of blue crab individuals. This device has been scanned with a scanner and converted into a JPEG file. These files have been examined with the software "FISHSELECT" which includes a model based on an individual shape. The values between the shape reflecting the body forms of blue crabs and the actual body shapes were recorded statistically and visually and recorded in the database for a more detailed examination of relations with data base. At the end of the study, it was determined that the blue crab body form had the appropriate shape "SHIP". The value was determined 98.35 for R2 and 65.78 for AIC (Figure 5).

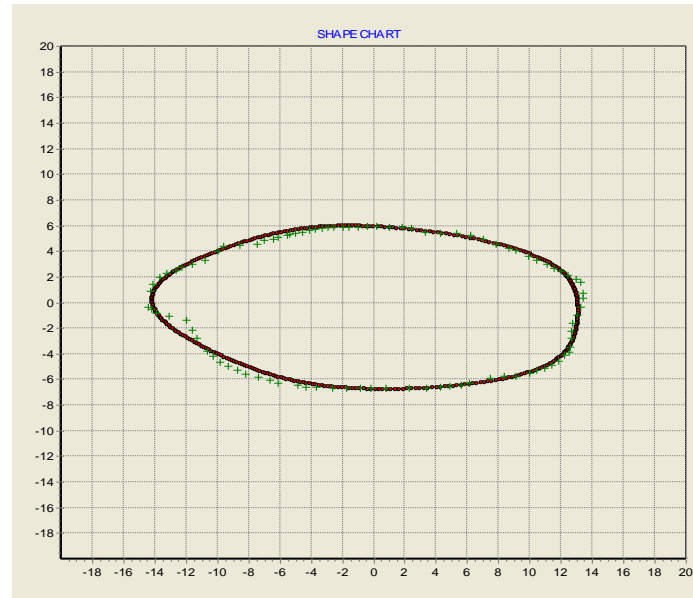


Figure 5. Example on the fits of the models selected to describe cross-sections for blue crab

This study was investigated some morphological characteristics of blue crab relationship between fishing gears. The data obtained from literature and this study was presented. The main results of this study can be summarized as the minimum catch size ratio were found 39% in trammel gill net and 27% in without escape vent traps. With the modification of traps the ratio decreased to 6%. The average length were found 15 cm for the normal traps, 16,3 cm for escape vent traps. Meanwhile trammel gill net is found as not selective fishing gear for this species so we have focussed on traps. Escape vents were prepared based on carapace length (CL). Soft escape vents for 6 cm were used. Crab shape was determined at the time of crab's escape using morphometry tool. Crab's escape was observed by underwater camera from fishing gear. After laboratory study, the "SHIP" shape was detected which suitable form to crab's body. The value was detected 98,35 for R2 and 65,78 for AIC.

While 41 (23%) individuals were caught under 13 cm of carapace width, which is the minimum catching size in normal traps, this number decreased 5 individuals (6%) in ER traps. This number is 24 (39%) in trammel nets. When the caught individuals are examined regarding their length, the proportion of individuals with average height and legal size in ER traps is higher than normal traps. These findings are consistent with the results reported by Guillory and Hein (1998).

The average carapace length corresponding to the minimum landing size was found to be 6 cm. It is observed that the result obtained is the escapement individuals which are under illegal size is high and the average length of individuals into the trap increases, and these results are similar to those reported by Guillory and Prejan (1997).

In this study, when the length-fishing quantities of EV (trap with escape vent) and normal traps are examined, it is found that EV traps are more efficient in terms of average length of individual than normal trap. Miller (1990) noted that the rigid escape rings and the blue crab exterior skeleton structure are ideal for the passage of crabs. Gökoğlu and Oray (1997) studied on the blue crab fisheries in Antalya Bay and used 200 m in long trammel net. They found that the fishing yield varied between 5-16 kg, and that the captured individuals were taken out of the trammel nets after they were crushed and killed from the trammel net. Bellchambers and Lestang (2005) investigated crab fisheries in Southwest Australia with various fishing gear and reported that juvenile individuals could not be caught by traps, but could be caught by trawls. Atar et al., (2002) compared the effectiveness of three different traps for the catching and catching ratio in Beymelek lagoons (Antalya, Turkey) and they reported that the CPUE is much higher of the fyke nets than the traps.

In the present study, the trammel gill net has higher CPUE than the traps. It has been observed that the trammel nets are not suitable for blue crab selectivity because of the lateral rays, clamps, and hard shell structure. For this reason, the ratio of individual under the legal size of 13 cm is higher in trammel nets particularly. Further studies should be done on the selectivity of different mesh shape and size in different fishing gear. Moreover it is also needed the studies focused on the morphologic characteristics of blue crab.

Acknowledgements

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Morphological Characteristics of Mackerel Species (*Trachurus trachurus* and *Trachurus mediterraneus*) and Relationship between Mesh Openness for Selectivity

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Abstract: This study aimed at predicting basic selectivity parameters using specification net mesh and also studied species. Hence the selectivity estimation can be challenging in many different types of fisheries without to need full-scale experiments to estimate gear selectivity which are extremely resource demanding. The studies were carried out in three basic steps at sea, laboratory and computer simulations, respectively. Fish samples were collected during 2013 covering a whole year. 50 individual for each species were collected and transported to the laboratory for the cross-section measurements and also fall through experiments. Data obtained from laboratory studies were integrated to the computer using by Fishselect model for the simulation of the data. At the end of the simulation isobar diagrams which shows selection of the two investigated species versus mesh sizes and openness degree. As a result of this study, it was observed that the results obtained from simulations are quite well agree with full-scale selectivity results for *T. trachurus* and *T. mediterraneus*. Both CS's model CS1 and CS2 are found as ellipse for *T. trachurus* while CS1 is flexdrope and CS2 is ellipse for *T. mediterraneus*. In conclusion, estimation of fishing gear selection parameters by fishselect model is advised as cheap and realistic method for improvement of fishing gear selectivity

Keywords: Mackerel, *Trachurus trachurus*, *Trachurus mediterraneus*, selectivity, morphology, simulation

1.INTRODUCTION

One of the methods implemented in fisheries management to ensure the sustainable use of resources is the regulation of mesh shape and size of the fishing gear. The primary goal of these regulations is to ensure that small-sized individuals who have not yet reached fertility in the stock escape from net meshes of the gear during fishing operations. Selectivity is defined as the phenomenon has long been known in Turkey and in the world and carried out many studies on this issue.

Today, the main methodology for evaluating fishing gear selectivity is based on the collection of experimental data by sea trials and subsequent statistical analysis of the data. However, due to the variability of uncontrollable factors between trawl hauls, it is necessary to carry out a large number of trawl hauls operations in order to obtain reliable results. This makes the selectivity work difficult, expensive and time consuming.

In this study, morphological structures and body forms of target species were determined by morphological measurements and evaluations to be done in the laboratory, and researches were carried out on determination of mesh sizes with the best selectivity value and relation with body morphology. Through these studies it will be predicted how the horse mackerel will give the selectivity value in the studied mesh. In this regard, information and data will be obtained more quickly and cheaply within the scope of the management of the fishery.

2.MATERIALS AND METHODS

In this study, the most suitable mesh size and shapes are predicted with "FISHSELECT" software by using the morphological characteristics of fishes. FISHSELECT(Herrmann et al., 2009) is a fish morphology data- and simulation –based methodology that can be applied to investigate the basic size selective properties of meshes of different shape and size for individual fish species. Main steps in the methodology a) Data collection b) Experiments in lab. c) Simulation of data and finally d) Prediction of selective properties for different mesh shape

Within the scope of the sea trials, 50 different mackerel species of different lengths were caught and these sample species transported to the laboratory by the tanks. Deformed individuals have not been assessed. The species were kept alive until applied in the FISHSELECT measurements. Polyester tanks in a variety of sizes and oxygen tubes for the ventilation of tanks aboard were used to collect live fish. Thus more accurate morphological measurements on these fresh species were done in the laboratory studies (Fig. 1).



Figure 1. A view of sea trial

The length, weight, cross-sections of the individuals sampled in the sea and the fall-through trial results of the fish from different mesh size and shapes were determined by laboratory studies. A PVC measuring board was used for the length measurement. The full size (total size) of the fish was taken at the measurement. A precision scale with a precision of 0.01 gr was used for weight measurement. A mechanic morphometer was used to determine the cross-sections of the individual (Fig. 2). And mesh templates made of 5 mm thick white PVC sheet and representing 487 mesh shapes were also used for fall-through experiments (Fig. 3).



Figure 2. Morphometer

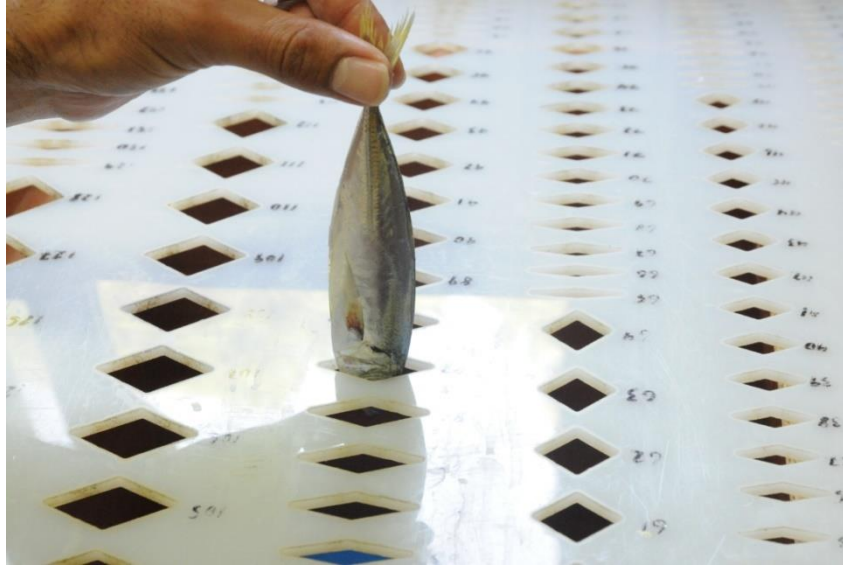


Figure 3. A view of fall-through experiments

3.RESULTS AND DISCUSSION

In this study, total 100 individuals (*Trachurus trachurus* and *Trachurus mediterraneus*), 50 for each species, were studied. Flexibility and compression ratio were examined and recorded when the body was tagged to the net in the external body form, stiffness, net tagging points, cross-sections (CS), and fall-through experimental (.EXR). For the individuals belonging to both species, the weight and fall-through experiment results were recorded in the database of the software and the fish list was created. *Trachurus mediterraneus* was found to be distributed intensely in individuals between 170-200 mm in length, and individuals of *Trachurus trachurus* were found to be between 190-200 mm and 250-260 mm in length (Fig. 4). A linear relationship between length-weight and length-diameter was determined (Fig. 5).

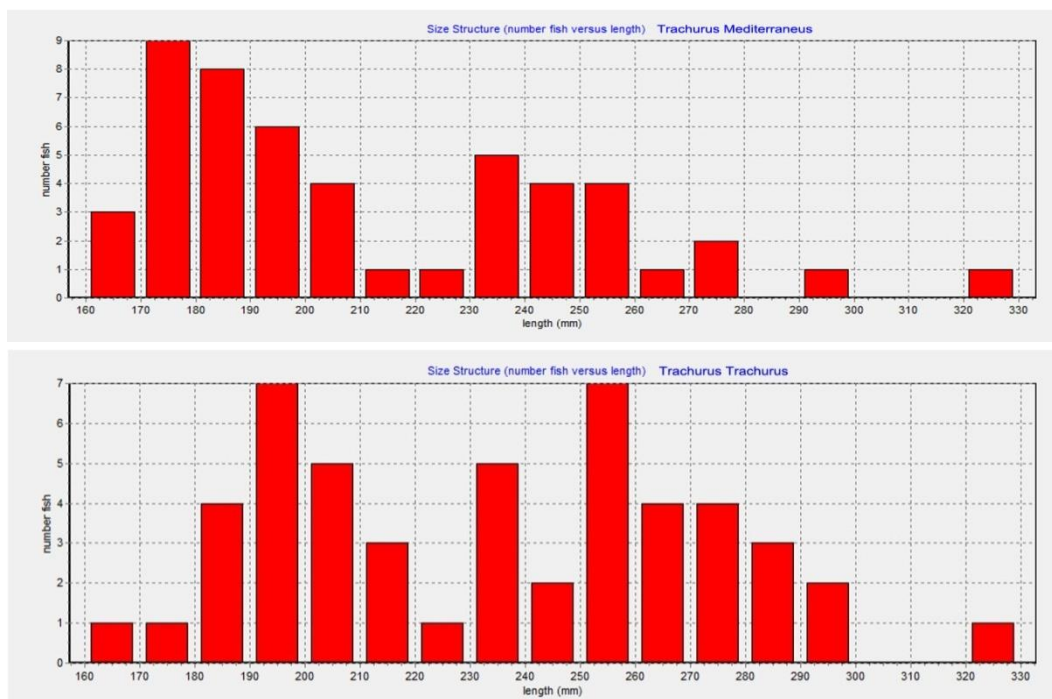


Figure 4. Length-frequency distributions

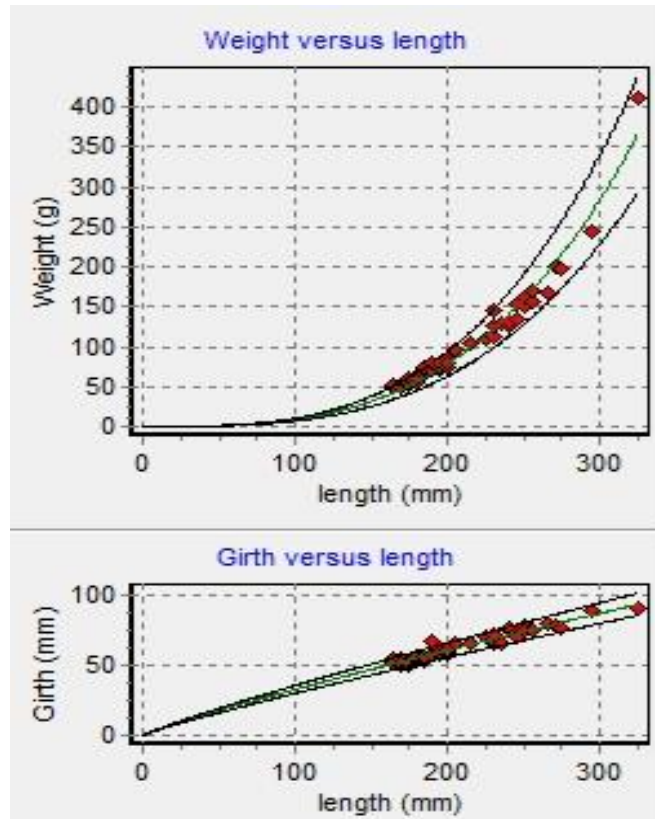


Figure 5. Relationships length-weight and length-girth for the *T. mediterraneus* species

In the study, 2 cross-sections (CS) were determined for *Trachurus trachurus* and *Trachurus mediterraneus* species (Fig. 6). These points were determined on the basis of dorsal-ventral regions, which are the highest points during the escape from the net. Cross sections were found at the same points for both species.



Figure 6. Cross-sections for the *Trachurus mediterraneus*

The relationship between the size of each individual and CS point is determined by the software. Linear growth was determined between length and cross section. As a result of analysis with software, 7 models were obtained. The model with the highest R2 value and the lowest AIC value from these models constitutes the body cross section model for the simulation use. R2 and AIC values are calculated according to the radius and angle values of the actual section of the fish. For CS1 and CS2, Flexdrope2 and Ellipse shapes and for *T. trachurus* and for both CS1 and CS2, Ellipse shapes were found to be the best models for *T. mediterraneus*, respectively.

In the study, it was determined that the fish had been subjected to compression from three different points as they passed through the net. In FISHSELECT software, there are symmetric, asymmetric, horizontal, and vertical and compression models at certain angles. Asymmetric compression models with 90, 270 and 0 degrees have been applied on the horse mackerel samples. A total of 255 models were prepared for the simulation. For the simulation, 50 individuals belonging to *T. mediterraneus* and *T. trachurus* were used. For both species, 478 different mesh and 255 escape models were applied. For one species, 6094500 trials were conducted (50 individuals x 478 mesh x 255 escape model). Two separate computers were used for an average of 3 months study. Among the 6094500 test results, the model with the highest value of $DA=S/S+D$ equation was determined as the best model. Then 5000 virtual population in minimum and maximum length intervals has been created using by FISHDELECT software.

In the precise simulation phase, 5000 virtual populations instead of 50 individuals, 357 diamond mesh instead of 478 mesh, and just 1 best model instead of 255 previous models, respectively were taken into simulation. 1785000 trials were conducted and continued for about 3 months. At the end of the simulation, L50, SR values were obtained graphically and numerically with the "Retention Data" tab. The network visibility and mesh size data in the mesh list were evaluated by the statistical software "R" and the selectivity isobars of the horse mackerel species were obtained (Fig. 7).

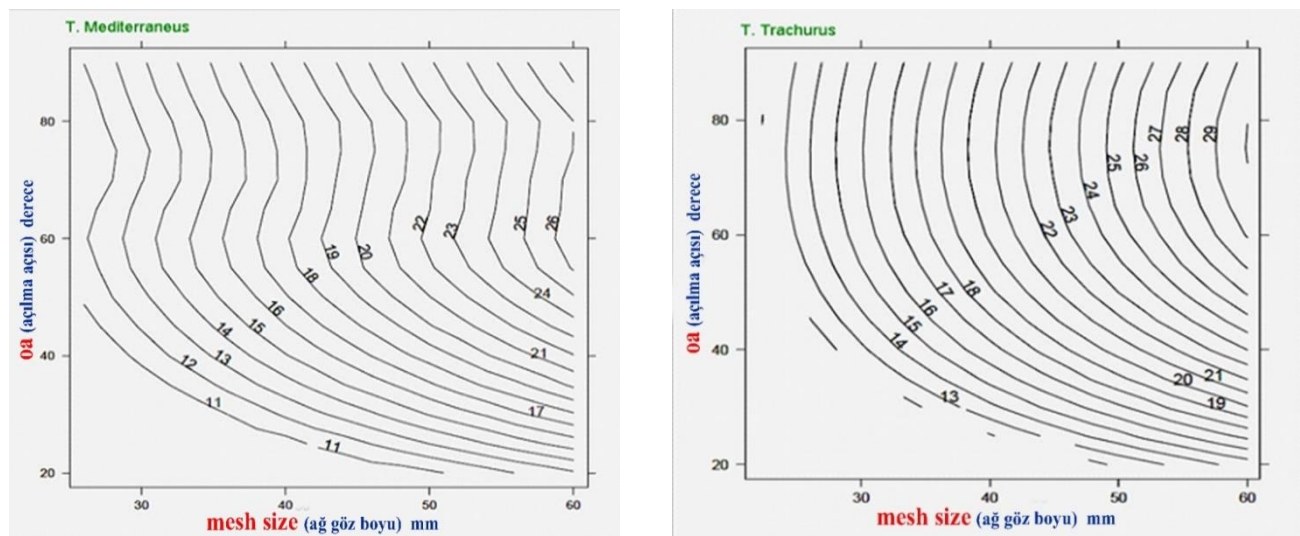


Figure 7. Selectivity isobar graphics of *T. trachurus* and *T. mediterraneus* species

According to the Turkish Commercial Fisheries Regulations No: 3/1, minimum landing size of horse mackerel species is 13 cm. Corresponding to this 13 cm MLS mean L50 values of *Trachurus trachurus* and *Trachurus mediterraneus* species were again calculated by these design guides as seen in Table 1.

Table 1. Selectivity values (L50 and SR) corresponding to the minimum landing size of two different horse mackerel species

<i>Trachurus trachurus</i>				<i>Trachurus mediterraneus</i>			
Mesh size (mm)	OA	L50 (cm)	SR	Mesh size (mm)	OA	L50 (cm)	SR
26	55	13,15	0,56	30	55	13,34	0,60
30	45	13,73	0,57	34	45	13,61	0,61
34	35	13,19	0,55	36	40	13,42	0,61
38	30	13,11	0,57	40	35	13,61	0,68
40	30	13,76	0,61	44	30	13,30	0,67
44	25	13,03	0,57	46	30	13,86	0,70
46	25	13,59	0,55	50	25	13,02	0,71
54	20	13,12	0,55	52	25	13,49	0,73

Özdemir et al. (2006) studied with gill nets which have 36 mm mesh size and found L50 values as a 15.46 and 15.67 cm for the horse mackerel species. In our study, the L50 which corresponds to the 36 mm mesh size is given in the table below. When the results are compared with our values which have been determined FISHSELECT methodology, it is seen that our values are quite well agree with the previous experimental values. The selectivity values and cross-sections of the both of horse mackerels species examined in this study were found to be close to each other. This study was carried out following to the method of Herrmann et al., (2009), Frandsen et al., 2010 and Tokaç et al., 2012.

As a result of the selectivity simulation using the FISHSELECT software, the selectivity isobar graphs enable it to be performed at a less cost in the laboratory and office instead of costly sea trials, which require a lot of sea work and individual measurement and are difficult to achieve.

After anchovy (*Engraulis encrasicolus*), horse mackerel (*Trachurus mediterraneus*) is in the second importance row among commercial fishes caught in the waters of Turkey. Therefore there is a need to implement responsible fishing techniques on the horse mackerel stocks for the sustainable fishing of these species.

Acknowledgements

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Blood Cells in Fish as Biomarker for Early-Warning Tool for the Environmental Pollutants

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Abstract: The aquatic environment is generally the end-recipient of most toxic substances provoked directly or indirectly by the anthropogenic activities. The productivity of the aquatic organisms is declining due to poisoning of these organisms, thus, resulting in a serious problems of natural ecosystems and threatening the aquatic biodiversity. New trends in the adverse impacts on freshwater ecosystems are related to their complexity making impossible analysis and predictions of bio-risks basing on chemical analysis. Multi-component mixtures of pollutants can provoke a deleterious effect even in low concentration of the individual pollutant. Investigation of the effects of toxicants of aquatic organisms requires a multi-disciplinary approach including on-site environmental investigation of inputs and toxicology. Most ecotoxicological studies and chemicals regulation focus on hazard and exposure assessment of individual substances only, the problem of complex adverse effect in the environment is neglected to a large extent. The absence of environmental realism is clear in the current methods of assessment. The knowledge on using the concepts as tools for the predictive complex adverse effect assessment is insufficient. This gap seriously hampers the application of scientific approaches in fishery. Fish blood cells represents a suitable biomarker of environmental health and provides a tool for biomonitoring water quality. Hematological biomarkers has the advantage of specialty for potential widespread use in early warning. Particularly, differential leucocyte counts have a number of features that make them useful sentinels for biomonitoring of water quality; the persistence of a stress condition may lead to the suppression of the leukopoietic centers, disrupting the leucopoiesis. Decrease in erythrocyte counts, haemoglobin concentration and hematocrit ratio, and increased thrombocytes, nuclear abnormalities in erythrocytes and increased frequency of micronuclei, lobed and bi-nucleated cells can represent the environmental problems. With precise interpretation, fish blood cells have the potential as early-warning biomarker for environmental pollution surveillance and can be integrated to the ecological studies. These results indicate that blood cells, especially erythrocytes, are sensitive to waterborne toxic agents, and their morphological changes may be an indicator of physiological disturbances, including heavy metal intoxication.

1. INTRODUCTION

Environmental pollution has known for centuries but only started to be important following the industrial revolution in the 19th century. Environmental pollution occurs when the natural environment cannot destroy an element without creating harm or damage to itself. Pollution is paid attention when nature can not decompose an element that has been brought to it in an unnatural way. Water pollution including marine/ocean pollution seems one of the most problematic environmental pollution categories. It is widely known that over 80% of marine pollution comes from land based activities. The pollution in aquatic environment can be resulted from oil spills, fertilizers, sewage disposal or toxic chemicals, in general. More specifically, Wilhelmsson et al (2013) reported that marine environment collects the contaminants that comes in many different forms, such as toxic chemicals (e.g., organic compounds, DDT, PCB, metals, pharmaceuticals, gas), solid waste (e.g., plastics), increased nutrient (e.g., nitrates and phosphates) and sediment inputs due to human activities (e.g., industry, agriculture, deforestation, sewage discharge, aquaculture), radioactivity, oil spills, and discarded fishing nets. Aquatic organisms are subjected to a different kind of pollutants due to human activities. When a toxic compound enters an ecosystem, it can lead to a number of alterations at different levels of structural complexity, ranging from molecular damage to modifications at the level of organisms, populations or communities (Colica et al 2017).

Depledge (1994) described the term of biomarker as “biochemical, cellular, physiological or behavioural alteration that can be measured in tissue or body fluid samples, or at the level of whole organisms, to provide evidence of exposure and/or effects from one or more contaminants. Assessing early changes in the health status of the organisms is possible by means of biomarkers thus the biomarkers are useful tools in detecting the environmental pollution and its effects on the organisms including aquatic organisms (Schettino et al 2012). The blood parameters in fish are considered suitable biomarkers for detecting fish health. Linking with this fact the blood parameters are taken into consideration as the biomarker for detecting the environmental pollution in aquatic environment. Witeska (2004) reported that blood cells, particularly erythrocytes, are sensitive to waterborne toxic agents, and their morphological changes may be an indicator of physiological disturbances, including heavy metal intoxication.

The Blood Cells Use in Fish to Detect Environmental Use

The blood cells in teleost fish are erythrocytes (red blood cells), leukocytes (white blood cells) and thrombocytes (platelets) as presented in Fig 1.

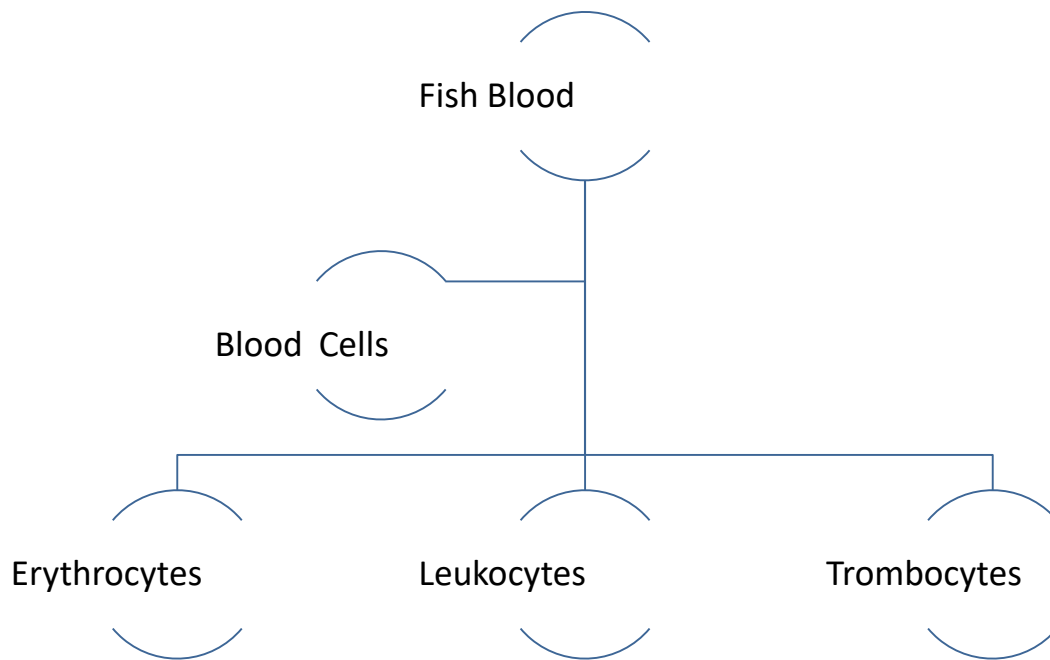


Fig 1. Fish blood cells

The blood elements respond the aquatic pollution. The fish blood cells as a biomarker can be used in assessing environmental pollution in various indicators such as hematocrit change, leucocytes ratio, the morphological change of the cell (Fig 2). Thus, it is possible to detect the aquatic pollution by using the blood cells characteristics.

The potential biomarkers in fish blood to assess the environmental pollution

Related with Red blood cells

Hematocrit value (decrease or increase)
Hemoglobin value(decrease or increase)
Erythrocytes count(decrease or increase)
MHCH (decrease or increase)
Erythrocyte morphology (swelling, cell wall change etc)
Erythrocyte and its nuclei anomaly (such as nucleus fragmentation, etc)

Related with white blood cells

Leukocyte count (decrease or increase)
The ratio of differential leukocytes (neutrophil, monocyte, lymphocyte, eosinophil)

Related with Platelets

Trombocytes count(decrease or increase)
Trombocyte morphology
Coagulation characteristics
Clot formation and its duration

Fig 2. Potential blood cells biomarkers in fish

The blood cells in teleost fish can provide a suitable biomarker of environmental conditions. However, to evaluate the blood cells as biomarker in fish the normal range and the morphology should be known. The variation in blood cells, particularly for their counts is possible; thus, it is necessary to know the normal ranges of blood cell counts. The morphology of the cells can provide more clear results in detecting the aquatic pollution and its effects on the organisms. It should be emphasized that blood cells can be a useful tool in early warning of the aquatic pollution. The reflection of pollution in fish organisms can be detected rapidly.

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Direct Analyze of Different Grids Effects on Shrimp Trawl Selectivity; an Experimental Assessment with a Flow Channel

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Abstract: Shrimp trawl fishery has an essential topic for fisheries management with characterized by low selectivity ratio. Trawl fishery is an intensive fishery method especially for shrimp species with high economic value. Different sorting grid methods are widely used in the world to increase shrimp trawl selectivity. In this study, sorting grid model, bar spacing and sorting grid angle were investigated experimentally for shrimp trawl fishery in the Iskenderun Bay. For this purpose, *Metapenaeus monoceros* individuals, provided live from nature, were used. These individuals were stocked in the Fish Behaviour Laboratory of Iskenderun Technical University. After, selectivity simulation experiments were conducted in this laboratory discharge from the open channel formed by a flow. In each bar spacing, about 10 replicate experiments were made with about 20 individuals. In the experiments, individuals, which can go behind the sorting grid, were named as selected catch, individuals, which accumulate on sorting grid, were named as escaped catch and individuals, which are at the bottom of the sorting grid, were named as unselected catch. The values were directly evaluated in a ratio proportional manner. These selectivity experiments conducted in the laboratory environment were applied for the first time and provide useful data for fisheries management.

Keywords: Shrimp trawl fishery, grid selectivity, flow channel

1.INTRODUCTION

Shrimp trawl fishing has been characterized by low selectivity and high discard rates all over the world (Boopendranath, et al., 2008; Aydın et al., 2008; Zhou et al., 2010; Stepputtis, et al., 2016). Studies of in the subject have leads to reducing the negative impact of this fishery on other marine organism (Lutcavage, et al., 2017). In this direction, the removal of organisms that should not be taken for various reasons during the shrimp trawl fishing (e.g. juveniles, threaten species). In some cases, species and size selectivity have been the most important aspect of shrimp trawling (Gallaway; 2017).

In shrimp trawl selectivity studies different grid systems have been tested for many years and even become legal requirement in some regions. This requirement is especially valid for shrimp trawl fishing in coastal areas. Turkey and especially the Iskenderun Bay is a fishing area, these coastal shrimp species and their trawl fisheries has intense. Experiments were conducted on the use of grids in shrimp trawl fishing in this area, which are nordmore grid systems and turtle separators in commercial fishing (TED) (Atabey and Taşkavak, 2001; Lutcavage et al., 2017).

The selectivity of grid trials have laborious and costly studies as they are in all selectivity studies in trawling because these studies has required intensive study in the sea. Although this research could not be an alternative to the commercial trawl selectivity studies, a mechanism that would give the idea of controlled preliminary experiments using live shrimp individuals.

2.MATERIALS AND METHODS

The live speckled shrimp (*Metapenaeus monoceros*) individuals caught alive from nature. The shrimp caught with trawling fish from the habitat were exposed to live sampling as a live channel. In these experiments, 120 shrimp individuals were used alive, but the dead individuals were removed during hauling trials.

This flow channel has filled with sea water, the water flow, is a maximum of 1.3 meters/second, has constituted by an electric motor and a gear connected. In a very short time, the live shrimps have selected in the grid placed in this channel, which can be of different material, openness, thickness and angle. The selectivity tests were made by made of plastic composite materials, at two different bar openings (2 cm and 2.4 cm) and 45 degrees (Figure 1).



Figure 1. Experiments on shrimp trawl selectivity in the flow channel

As a result of these experiments, 3 results were obtained in the cohorts; (1) selected; passing of grid open (2) escape; not passing and being directed towards the upper part of the water and finally (3) unselected; on the grid. After these experiments, which were made by ten repeats on both grid bar openings, carapace length of shrimp was measured for belonging to each group with a digital caliper. In three groups, average carapace length and ratio of number were taken into account while comparing the results of the two bar opening size.

3.RESULTS AND DISCUSSION

Grid selectivity results from 125 live speckled shrimp (*Metapenaeus monoceros*) were given by the flow channel in Table 1 and 2. In these tables, two outcomes with the individual percentages and the average carapax length were given in three groups by all hauling. When these tables were examined, it was obvious that the percentage of the increase of the grid bar opening sizes. These values were 55.42% in the 2 cm opening size of grid bar and 69.40 % in the 2.4 cm. However, in these result of carapax length were not obtained as expected. Because the sizes of the shrimps used in the experiments were very close to each other, more importantly, the small size shrimp individuals used in the 2.4 cm bar range than the other.

Table 1. The selectivity results obtained in the 2 cm grid bar opening in the flow channel for shrimp (CL: carapax length for shrimp PR; percentage ratio of number shrimp)

Hauling	Unselected		Escape		Selected	
	CL (mm)	PR	CL (mm)	PR	CL (mm)	PR
1	29.01	22.64	26.85	24.53	25.85	52.83
2	26.40	20.41	26.87	30.61	26.08	48.98
3	26.14	28.07	26.63	22.81	25.50	49.12
4	26.78	25.93	26.61	22.42	26.53	51.85
5	27.63	22.42	27.45	18.52	26.83	59.26
6	27.60	25.93	25.94	11.11	27.70	62.96
7	27.76	18.52	28.47	7.41	26.83	74.07
8	28.31	31.82	26.89	9.09	26.11	59.09
9	29.22	33.33	30.45	9.52	28.11	57.14
10	28.13	55.56	26.10	5.56	29.59	38.89
Means	27.70	28.44	27.23	16.14	26.91	55.42

It could be said that the preliminary experiment with the flow channel in the grid selectivity studies for the shrimp's trawl fishery can be beneficial in reaching the purpose, despite these research mistakes. In the study, meaningful results were

obtained in all three groups it was clearly found that the increase in grid bar spacing positively affects the selectivity (Aydın et al., 2008).

Table 2. The selectivity results obtained in the 2.4 cm grid bar opening in the flow channel for shrimp (CL: carapax length for shrimp PR; percentage ratio of number shrimp)

Hauling	Unselected		Escape		Selected	
	CL (mm)	PR	CL (mm)	PR	CL (mm)	PR
1	24.93	6.45	27.23	6.45	27.09	87.10
2	27.79	15.63	26.14	15.63	26.06	68.75
3	25.00	18.75	25.62	18.75	25.65	62.50
4	25.12	18.75	25.15	15.63	25.45	65.63
5	24.87	21.88	26.00	15.63	25.54	62.50
6	22.45	26.67	22.48	13.33	22.30	60.00
7	24.62	9.38	25.95	9.38	25.02	81.25
8	25.40	9.38	25.60	9.38	24.84	81.25
9	24.77	9.38	26.51	21.88	25.57	68.75
10	25.25	31.25	24.24	12.50	25.26	56.25
Means	25.27	16.75	25.80	13.85	25.57	69.40

The greatest contribution of pre-empting in the flow channel has observes possibilities that the sight provides, which will give the researcher many ideas for sea trial in the trawl selectivity. It has important that for the assessable mathematical results, the shrimp individuals to be used in the selectivity tests can be separated special size distributions in the targeted intervals.

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Seasonal Determination of Heavy Metal Levels in Some Economically Important Fish Species Captured from Western Black Sea Region

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Abstract: In this study, seasonal accumulation of manganese (Mn), cadmium (Cd), zinc (Zn), copper (Cu), iron (Fe), nickel (Ni) and lead (Pb) heavy metal levels were evaluated in *Engraulis encrasicolus*, *Pomatomus saltatrix*, *Sarda sarda* and *Merlangius euxmus* fish species caught from Sinop, Kastamonu and Zonguldak coastlines. Sampling was carried out for a year from December 2016 to December 2017. 25-30 Numbers of fish samples from each species were caught with proper fishing gears and transported to the laboratory. Minimum of 5 grams of muscle tissue were obtained from every fish. Heavy metal contents of samples were evaluated by reading values in ICP/MS spectrophotometer (Inductively Couple Plasma spectrophotometer) after samples treated with nitric acid-hydrogen peroxide (2:3) in 3 different steps under 40 bar pressure resistant wet decomposition unit. According to results of the present study all of the heavy metals have shown seasonal variation. Differences between stations were statistically significant. In general terms heavy metal levels measured from edible muscle of fish were in the appropriate limits determined by Turkish Food Codex, World Health Organization and European Union with the exception of Pb and Zn. As a result, hazardous heavy metal levels for human health were not established from four widely consumed fish species caught from Western Black Sea Region.

Keywords: Heavy metal, *Engraulis encrasicolus*, *Pomatomus saltatrix*, *Sarda sarda*, *Merlangius euxmus*, Kastamonu, Sinop, Zonguldak

1.INTRODUCTION

Heavy metal pollution in the marine environment is a problem of a wide interest at global level the character of semi-enclosed sea, the huge hydrographical basin and its hydrobiological features make the Black Sea a unique ecosystem, sensitive and exposed to these threats, Black Sea ecosystems are destroyed due to chemical pollution. Many factories but also coastal activities contribute to this phenomenon of major pollution. Many pollutants come from large rivers, phenomenon of major pollution. Many factories discharge wastewater with various degrees of treatment directly into the sea. Landlocked countries try to protect the marine ecosystem as much as possible and developed international laws to protect environment was a major concern because they pose a potential risk to flora and fauna species including humans through the food chain (Boran and Altınok, 2010; Jitar et al., 2013). The aims of this study were to identify effects of heavy metals on western Black Sea ecosystems and comparison of heavy metals in economically important fish species in Sinop, Kastamonu and Zonguldak.

2.MATERIALS AND METHODS

In this study we have collected samples from three stations of the western black sea coast distributed on Sinop, Kastamonu and Zonguldak (Figure 1).

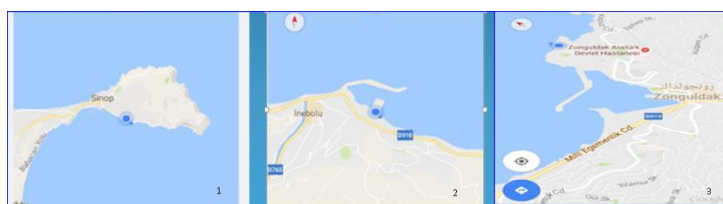


Figure 1. Sampling locations (1.Sinop, 2.Kastamonu, 3.Zonguldak)

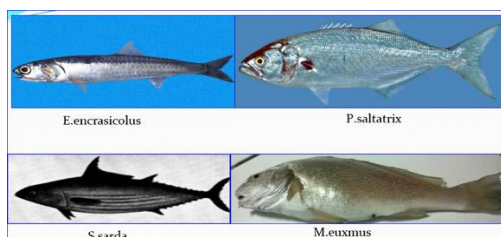


Figure 2. Fish species used in the study

At least ten fish from each species were caught in the Autumn winter Spring and summer seasons of 2016 /2017, then Fish samples were transported to the laboratory in a thermos flask with ice on the same day (Yılmaz et al., 2007). All samples were cut approximately 5 g samples of muscle (edible parts), from each fish. The tissue samples with deionized water, weighed and stored at -20 ° C in polyethylene bags, then samples were dried by the drying device under the temperature of 100° C, after that, all samples were analyzed three times for Cd, Cu, Fe, Mn, Ni, Pb, Zn by ICP/OES Optima 2010-Perkin Elmer which is a fast-multi-element technique (Zhang et al., 2007).

3.RESULTS AND DISCUSSION

Table.1. Concentrations of heavy metals in fish muscles (PPM)

Stations	Species	Seasons	Cu	Zn	Ni	Fe	Mn	Pb	Cd
Sinop	<i>Engraulis encrasicolus</i>	Autumn	16,0±0,49	123,4±1,02	2,3±0,46	275,4±2,35	0,2±0,12	5,6±1,32	0,3±0,03
		Winter	1,10±0,72	741,3±6,62	5,1±0,05	1392,0±17,61	58,1±0,44	0,8±0,09	0,7±0,02
		Spring	3,70±0,69	561,8±1,96	30,±0,06	812,7±2,46	42,6±0,02	5,5±0,19	2,8±0,05
		Summer	12,2±1,27	697,4±5,52	1,2±0,36	1297,4±10,47	110,7±0,97	0,5±0,94	1,2±0,01
	<i>Pomatomus saltatrix</i>	Autumn	7,30±0,36	221,1±0,79	3,8±0,07	210,7±0,29	1,2±0,02	6,7±0,19	0,2±0,02
		Winter	26,3±0,97	262,4±0,33	3,9±2,73	372,3±7,31	11,1±0,05	0,1±0,34	0,3±0,01
		Spring	26,9±0,73	707,3±0,28	3,0±0,06	432,8±0,46	13±0,04	0,9±0,18	0,3±0,01
		Summer	38,7±0,16	348,2±0,80	0,7±0,17	931,2±1,70	18,2±0,06	1,3±0,58	0,7±0,01
	<i>Sarda sarda</i>	Autumn	15,0±0,71	121,7±0,66	3,7±0,37	185,8±0,58	4,0±0,05	3,5±0,79	0,3±0,02
		Winter	32,2±1,38	125,1±0,34	2,1±0,12	350,5±0,80	1,0±0,03	2,4±0,11	0,9±0,03
		Spring	35,3±1,27	135,4±0,37	0,8±0,08	248,6±0,21	24,2±0,01	6,2±0,10	0,3±0,01
		Summer	18,6±0,87	473,5±0,46	1,1±0,12	655,3±2,01	34,3±0,17	1,1±0,17	0,3±0,00
	<i>Merlangius euxmus</i>	Autumn	15,2±0,57	117,3±0,67	21,3±0,61	200,8±0,98	1,9±0,008	1,9±0,37	0,3±0,02
		Winter	30,4±0,21	274,5±1,04	0,4±0,17	255,1±1,12	31,0±0,08	0,4±0,12	0,3±0,02
		Spring	38,7±1,01	257,9±1,93	3,5±0,09	190,3±1,16	27,5±0,22	3,6±0,30	0,3±0,02
		Summer	38,3±0,79	284,2±1,02	2,7±0,04	252,9±0,98	32,7±0,11	0,2±0,28	0,4±0,03
Kastamonu	<i>Engraulis encrasicolus</i>	Autumn	9,5±0,54	156,7±2,37	2,0±0,21	244,4±3,28	0,2±0,10	5,0±0,99	0,3±0,03
		Winter	8,1±0,65	538,3±4,69	0,9±0,08	1188,5±13,0	72,8±0,76	3,3±0,13	1,5±0,01
		Spring	2,1±1,20	774,4±3,38	1,9±0,11	910,3±4,06	83,4±0,43	0,2±0,25	1,4±0,01
		Summer	15,4±0,63	1417,7±4,5	1,1±0,10	1203,0±4,95	68,1±0,35	3,0±0,47	3,3±0,03
	<i>Pomatomus saltatrix</i>	Autumn	14,3±0,80	224,5±0,02	2,0±0,19	368,2±0,69	11,5±0,02	2,3±0,46	0,6±0,00
		Winter	16,9±0,54	551,5±5,58	1,5±0,45	326,3±4,16	6,1±0,09	0,9±1,35	0,3±0,01
		Spring	33,8±1,26	118,1±0,47	1,9±0,03	175,8±0,80	0,2±0,08	3,3±0,27	0,5±0,02
		Summer	42,7±1,16	210,0±0,87	3,3±0,10	246,8±1,78	19,3±0,14	5,0±0,29	0,3±0,01
	<i>Sarda sarda</i>	Autumn	17,9±0,06	118,3±0,65	1,5±0,04	267,0±6,61	0,6±0,05	1,1±0,46	0,3±0,03
		Winter	31,2±1,05	196,6±1,87	1,2±0,16	799,9±8,68	1,1±0,08	1,4±0,14	1,8±0,02
		Spring	13,0±0,80	469,2±1,97	2,3±0,06	4362,9±31,61	7,0±0,02	2,4±0,43	4,0±0,09
		Summer	34,0±0,67	142,1±0,96	4,0±0,26	300,0±1,59	0,2±0,03	4,5±1,07	0,4±0,02
	<i>Merlangius euxmus</i>	Autumn	19,7±1,03	249,0±2,60	5,7±0,26	256,1±1,62	24,1±0,27	4,4±1,15	0,3±0,02
		Winter	26,1±0,66	355,2±1,24	0,7±0,09	367,4±2,50	37,0±0,10	1,7±0,21	0,3±0,04
		Spring	28,7±1,99	290,5±2,23	0,9±0,26	518,0±1,84	28,5±0,20	1,6±0,63	0,3±0,02
		Summer	40,8±0,64	253,1±0,97	2,5±0,02	219,8±0,85	22,5±0,03	4,5±0,25	0,3±0,01
Zonguldak	<i>Engraulis encrasicolus</i>	Autumn	5,9±1,00	411,1±0,55	2,3±0,11	563,3±1,82	19,2±0,05	1,5±0,45	0,7±0,03
		Winter	11,3±2,30	487,8±3,90	0,7±0,43	670,0±3,08	34,9±0,31	1,1±1,39	0,7±0,03
		Spring	8,7±0,14	1013,1±3,18	1,8±0,07	865,9±1,38	143,0±0,21	4,8±0,03	1,1±0,03
		Summer	35,7±0,66	360,0±0,58	1,1±0,03	366,9±1,02	14,2±0,11	3,1±0,34	1,1±0,05
	<i>Pomatomus saltatrix</i>	Autumn	34,1±0,91	224,9±0,62	0,4±0,12	178,5±0,71	0,1±0,06	0,8±0,20	0,3±0,02
		Winter	12,1±0,13	241,7±0,47	2,0±0,16	474,6±3,40	10,7±0,07	0,7±0,47	0,3±0,03
		Spring	29,8±0,82	369,5±1,72	4,5±0,10	439,6±1,00	6,9±0,06	6,3±0,49	0,3±0,02
		Summer	31,3±0,83	81,0±0,21	3,0±0,14	302,5±0,55	2,0±0,02	7,5±0,36	0,3±0,01
	<i>Sarda sarda</i>	Autumn	46,1±0,23	195,0±0,49	1,7±0,06	979,7±4,41	2,7±0,02	0,3±0,28	0,2±0,03
		Winter	32,8±1,13	106,5±0,43	1,5±0,07	444,0±2,87	3,0±0,10	3,5±0,31	0,5±0,04
		Spring	46,0±0,51	117,5±0,12	4,6±0,12	220,7±0,70	6,2±0,05	9,0±0,17	0,2±0,00
		Summer	31,1±0,31	291,2±1,23	3,1±0,09	348,6±1,45	0,8±0,04	5,3±0,17	0,3±0,01
	<i>Merlangius euxmus</i>	Autumn	25,5±0,38	243,4±1,38	1,2±0,11	463,4±3,75	4,6±0,02	0,9±0,49	0,2±0,04
		Winter	25,2±0,15	366,4±1,18	1,3±0,09	400,0±1,63	65,2±0,23	1,3±0,29	0,3±0,02
		Spring	31,8±0,60	331,7±0,32	1,8±0,05	275,8±0,99	48,9±0,12	0,8±0,11	0,2±0,01
		Summer	40,0±0,79	184,8±2,21	3,0±0,10	187,1±3,53	26,1±0,27	4,0±0,03	0,3±0,02

This study has shown Cd concentrations were the lowest in most samples also Fe concentrations were the highest in all samples, the average metal concentrations in muscles decreased in the following order: Fe>Zn> Cu> Pb> Ni> Mn> Cd, Moreover there was some variability in the metal concentrations measured the same samples obtained from three different stations. The metal concentrations of muscle tissues in all species were higher during summer, the reason of this could be spring rains or rivers that carry chemical pollutants to the sea. However, evaluated heavy metal levels from edible muscle of fish were within the safe limits determined by Turkish Food Codex, World Health Organization and European Union except Pb and Zn. In conclusion, heavy metal levels in four widely consumed fish species caught from Western Black Sea region were determined not to be hazardous for human health.

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Variation of Seedling Morphogenetic in Mediterranean Hackberry (*Celtis australis* L.) Provenances

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Abstract: *Celtis* is a taxon that is used for many purposes such as fodder, fuel, medicine, fibre, timber in forest land and around agricultural fields. The genus plays a vital role in socioeconomic structure of people by supplying highly palatable, nutritious and tannin-free green fodder particularly during the period of scarcity of green fodder to livestock. Therefore; in this study it was focused on Mediterranean hackberry (*Celtis australis* L.). This study was carried out on 2+0 bare root seedlings of Mediterranean hackberry which was an one of the most important species of Turkish flora to determine morphological variations among seven provenances of the species based on seedling height, root-collar diameter, fresh/dry weights of stem and root. Large and significant differences ($0.05 > p$) among provenances and within provenance were found for seedling morphogenetic parameters based on results of variance analysis, and collected data. Sinop-Duragan provenance showed better growth performance than other provenances. It is possible that the variation in morphological characters between provenances is due to resource availability at the time of fruiting and so to seed size.

Keywords: *Celtis*, Height, diameter, seedling, nursery, quality, provenances.

1.INTRODUCTION

Our country, which has different ecological conditions, is home to a large number of forest tree species in terms of natural distribution. According to figures obtained from recent statistical research on this subject it is located close to 12.000 species of plants in Turkey, which is endemic species of plants and more than 3.000 qualifications (Avcı, 2005). Our country, which has an area of 22.2 million hectares in particular, is home to a large number of forest trees forming forests of pure and mixed stalagmites. These forest trees, which are evaluated as native and secondary species, have a wide range of usage both in raw material sense and functional sense due to their different characteristics. Mediterranean Hackberry (*Celtis australis* L.) is one of the species found in the stands of the Tali species and mixed with mostly leafy species. Mediterranean Hackberry is an important species in terms of rural development. It is a very valuable species especially in the case of harsh winters and green fodder. The wood is durable and elastic. It is a durable species. It is preferred because of its decorative feature in landscape arrangements. It is especially suitable for live fence construction. Fruits are consumed by many bird species because of their meaty and juicy content. In the fields of medicine and cosmetics, the materials obtained from fruits, leaves, seeds and chewing gum are widely used (Yaltırık, 1998; Yücedağ and Gültekin, 2008). In this study; Mediterranean Hackberry (*Celtis australis* L.), which has a wide use potential in agriculture, forestry, arid zone and roadside afforestation, is aimed to determine the variations between the morphogenetic properties of the seedlings produced from the seeds collected from different origins.

2.MATERIALS AND METHODS

The research was conducted in open-air conditions at Gökçeşey Forest Nursery on 10 March 2016. The parcels in which the seeds are made are also sandy-clay-clay in soil textures. The soil pH value is 7,12, the nitrogen amount is 3,76 kg da⁻¹, phosphorus is 3,45 kg da⁻¹ and potassium is 59,2 kg da⁻¹. The structural structure of the soil has a crumbly structure and the food and water exchange is high. The average annual precipitation is 915 mm, average annual temperature is 18.7°C, mean relative humidity is 70% and vegetation period is 6 months (Anon., 2017).

In the study, necessary measurements and determinations were made on the seedlings grown from seeds collected from 4 different Mediterranean Hackberry provenances. In this context, descriptive information about the provenances used in the research are given in Table 1.

Table 1. Mediterranean Hackberry Provenances Used in Research

Provenances	Altitude (m)	Aspect
Sinop-Durağan	925	NW
Antalya-Kemer	850	N
Samsun-Vezirköprü	820	N
Balıkesir-Burhaniye	760	NE

Mediterranean Hackberry seeds have germination inhibition (Ürgenç, 1998; Tardio et al., 2006). For this reason, the seeds were first stored in the refrigerator at + 4°C temperature. Then the seeds to be folded were allowed to stand at room

temperature (+20°C) in warm water for 2 days to provide swelling. The swollen seeds were taken to cold-wet folding in 10x20 cm sized and perlite-containing cups and in cold air storage (+ 4°C) for 45 days. Seeds taken from the folds were planted in 4 replicates on March 10, 2016 in accordance with the random block experimental desing. The sowing was carried out by a line squeezing method at a depth of 8 mm. Each 50 cm x 2 cm line drawn on the October parcels was accepted as parcels. Each origin was represented by 120 seeds in each replicate. 2 + 0 elderly and nude rooted seedlings belonging to different origins have determined their height, root collar diameter, stem and root fresh weights.

One way ANOVA and Duncan test were used to determine the morpho-genetic differences between the sources in Statistical Analyzes. For this purpose, SPSS package program was used.

3.RESULTS AND DISCUSSION

Results

As a result of measurements made on 2 + 0 age seedlings belonging to different Mediterranean Hackberry provenances, it was determined that the average length of the seedlings changed between 26,4-53,2 cm. As a result of the analysis of variance applied to these values, it was determined that there was a significant difference between the origin and the origin at the $P < 0.05$ confidence level, and it was found that 4 different groups were formed as Duncan test at $P < 0.05$ confidence level and that Sinop-Durağan by Antalya-Kemer, Samsun-Vezirköprü and Balıkesir-Burhaniye provenances, respectively (Figure 1).

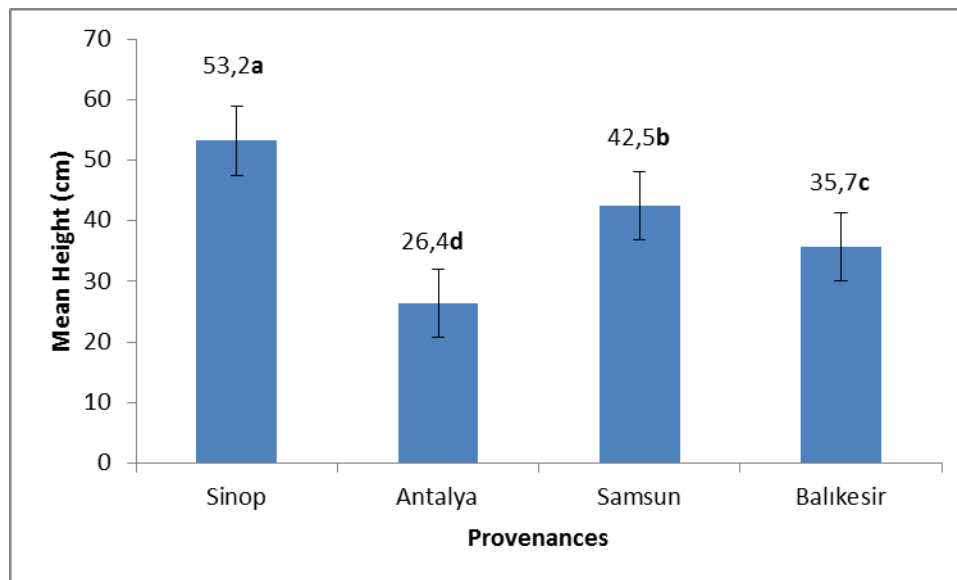


Figure 1. Results of ANOVA and Duncan Range Test of Mean Seedling Height.

The root collar diameter of the different origins was also measured in the study. As a result of the measurements, it was determined that the average root collar diameter changed between 12.2-5.1 mm. As a result of the analysis of variance, it was determined that there is a statistical difference in the confidence level of $P < 0.05$ among the fictitious origins. In this respect, it was determined that 3 different homogeneous groups emerged as a result of Duncan test performed at $P < 0.05$ confidence level. According to this, the origin of Sinop-Durağan provenance in the first group was determined as the best origin due to the root-throat diameter development, while the origin of the weakest development was determined as the Antalya-Kemer provenance in the last group (Figure 2).

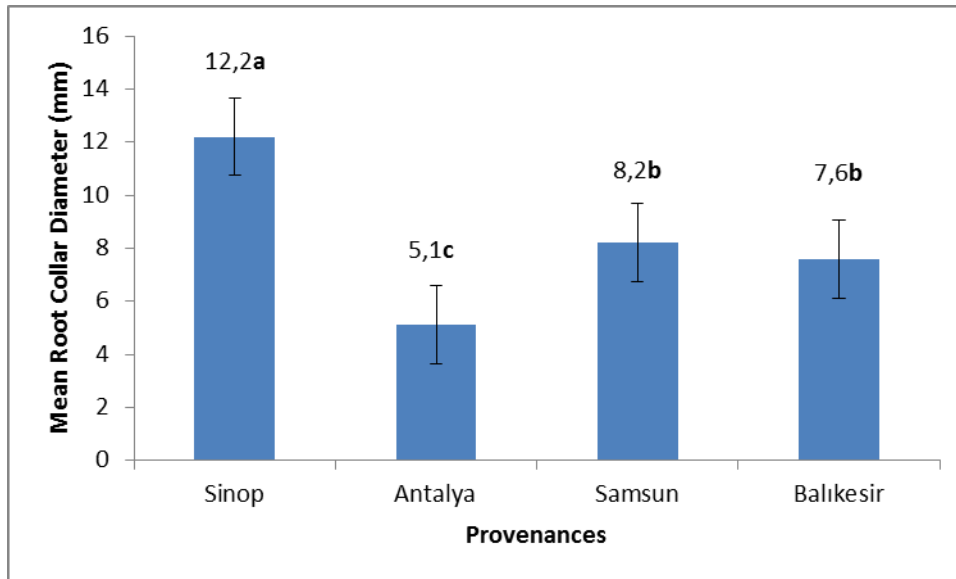


Figure 2. Results of ANOVA and Duncan Range Test of Mean Seedling Root Collar Diameter.

The fresh weight of the seedling root was also measured in the study. According to this, it was determined that the root fresh weight of the seedlings in which the measurements were made varied between 3.2-6.3g. As a result of the one-way analysis of variance, it was determined that there was a significant difference in root fresh weight change among origin at $P < 0.05$ confidence level. As a result of this Duncan Range test, 3 different homogeneous groups were detected between the origins. According to this, while the Sinop-Durağan provenance was in the first group and showed the highest weight value, Antalya-Kemer provenance was in the last group with the lowest weight value (Figure 3).

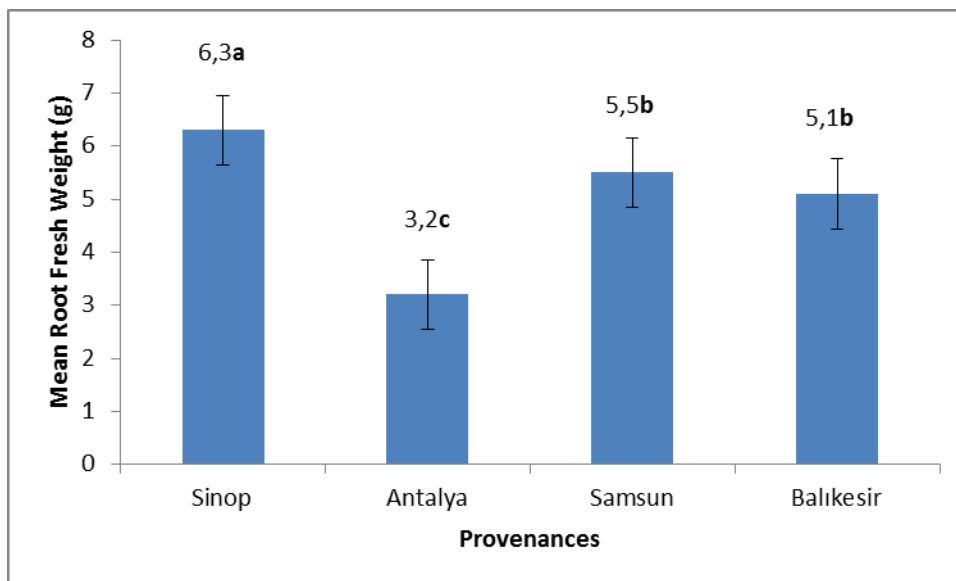


Figure 3. Results of ANOVA and Duncan Range Test of Mean Root Fresh Weight

The morphological character finally evaluated in the study is the fresh weight of the stem. It was determined that the average fresh weight of the seedlings changed between 5.2-8.2g. As a result of the applied variance analysis, it was found that there was a meaningful correlation between fresh body weight at $P < 0.05$ confidence level. As a result of the Duncan Range test applied in this direction, 3 different homogeneous groups with $P < 0.05$ confidence level were determined. According to this, as in the fresh weight of the stem, while the body has the highest weight value in the fresh weight, Sinop-Durağan provenance in the first group and Antalya-Kemer provenance in the last group in the lowest stem fresh weight value (Figure 4).

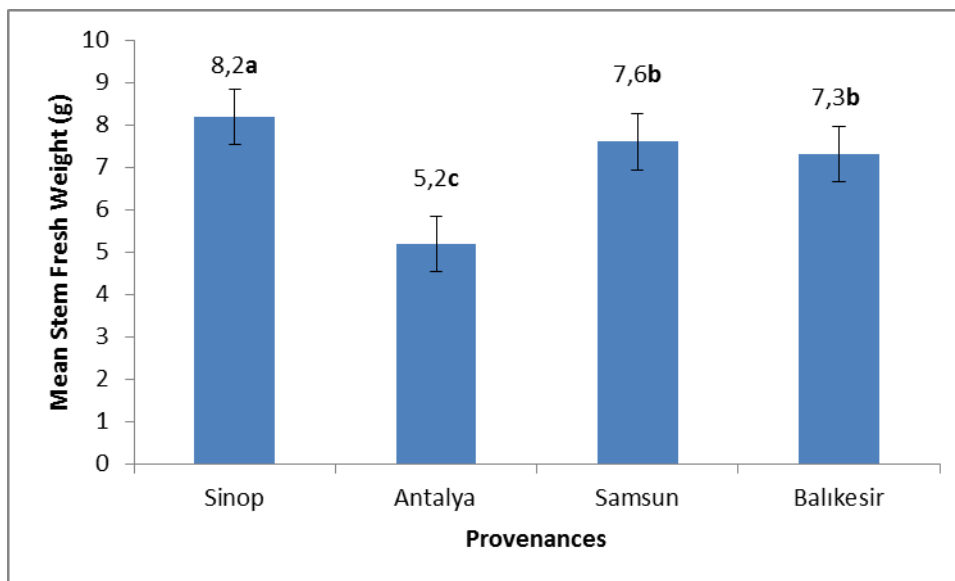


Figure 4. The Results of ANOVA and Duncan Range Test of Mean Stem Fresh Weight

Discussion

Some morphogenetic parameters in 2 + 0 elderly seedlings produced from 4 different origins (Table 1) of the hedgehog variety widely used in many functional special plantations, especially in arid zone plantations, which have a wide usage area in Gökçebey Forest Nursery, the variations arising from the direction of In this scope, fresh weight of stem, stem, diameter of stem, root and stem were measured. It was determined that the mean height growth values between the origins were changed between 26.4-53.2cm, the variance analysis and Duncan Range test results showed that the Sinop-Durağan provenance made the best height development according to the average sapling size (Figure 1). It has the Antalya-Kemer provenance as the lowest growth value in terms of average seedling growth (Figure 1). In another study conducted in similar age-old seedlings of the Mediterranean Hackberry species, it was determined that the average length of the seedlings varied between 18,9-55,4 cm (Carneiro et al., 2007). According to these values, it is possible to say that the height development of the hedgehogs examined in the survey is at a satisfactory level. The mean root throat diameter changes between 5,1-12,2 mm and the best development in the research area was determined by the Sinop-Durağan provenance (Figure. 2). In another study conducted on this subject, it was determined that the root-throat diameter changes in the 2 + 0 and 2 + 1 aged bare-rooted Mediterranean Hackberry were changed by 6.8-15.4 mm (Singh et al., 2006). It can be said that the development of the different provenances investigated in terms of root collar diameter growth is not sufficient in the evaluation made with different research results. Fresh root weight was also studied during the study. As a result of the investigations, it was determined that the average fresh root weight was changed between 3.2-6.3g (Figure 3). As it is in other morphological characters, while the first order was Sinop-Durağan provenance in terms of fresh root weight, the last group was Antalya-Kemer provenance. In the same type of study in India, the possibility of use of the hedgehog in agricultural forestry applications was investigated, but the mean value of the average fresh root weight of the seedling changed between 7.6-15.4g (Singh et al., 2006). The root fresh weight values of the seedlings obtained from 4 different origins in these evaluations and comparison direction were found to be low. The last morpho-genetic character studied in the study is the body fresh weight. As a result of the examinations, it was determined that the average body fresh weight was changed between 5.2-8.2 g and the best body was in Sinop-Durağan provenance for fresh body weight by taking the first group among the homogeneous groups formed by the Duncan Range test (Figure. 4).

In the light of findings and evaluations obtained from this survey, it was determined that Sinop-Durağan provenance originated from Western Black Sea Region in 4 different origins according to their morphogenetic characteristics in Gökçebey nursery conditions. According to these initial and preliminary results obtained in this context, it is considered that the use of Sinop-Durağan origin might be beneficial for the adaptation ability of mixed forests with artificial roads in the region and similar ecological conditions. However, it is not possible to come to a definite conclusion with these first year results obtained in this matter. For this reason, this study should be performed with a wider selection of origin for a longer time and more accurate results should be obtained. There must be genetic conservation studies and genetic resources for Mediterranean Hackberry. The continuity of the products obtained from this kind should be ensured. Care should be given to the cultivation of till seedlings and should be included in the foliage especially in mixed forest establishment studies. The durability of the drought must be investigated. It should be evaluated in Mediterranean Hackberry agroforestry studies.

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Global Warming and Eco-Friendly Strategies to Fight with the Pine Processionary Moth, *Thaumetopoea pityocampa*

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Abstract: Global warming is the current increase in temperature of the Earth's surface both land and water. Both land and oceans are warmer now than record-keeping began in 1880. Average temperatures around the world have risen by 0.75°C (1.4°F) over the last 100 years about two thirds of this increase has occurred since 1975. This global warming affects all living things including human and ecosystems. For example, a rise in the Earth's temperature could lead to an increase in the number of insects worldwide. Insects are among the groups of organism most likely to be affected by climate change because climate has a strong direct influence on their development, reproduction and survival. Moreover, insects have short generations times and high reproductive rates, so they can more like to respond quicker to climate change than long-lived other organisms, such as plants and vertebrates. *Thaumetopoea pityocampa*, also known as the pine processionary moth is an good example for this issue. *Thaumetopoea pityocampa*, is a model insect indicator of global warming. It has been reported that the northwards and upwards range expansion of this Mediterranean species being directly associated with the recent warming up. Scientists in order to get necessary precautions try to get knowledge about the future drivers of this moth expansion from Western Europe to Turkey and then other countries. As for the pest insects, the first come to mind is the chemical struggle. But it has long been known that this method affects not only the target harmful insect but also all living things in ecosystem, including man. For this reason, the use of eco-friendly methods of fighting the pine processionary moth is becoming widespread. The purpose of this study is to explain the eco-friendly fighting methods used against this pest in the Mediterranean Region and discuss their importance and effects.

Keywords: Global warming, Pine processionary moth, *Thaumetopoea pityocampa*, Eco-friendly strategies.

1. INTRODUCTION

Global warming is the current increase in temperature of the Earth's surface. Both land and oceans are warmer now than record-keeping began in 1880. Average temperatures around the World have risen by 0.75°C (1.4°F) over the last 100 years about two thirds of this increase has occurred since 1975. It has been reported that global average surface temperature has increased by around 0.6 °C during the past century and will continue to rise in the future. We have still many unknowns in our understanding of effects of climate change to biological systems. But there are many evidences that insects are good indicators as creatures that can adapt easily and quickly to current human-driven climate change (Walther, et al., 2002; Kharin, et al., 2018).

Insects with short generation times and high reproductive rates can more like to respond quicker to climate change than long-lived other organisms, such as plants and vertebrates (Logan, et al., 2003; Menéndez, 2007). *Thaumetopoea pityocampa*, also known as the pine processionary moth is an good example for this issue (Battisti, et al., 2005; Battisti, et al., 2006; Csóka, 2017). It is a model insect indicator of global warming. It is one of the most destructive species to pines and cedars in Central Asia, North Africa and the countries of southern Europe. The pine processionary (*Thaumetopoea pityocampa*) is a moth of the Notodontidae family, widespread in Eurasia and North Africa. They manifest themselves with cottony caterpillar pouches on pine trees. Caterpillars, usually fed at night, are located at the intersections of daytime. This insect is quite dangerous for the pine forests because it destroys green leaves of pine, thus compromising the life cycle. It is also harmful both for humans and some animals, because during the larval stage this insect has a hair that is particularly painful. The urticating hairs of the caterpillar larvae cause harmful reactions in humans and other mammals. The species is notable for the behaviour of its caterpillars, which overwinter in tent-like nests high in pine trees, and which process through the woods in nose-to-tail columns, protected. *Thaumetopoea pityocampa* (Den. and Schiff) is one of the most common defoliator insects found also in Turkey. There is an urgent need to control and minimize the damages caused by these defoliating caterpillars.

The purpose of this study is to explain the relationship between global warming and increase in number of this insect and some eco-friendly fighting methods used against this pest in the Mediterranean Region.

2. MATERIALS AND METHODS

In this study, the scientific studies that draw attention to the spread of this forest pest and the close relation between global warming have been examined and the possible worst results of the future have been pointed out. As a clear example of global warming's effects on biological systems and human beings, attention has generally been given to insects' response.

In this sense, the importance of developing the right ecology-friendly methods of combating pine processionary moth, an important forest pine pest, is emphasized.

3.RESULTS AND DISCUSSION

The pine processionary moth, *Thaumetopoea pityocampa* is also one of the most important forest pest in Turkey. The larvae of this pest feed on coniferous species, (*Pinus brutia*, *P. nigra*, *P. pinaster*, *P. pinea* and *Cedrus libani*) and cause decreasing the annual diameter increment of host trees. These insects can cause to tree mortality. Therefore, regular application of various control methods are required. The control methods involve in mechanical-physical, chemical, bio-technical and biological measures for *Thaumetopoea pityocampa* management.

There are many methods to fight with the Pine Processionary moth. In order to struggle this pest mainly two different ways have been applied: The chemical struggle that may causes an imbalance of the ecosystem and newly tested eco-friendly biological organic control methods (Colacci, et al., 2017). In this study, eco-friendly biological organic methods of fighting ecology will be emphasized by ignoring chemical reaction methods known as ecosystemic harmful side effects.

Scientist in order to get necessary precautions try to get knowledge about the future drivens of this moth expansion from western Europe to Turkey and then other countries. As for the pest insects, the first come to mind is the chemical struggle. But it has long been known that this method affects not only the target harmful insect but also all living things in ecosystem, including man. For this reason various eco-friendly fighting methods (natural control) have been developed (Mirchev, et al., 2011; Salman, et al., 2018). Natural Control refers to the control of insects provided by natural processes, without human involvement. As it is known insects can reproduce very quickly and sometimes the insects used in this natural control are called beneficial insects.

How Does Natural Control Happen?

Natural control refers to the maintenance of insect populations within certain bounds by environmental conditions, or factors.

Both non-biological and biological factors contribute to the natural control of insects.

1. Physical factors such as weather (e.g. cold winters can reduce some insect populations).
2. Quality and quantity of available food.
3. Competition between species or among individuals of the same species.
4. Amount and quality of living space or territory.
5. Natural enemies such as predators and parasites.

There are many ways for management of natural eco-friendly control methods for the pine processionary moth is very important. Some of the eco-friendly strategies to fight with the pine processionary moth as an economic pest in coniferous forests that are frequently used will be mentioned in this study. For example, the beneficial role of insectivorous birds potentially contributing to the biological control of forest insect pests appears crucial in the context of climatic warming species currently expanding their range such as the pine processionary moth, *Thaumetopoea pityocampa*.

It is controlled to some extent by predators, parasites and viruses which attack the moth at different stages of its life-cycle: Eggs are eaten by the orthopteran *Ephippiger ephippiger*.

Larvae are eaten by birds such as great tit (*Parus major*) and great spotted cuckoo (*Clamator glandarius*).

Larvae are parasitised by solitary wasps (*Ichneumonidae*, *Braconidae*) and some species of horse-fly (Tachinidae).

Pupae are eaten by hoopoes (*Upupa epops*).

Adults are eaten by bats.

One of the few natural enemies of the pine processionary moth is red ant (*Formica rufa* Linnaeus, 1758) and this ant species can be used to fight this moth.

Larvae may be infected by the processionary moth virus *Smithiavirus pityocampae*.

Larvae are eaten by *Calosoma* ground beetles. In recent years, this predatory insect that is the valuable in this fight is gaining importance in Turkey and in many countries. Pine processionary moth larvae are eaten by *Calosoma sycophanta*. The *Calosoma sycophanta* or forest caterpillar hunter is a ground beetle belonging to the family Carabidae. *Calosoma sycophanta* can reach a length of about 21–35 millimetres. This large ground beetle has characteristic metallic bright green elytra, while scutellum is metallic bluish. 33 *Calosoma* production laboratories have been reported by the authorities in Turkey. Many of the insects produced in these laboratories are released into natural forests.

In addition, a series of studies were carried out to design pheromone-based monitoring of the Pine Processionary Moth (PPM), *Thaumetopoea pityocampa*. The results suggest that pheromone-based traps provide a suitable tool to monitor *T. pityocampa* populations. By this way, a mass capture of the males can be achieved. It should be known that proper trapping and timing is very important in this struggle.

Another method that finds application in some areas consists of wrapping the stem of pine trees with plastic films having entomological glue before the larvae descends to soil (from the second fortnight of February to the first fortnight of March). When they becomes full with larvae of pine prosesesionario moth, the traps are replaced.



Fig. 1. *Thaumetopoea pityocampa* (pine processionary); heavy defoliation in a young Turkish pine (*Pinus brutia*) plantation, the slopes of the Amanos overlooking the Iskenderun Gulf, Iskenderun.



Fig. 2. *Thaumetopoea pityocampa* (pine processionary); a tent of mature larvae.

Global warming, which is a cumulative consequence of anthropogenic activities, affects our lives in many ways. One of these is the increase in the number of the insects we share the same planet. Scientists say global warming cause an increase in the number of *Thaumetopoea pityocampa*, a pine forest pest. Mediterranean pine forests in the region, including Turkey, are adversely affected by these pests. Eco-friendly methods are being developed to prevent damage to the forests of the beetle (İpekdağ, et al., 2016; Erkan, 2018). The beginning of these is the struggle with *Calosoma* (Kanat and Özbolat, 2006). It is also very important that, in order to achieve sufficient success in combating this pest, not only *Calosoma* but also a few eco-friendly methods of combat should be applied together.

In addition, enough precautions must be taken to protect the employees involved in this struggle and people. Because pine processionary moth's caterpillars have highly allergic hairs (Dog, 2018). It is also important to have a correct information activity in the public green areas where the processionary fight program is being implemented. Some posters, having informations about biological control approach with reduced environmental impact, should be used. Even if the best method certainly consists in burning these stinging larvae, it should not be forgotten that even the remaining carbonized residue from burned larvae can be allergic. These stinging hairs are very fine and therefore can be easily transported from the air.

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The Impact of Silvicultural Applications and Environmental Cleaning Conditions on Landscape and Usage Values Highlands

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Abstract: Highlands are natural spaces where the individuals that appear beyond the tree limit and survive through the war zone continue to exist with their degraded crown and stem qualities. These areas, which exist right above the Alps forest boundary, are of great importance and invaluable in terms of grazing, recreation and natural landscape. Recently, the natural forms of these areas have been dramatically destroyed due to the overgrazing activities and unauthorized settlements. In this regard, silvicultural applications in the forests near the highlands appearing as glades and gaps in upper forest areas also have direct and indirect impacts on the landscape and usage values of these highlands. This study based on the original research results was carried out on 3 highlands (Uluyayla, Gezen and Zoni) in a forest area within the administrative boundaries of Bartın and Ulus districts. The altitude of these investigated highlands range from 1300 to 1470m. The size of them range from 10-120ha. The dominant stands on these highlands are generally comprised of mixed forest structures such as pure fir, oriental beech+fir and scotch pine + oriental beech + fir. These stands are of generally multi-storied and also partly single-storied even-aged forms. These investigated forest forms were generally at the age of tending, and subjected to moderate and heavy high thinning interventions. On these highlands in the research area are carried out 80% grazing, 100% hunting and picnic and 45% camping activities. Accesses to highlands are, to a great extent, sufficient and the road density averagely ranges from 15-25 m/ha. A total of 250 persons from different levels of education were interviewed in the evaluations by the help of questionnaires. When the forest forms where tended areas were promoted through their photos were evaluated by the visitors, 'Scotch Pine + Beech + Fir' forest form where a 85.6% of moderate thinning treatments are made was preferred. The data obtained from the questionnaires was evaluated via the Dynamic Analytic Hierarchy Method and it was found that the following factors are effective on the landscape and usage values of highlands: **1. Environmental pollution, 2. False choice of recreation areas, 3. Unplanned Exploitation, 4. Road network, 5. Stand Type, 6. Silvicultural Applications and 7. Biodiversity.**

Keywords: Highland, silviculture, landscape, recreation, environmental pollution, stand structure

1. INTRODUCTION

People who survive in the complex and boring conditions of the big cities feel the need for a psychological and physical rest after a certain period of time, going to the conditions that are calm and naturally intertwined. This necessity has led people to coastal tourism, but nowadays individuals who need relief also benefit from alternative tourism opportunities. At the forefront of these alternative tourism possibilities are the highlands and highland tourism, which allows for pure harmony, the fresh air provided by the forests and the relaxing effect. Plateau and plateau activities are carried out in almost every region of our country and plateau tourism is realized as an alternative tourism activity (Şişman, 2010). In particular, the highland tourism carried out in the Eastern Black Sea Region provides important contributions to the local people in terms of rural development as much as it is important in surviving the cultural riches in the region. Ensuring the realization and continuity of this important tourism activity is also valuable in terms of country economy and promotion. However, during these activities, it is necessary to protect the natural landscape structure and the ecological balance in the highlands which are in the foreground due to natural structures and which are mostly located in the upper zone and the end of the natural forest resources. The same obligation is also very important for the protection of forests around these springs.

The purpose of this study is to determine the effects of the silvicultural activities on the natural forest resources at the end of the highland, the characteristics of the stand establishment and the environmental cleanliness situation in the spring, and the factors effecting on the usage and landscape value of the highlands.

2. MATERIALS AND METHODS

The research was carried out in 2016 and 2017 at Uluyayla, Gezen and Zoni Highlands located in Bartın Region. These plots provide an important opportunity for recreational activities within the scope of highland tourism as well as hosting valuable prefabricated stands in terms of forest resources in the region. In this context, these flats have been hosting the increasing number of visitors in recent years. Among these, silvicultural applications are carried out for various purposes in the forests around Gezen and Uluyayla, but there is no silvicultural application in the Zoni plateau which is within the boundaries of Küre Mountains National Park absolute protection zone. Some introductory features of these springs are shown in Table 1.

Table 1. Description of Highlands

Highland	Location	Mean Altitude (m)	Area (ha)
Uluyayla	Ulus	1000	60
Gezen	Ulus	1510	2,2
Zoni	Arit	1100	3,2

In the study, silvicultural interventions, especially moderate and high smashing or selective cutting, were planned to be included in the questionnaire form as a visual material in the forests adjacent to the spring areas which constitute the study area. For this purpose, stand organizations dominated at the end of each of the three springs and areas where different silvicultural applications were made are photographed. Later, a simple survey of 15 questions was organized to determine the thoughts and preferences of the people on the plateau tourism with these forest structures and silvicultural interventions. Then, in order to determine the number of persons (sample size) to which the questionnaire will be applied, the following Equation 1 was used (Kalıpsız, 1994, Güngör, 2010, Akalp, 2016).

$$n \geq \frac{Z^2 \times N \times p \times q}{N \times D^2 + Z^2 \times p \times q} \quad (\text{Equation 1})$$

As a result of the calculations made using the Equation 1 is above, the questionnaire study with a score of 135 persons from the Uluyayla, 65 from the coming to the Gezen highway and 58 from the highland from the Zoni to with different education levels and from different business groups was performed.

The results from the questionnaires were analyzed using "Dynamic Analytical Hierarchy Process Method (DAHMP)". The most important reason behind the use of the DAHMP method in study is to allow comparison of quantitative and qualitative data (Eleren, 2006; Güngör, 2010). For this purpose, in order to make the necessary calculations with DAHMP, the DAHMP calculation matrix was developed to calculate the combined effects of the main factors and the sub-factors under these main factors. In addition, it was tried to calculate the loads which are used in the calculations for the purpose of the research with DAHMP and which are the closest to the truth with the calculated iterations of the integrated investigated criteria. The criteria and symbols used in the calculation matrix made by DAHMP are given in Table 2.

Table 2. Criterias and Symbols

Criterias	Symbols
1. Environmental Pollution	EP
2. False Choice of Recreation Areas	FCRA
3. Unplanned Exploitation	UE
4. Road Network	RN
5. Stand Type	ST
6. Silvicultural Applications	SA
7. Biodiversity	B

The criteria shown in Table 2 must be calculated as a percentage of the mean and weight for use in the DAHMP. The mean and weight (%) values of the main criteria are shown in Table 3 as a result of the calculations made.

Table 3. Mean and Weight Scores of Criterias

Criterias	\bar{x}	Weight Scores (%)
1. Environmental Pollution	7.36	30.6
2. False Choice of Recreation Areas	6.92	25.3
3. Unplanned Exploitation	6.65	12.8
4. Road Network	5.46	11.2
5. Stand Type	5.32	10.4
6. Silvicultural Applications	4.38	5.7
7. Biodiversity	2.15	4.0

In the evaluation of the criteria examined in the study, an 11-level scale developed by Saaty (1990) was used. However, the consistency of the responses to the survey questions needs to be determined in order to determine the effect on the preferences of the tourists in the highland tourism activities carried out in the three springs which constitute the research area of landscape type, silvicultural applications, environmental pollution and other factors. For this purpose, variables

of "Consistency Indicator (CI)" and "Consistency Ratio (CR)", which are commonly used by Saaty (1990) and Eleren (2006).

3.RESULTS AND DISCUSSION

Results

In order to determine the consistency of the responses given to the survey results of the visual material and multiple choice answers applied in this study using silvicultural applications, stencil construction, environmental cleanliness and other elements in the research area using DAHPM, the corrected criterion criterion given in Table 4 was compared and the consistency indicator and the consistency rate is calculated.

Table 4.Comparisons of Rotated Values of Criterias

	EP	FCRA	UE	RN	ST	SA	B	Weight Scores	Consistency Criteria
EP	0.52	0.41	0.37	0.34	0.26	0.35	0.41	0.38	7.45
FCRA	0.45	0.48	0.32	0.42	0.18	0.17	0.23	0.35	7.38
UE	0.34	0.24	0.43	0.23	0.24	0.26	0.34	0.33	7.36
RN	0.28	0.36	0.34	0.48	0.15	0.42	0.21	0.32	7.35
ST	0.21	0.18	0.27	0.43	0.53	0.52	0.32	0.30	7.28
SA	0.17	0.27	0.21	0.32	0.51	0.55	0.45	0.28	7.26
B	0.12	0.15	0.24	0.16	0.23	0.28	0.48	0.24	7.23

(n=7, CI=0.10, CR=0.08<0.12: Comparison is Consistent.)

Discussion

When the values in Table 4 are examined, the CR value of less than 0.10 indicates that the evaluation table is correct and that the answers to the questionnaire data have a high level of consistency. As a matter of fact, the consistency rate of DAHPM was found to be high in another survey about the location of afforestation areas (Özel et al., 2014). According to this, in the three springs constituting the study area, the natural landscape structure, ecological balance and utilization value are determined as; 1.EP, 2.FCRA, 3.UE, 4.RN, 5.ST, 6.SA and 7.B criteria. It is believed that these findings are particularly evident in the observation that environmental pollution, which is more widespread than domestic wastes, has the greatest influence both on the deterioration of the natural environment and on the decrease of the use value of the springs by all the different waters. As a matter of fact, it is emphasized that in a survey conducted on the Ayder plateau, skewed settlement and pollution affected the sustainable management of the plains negatively (Atasoy et al., 2009). On the other hand, stand type and silvicultural practices have also been found to have an effect on the preference for sightseeing, which makes highland tourism. It was found out that 85,6% of the participants in the selection of the different stands used in the questionnaire survey preferred moderate high selection cutting oriental beech + Uludağ fir and scots pine + oriental beech + Uludağ fir mixed forest forms. A study in the USA has also found that forest types and silvicultural interventions have influenced people's recreational preferences and prefer mixed forest establishments with a single layered organization in which individuals can clean, move easily, and perform physical activities (Brunson and Shelby, 1992). Another important result is that road network and other infrastructure should be sufficient within the scope of ecotourism activities to increase the contribution to rural development, especially Uluyayla from the other side. However, care should be taken not to destroy the natural equilibrium in road works and other physical infrastructure applications, especially to provide access to the springs, should be main purposes. As a matter of fact, these deficiencies have been brought to the agenda in a research conducted in Uluyayla and the ecological balance has been maintained and a plateau area has been planned in detail for different tourist alternatives (Topay, 2003).

The results obtained from the research, the plots should be continuously monitored and evaluated. The natural structure of the springs and the high visual landscape value must be preserved. Use value should not exceed protection value. Multidimensional decision making techniques must be utilized and eco-based planning should be done when running the spring for recreational purposes. These plans should never be compromised and the protection / use balance always protected. The contribution of the spring to the rural development must be constant. Traditional structures must be protected and uneven construction should not be allowed. As with all natural resources, legal measures must be taken to ensure the continuity of the arcs, which is an important component of forests and forests. Trainings should be given against contamination of springs by household wastes and other wastes, and protective measures should be taken as soon as possible.

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The Effect of Chip Size on the Particleboard Properties

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Abstract: The geometry of chips used in particleboard production is one of the important factors affecting board properties. In this research, effects of chip size change on particleboard properties were investigated. In the production of test boards, 40% softwood, 45% hardwood chips and 15% mixed sawdust was used. Three layered test boards were produced using 12% urea formaldehyde (UF) resin in the surface layers and 8% in the middle layer. According to the obtained results, it was found that the mechanical properties improved with increasing the surface and middle layer chip sizes, especially the screw withdrawal strength increased by 5.3%. However, it was determined that water uptake and thickness swelling values were adversely affected by an average of 5.5%. It has been found that as the middle layer chip sizes remain constant while the top layer chip sizes increase, the surface soundness improves, whereas as the middle layer chip sizes increase, the surface hardness decreases.

Keywords: Wood based boards, particleboard, chip size, particle geometry physical and mechanical properties.

1. INTRODUCTION

Particleboards (PB) are produced by mechanically reducing wood material into small particles, applying adhesive to the particles and consolidating a loose mat with heat and pressure into a panel product. PB properties can be changed with some factors such as raw materials, particle size and geometry, resin type, and the density variations due to random particle deposition during mat forming. The dimensions of chips used in particleboard production significantly affect physical and mechanical properties of panels, surface quality and processing properties (Özen, 1980, Youngquis, J.A, 1999, İstek and Sıradağ, 2013).

In the production of particleboard, when very fine chips are used, the mechanical properties are especially reduced and very thick chips cause void formation and thus decrease the some board properties. It is known that the ratio of chip length to chip thickness, which is expressed as fineness, affects board properties considerably. It is emphasized that the particle surfaces are parallel, the thicknesses are homogeneous and the thin chips are more suitable for board production (Bardak, 2010; Göker and Akbulut, 1992).

Particle geometry including shape and size is a major parameter, which can create a significant impact on the properties of the boards (Hashim et. al. 2010). Kind of particle shape and size considerably influenced overall board properties. (Frybort, et. al. 2008). Particle geometry plays more important role on development of board properties than the actual mechanical properties of the board type (Suchsland and Woodson, 1990). A research by Miyamoto et al. showed that particle shape affected the linear expansion of particleboard. Sackey et al. pointed out that the fines content and the ratio of all particle-size fractions strongly influenced the internal bond strength of the samples. Particle geometry relates to dimension of particles used for the production of particleboard. Reported literature abound on its effects on properties of resin-bonded particleboards (Maloney 1977; Vital et al. 1980). According to most of these studies, bending and modulus of elasticity as well as dimensional stability of boards improve with increase in particle length used for board production (Badejo, 1988).

In this study, the suitability of different sized chips to particleboard production was investigated and the effect of chip size changes on physical and mechanical properties was determined.

2. MATERIALS AND METHODS

Experimental boards were manufactured by using 40% softwood, 45% hardwood chips and %15 market sawdust. Test samples were produced in Kastamonu Entegre (Turkey). Three layered test boards were produced using 12% urea formaldehyde (UF) resin in the surface layers and 8% in the middle layer. UF resin has $62 \pm 1\%$ solids and 8.2 pH and was produced in the same institution. As a hardener, 1% ammonium chloride (NH_4Cl) (20% solution) was used based on amount of solids weight in resin. For the production of test boards, the press temperature, maximum press pressure and the press duration were as 180°C , 30 kg/cm^2 and 190 seconds respectively. Average density of test boards was calculated as 630 kg/m^3 .

The lower and upper surfaces of the three-layered test boards consist of relatively thinner chips at 38% (19-19%) of the total chip weight and the middle layer at 62% thicker chips. The chip size distribution used in the production of test boards is given in Table 1.

Table 1. Surfaces and middle layer chip size change.

Number of experiments	Sieve dimensions	
	Lower and upper layers (mm)	Middle layer (mm)
3	2,5x0,8	10,5x10,5 / 6,0x20 6,0x20 / 6,0x6,0
3	2,7x0,9	10,5x10,5 / 6x20 6,0x20 / 6,0x6,0
3	3,0x1,0	10,5x10,5 / 6x20 6,0x20 / 6,0x6,0
3	2,5x0,8	10,5x10,5
3	2,5x0,8	6,0x20

The tests were carried out according to the Turkish and European norm standards (TS EN) given in Table 2.

Table 2. TS EN standards for test boards.

Test specimens and their dimensions	TS EN 325 and TS EN 326-1
Water absorption (WA) and thickness swelling (TS)	(TS EN 317)
Bending strength (BS) and modulus of elasticity in bending (MOE)	(TS EN 310)
Internal bonding strength (IB)	(TS EN 319)
Screw withdrawal strength (SWS)	(TS EN 320)
Surface soundness (SS)	(TS EN 311)

3.RESULTS AND DISCUSSION

Sieve analysis of surface layers chips and middle layer chips were given in Table 3.

Table 3. Sieve analysis of surface layers chips and middle layer chips.

Sieve analysis of surface layers chips (2,5x0,8 mm)			Sieve analysis of middle layer chips 10,5x10,5 / 6,0x20 / 6,0x20 / 6,0x6,0 mm		
Chip sizes	Weight (gr)	Amount (%)	Chip sizes	Weight (gr)	Amount (%)
2 mm	0,74	0,54	6,3 mm	1,78	1,61
1 mm	28,59	21,02	4 mm	4,10	3,70
0,8 mm	4,87	3,58	2 mm	34,25	30,95
0,6 mm	36,45	26,80	1 mm	52,10	47,08
0,4 mm	18,03	13,26	0,8 mm	2,03	1,83
0,315 mm	17,60	12,94	0,5 mm	14,64	13,23
0,2 mm	19,65	14,45	0,315 mm	0,67	0,61
0,1 mm	5,88	4,32	0,2 mm	0,45	0,41
Waste	4,20	3,09	0,1 mm	0,32	0,29
Total	136,01	100,00	Waste	0,33	0,30
			Total	110,67	100,00

The effects of chip size changes in particleboard production on the water absorption and swelling properties (2h) are presented in Figures 1a and 1b.

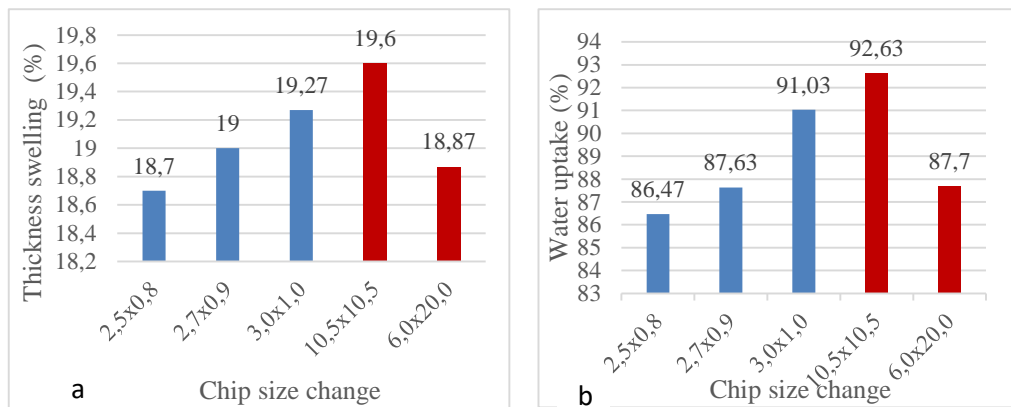


Figure 1. The effects of chip size changes on thickness swelling (TS) and water uptake (WA)

As shown in Figure 1, the TS and WA rates (2h) increases with increasing surface layer chip size by keeping middle layer chip thickness constant. On the other hand, it has been found that when the surface layer chip sizes are kept constant and the middle layer chip sizes are decreased, the rates of the TS and WA values (2-h) decreases. The surface chip size was kept constant and the WA value was improved by 5.6% by decreasing the middle chip size from 10.5x10.5mm to 6x20mm. The effects of chip size changes in particleboard production on internal bonding strength (IB) are presented in Figure 2.

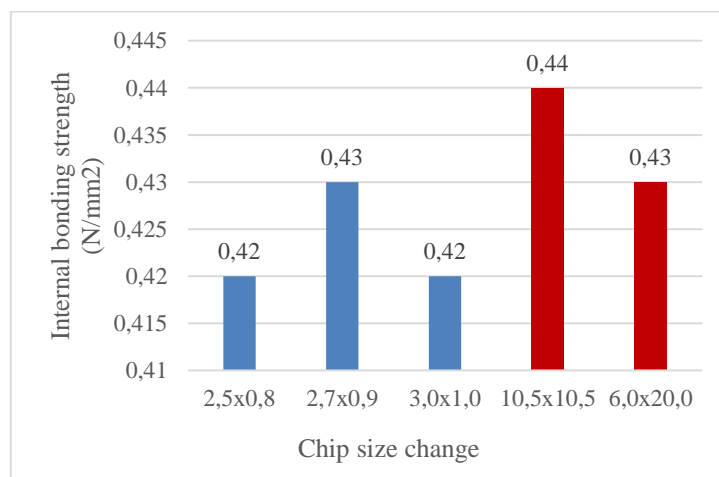


Figure 2. The effects of chip size changes on internal bonding strength.

When the surface chip size was kept constant and the middle chip size was increased, the best IB strength was found as 0.44 N/mm². On the other hand, it was determined that when middle layer size was kept constant and surface chip sizes are decreased, the IB strength was adversely affected. In class P2 board with 18 mm thickness, the IB strength should be $\geq 0,35$ N/mm². The effects of chip size changes in particleboard production on bending strength (BS) are presented in Figure 3.

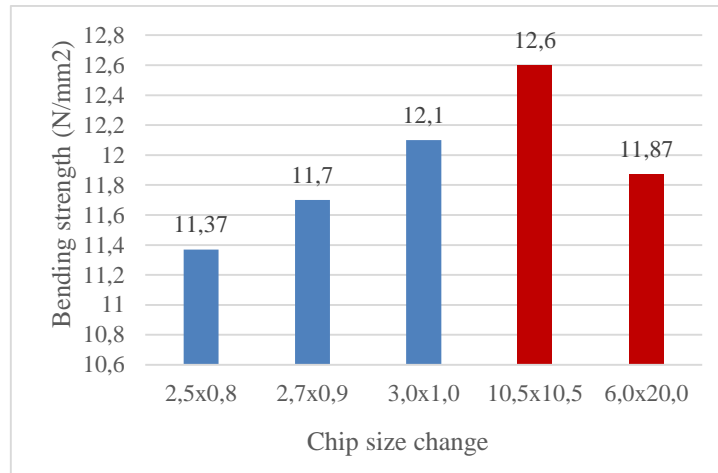


Figure 3. The effects of chip size changes on bending strength

The rates of increase in the BS were found to range from 3.4% to 4.5% with increasing surface layer chip size. It was also found that decreasing the chip size in middle layer decreased the BS by 6.3%. The effects of chip size changes in particleboard production on modulus of elasticity in bending (MOE) in Figure 4.

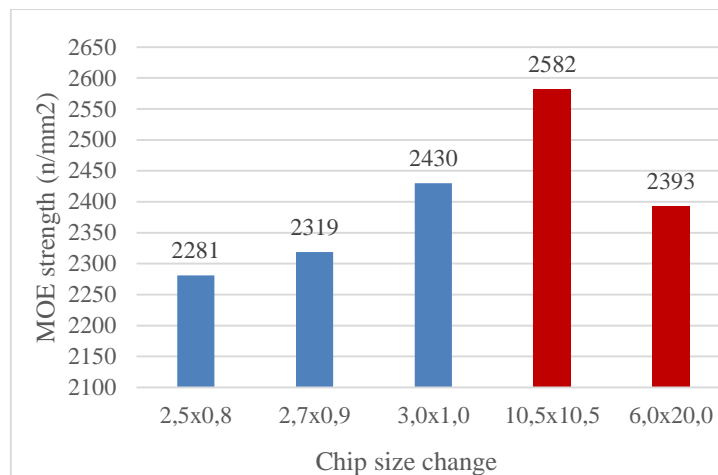


Figure 4. The effects of chip size changes on modulus of elasticity in bending.

It has been determined that the MOE increases with the increase of both middle and surfaces layers chip sizes. It was also found that decreasing the chip size in middle layer decreased the MOE by 7.3%. The effects of chip size changes in particleboard production on surface soundness (SS) in Figure 5.

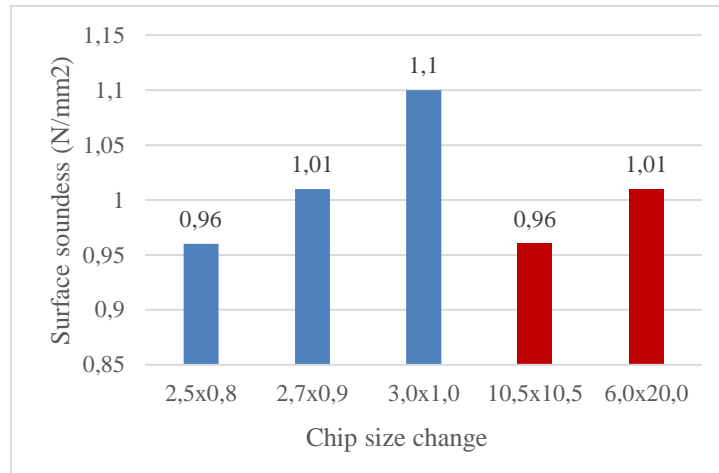


Figure 5. The effects of chip size changes on surface soundness.

It was determined that increasing the chip size in surface layers increased the SS by 14.5%. It was also found that decreasing the chip size in middle layer increased the SS by 5.20%. The highest SS value was found to be 1.1 N/mm² in the surface chip size of 3,0 x1,0 mm. The effects of chip size changes in particleboard production on screw withdrawal (SW) in Figure 6.

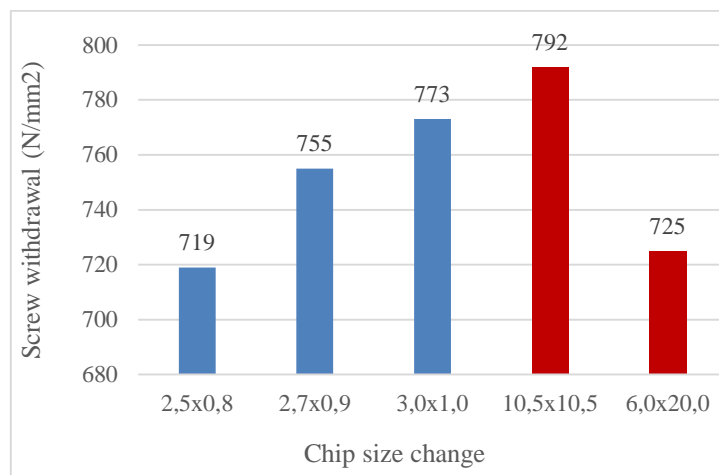


Figure 6. The effects of chip size changes on screw withdrawal.

As shown in figure, it has been found that when the surface layer chip sizes are kept constant and the middle layer chip sizes increased, SW strength increased by 5.3%.

In this research, effects of chip size change on particleboard properties were determined. According to the findings obtained, the following conclusions were reached.

- It has been determined that as the chip sizes increase, the water uptake and thickness swelling values are adversely affected.
- As the chip size increases, the bending and elasticity strength increases.
- As the middle layer chip sizes increased, the IB strength increased. On the other hand, the change in chip size in the surface layers did not cause a significant increase in IB strength.
- It has been determined that as the chip sizes increase, the water uptake and thickness swelling values are adversely affected.
- As the chip size increases, the bending and elasticity strength increases.
- As the middle layer chip sizes increased, the IB strength increased. On the other hand, the change in chip size in the surface layers did not cause a significant increase in IB strength.

As a result, decreases in chip size improved some mechanical and physical properties such as bending strength, modulus of elasticity in bending, water absorption and thickness swelling, on the contrary decreased the internal bonding strength, screw withdrawal and surface soundness.

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Effect of Sanding Process on Board Properties in Particleboard Production

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Abstract: One of the factors that affect the properties of wood based boards is the working techniques and features of the machines and equipment used in production. There are significant differences in efficiency and quality between continuous press technologies and multi-story press technologies used in the production of wood-based panels. In the production with multi story press technology, sanding process causes significant loss of raw materials and some properties are adversely affected. In this study, changes in the properties of particleboards produced after sanding in multi-story press were examined. According to the results obtained, it was determined that the sanding process caused the board thicknesses to fall between 5% and 8%, thus causing raw material loss. The board density tended to decline and it was found that it is decreased by 0.5% to 1.7% on average. Other features did not change significantly.

Keywords: Wood based boards; particleboard; sanding, physical and mechanical properties, multi-story press

1.INTRODUCTION

The most important factors that affect costs wood-based panel production are raw material, energy and labor expenses. In recent years, in the production of wood composite panels, sustainable alternative raw material sources can be used to produce boards in both economic and desirable specifications. Particleboard and fiberboard surfaces are coated with liquid and solid surface coating materials after sanding process.

One of the most important factors affecting the adhesion resistance of the coating materials is surface roughness value of the board to be coated. The quality of sanding depends on the characteristics of the sanding machine, the sanding process and the wood material. Surface roughness is not only the surface properties but also the mechanical properties of the panels (Kılıç et al., 2009).

Factors such as moisture content, density, hardness, abrasive properties of the sanding material, speed of rotation of the machine, and pressure affect the quality of sanding. Sanding is the smoothing of rough surfaces and sanding material is the abrasive materials used (İstek et al., 2012).

Surface quality of wood composites such as particleboard is an important physical property influencing different processes, including their finishing (İstek et al., 2010; Hızıroğlu 1999; Kılıç et al., 2009). For the panels, the smoothness of the surface increases, the adhesion between the surfaces improves due to the increased contact and attraction. For this reason, post-production surfaces of particleboard and fiberboards are sanded to a certain degree of roughness (Petri, 1987; Ayrılmış et al., 2010; Hızıroğlu, 1996).

In the manufacturing process of the particleboard and fiberboard, the formation and desired characteristics occur in hot press. When the hot press plate is closed, the surface of the panel is solidified in 1-2 seconds, and the thickness of this solidified part reaches to 3 to 4 mm, depending on the press technology. This part is removed by sanding after panel production. In wood-based panels produced by multi-layer press technology, sanding process causes significant mass loss and some properties are adversely affected.

The purpose of this study is to determine the changes in properties of particleboard produced in multi-layer presses after sanding process.

2.MATERIALS AND METHODS

The experimental panels were produced in Kastamonu Entegre particleboard plant Samsun/Turkey. Experimental boards were manufactured by using 25% pinewood, 35% poplar wood, 40% beech wood chips. Three layered test boards were produced using 12% urea formaldehyde (UF) resin in the surface layers and 8% in the middle layer. UF resin has 62 ± 1% solids and 8.2 pH and was produced in the different institution. As a hardener, 1% ammonium chloride (NH₄Cl) (20% solution) was used based on amount of solids weight in resin. The lower and upper surfaces of the three-layered test boards consist of relatively thinner chips with 38% (19-19%) and the middle layer with 62% thicker chips of the total chip weight. Production conditions of test samples were given Table 1.

Table 1. Production conditions of test samples

Max. press temperature	210°C±2
Max. press pressure	30 kg/cm ²
Average particleboard density	610 kg/m ³
Desired board thickness	18 mm
Press time	120±4 sec.

The methods used to determine the properties of the test specimens are presented Table 2.

Table 2. The methods used to determine the properties of the test specimens

Test specimens and their dimensions	TS EN 325 and TS EN 326-1
Water absorption (WA) and thickness swelling (TS)	(TS EN 317)
Bending strength (BS) and modulus of elasticity in bending (MOE)	(TS EN 310)
Internal bonding strength (IB)	(TS EN 319)
Screw withdrawal strength (SWS)	(TS EN 320)
Surface soundness (SS)	(TS EN 311)

3.RESULTS AND DISCUSSION

Average values of raw and sanded board properties are presented Table 3.

Table 3. Average Values of Raw and Sanded Board Properties.

Properties	Raw boards	Sanded boards	Rate of change (%)
Thickness (mm)	19,05±0,24	17,76±0,06	-6,8
Density (kg/m ³)	620±5,87	612±13,29	-1,3
Surface density (kg/m ³)	920±5,85	930±9,05	+0,8
Surface soundness (SS) (N/mm ²)	0,74±0,07	1,10±0,11	+32,7
Bending strength (BS) (N/mm ²)	11,58±0,77	10,61±0,82	-8,4
Modulus of elasticity (MOE) (N/mm ²)	2006±105	2029±192	+1,1

The effects of sanding process on board thickness are presented in Figure 1.

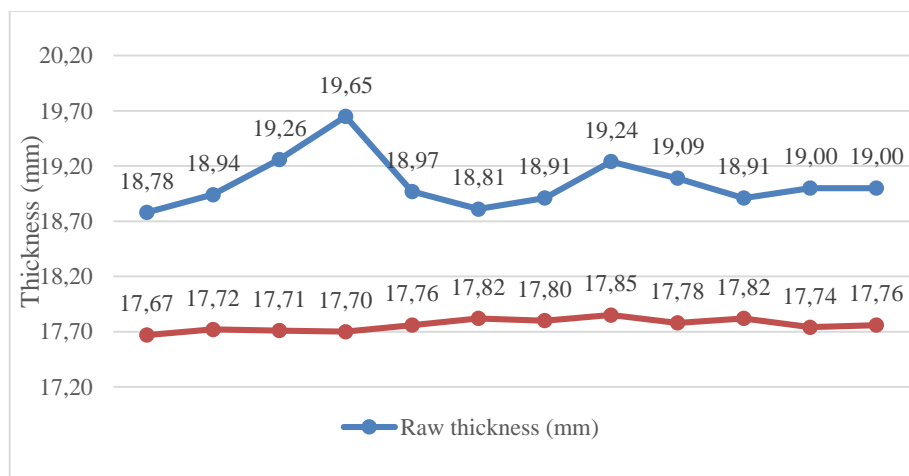


Figure 1. The effects of sanding process on board thickness.

It has been determined that the changes of thickness after pressing is not homogeneous, whereas the thickness is homogeneous after sanding. It was calculated that the board thickness decreased by 6.7% after sanding process. The effects of sanding process on board density are presented in Figure 2.

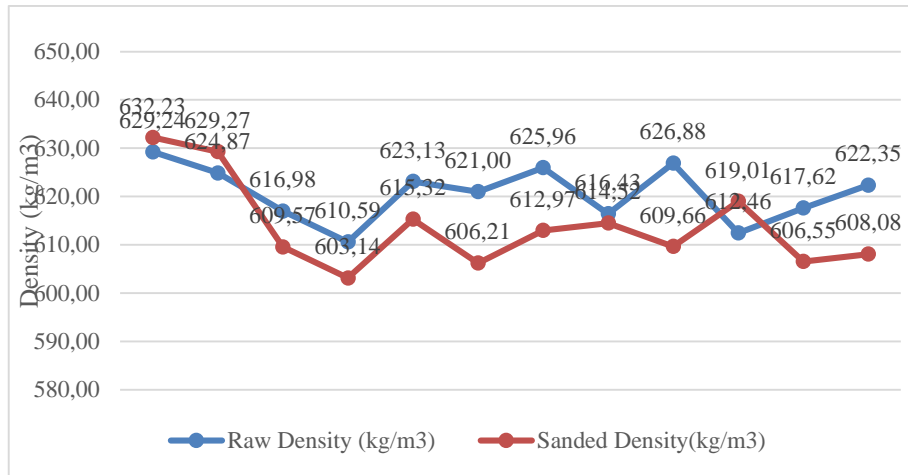


Figure 2. The effects of sanding process on board density.

It can be seen that the density of the board decreases with the sanding process. It is estimated that this reduction is in the average of 1.1%. The mean board density was 620 kg / m³ before sanding, and 613 kg / m³ after sanding. The maximum density deviation should not exceed $\pm 10\%$ from the mean for same type panel groups (Istek and Sıradag, 2013). The effects of sanding process on surface density are presented in Figure 3.

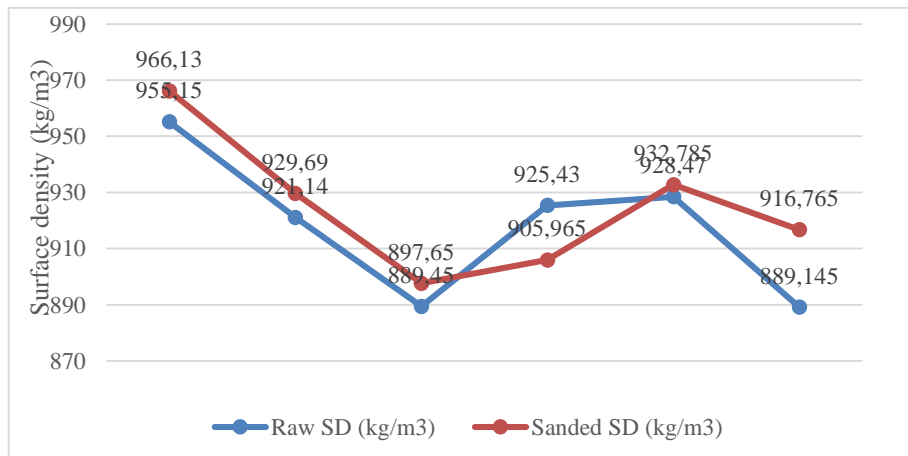


Figure 3. The effects of sanding process on surface density.

Surface density is expected to increase after sanding. However, it is stated that this situation changes depending on the press technology and production conditions. It was observed that surface density increased by 0.8% on the average. The effects of sanding process on surface soundness are presented in Figure 4.

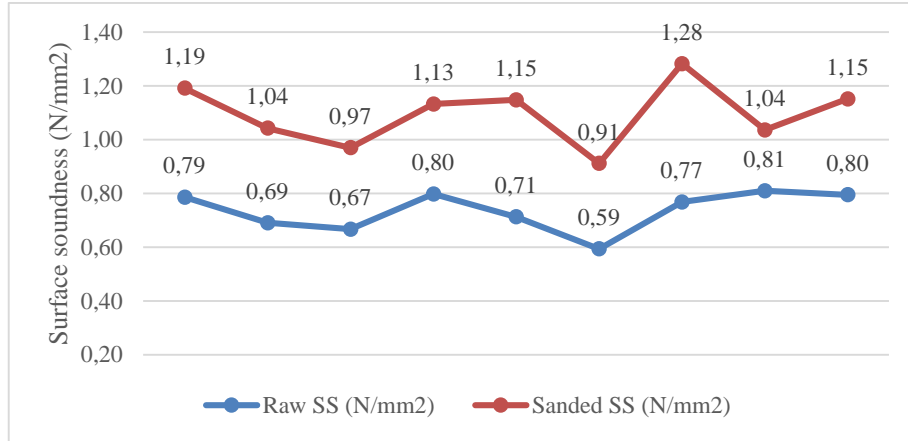


Figure 4. The effects of sanding process on surface soundness.

It was calculated that the sanding process increased the maximum surface soundness strength among the mechanical properties and this increase was 32.7%. This situation is believed to be caused by the removal of the first hardened chips that has weak bonds on the surface. The effects of sanding process on bending strength are presented in Figure 5.

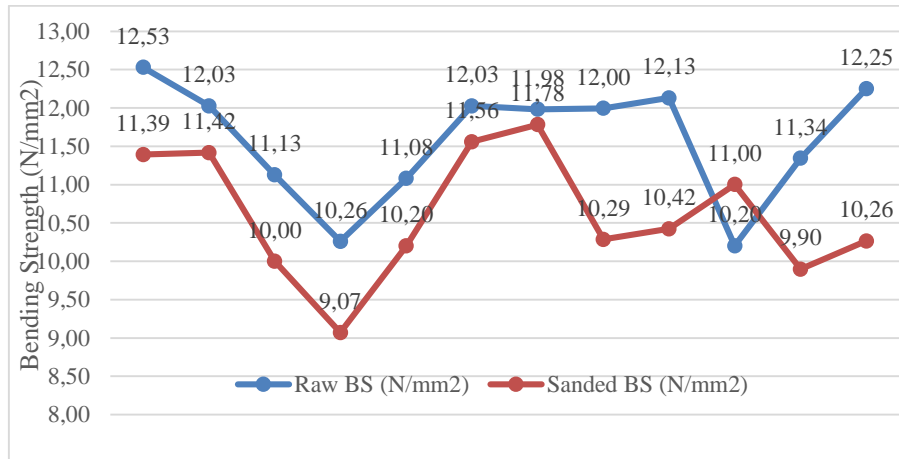


Figure 5. The effects of sanding process on bending strength.

The bending strength decreased by 8.4% after sanding. The average bending strength is found as 11.58 N/mm² before sanding and 10.61 N/mm² after sanding. The effects of sanding process on modulus of elasticity in bending are presented in Figure 6.

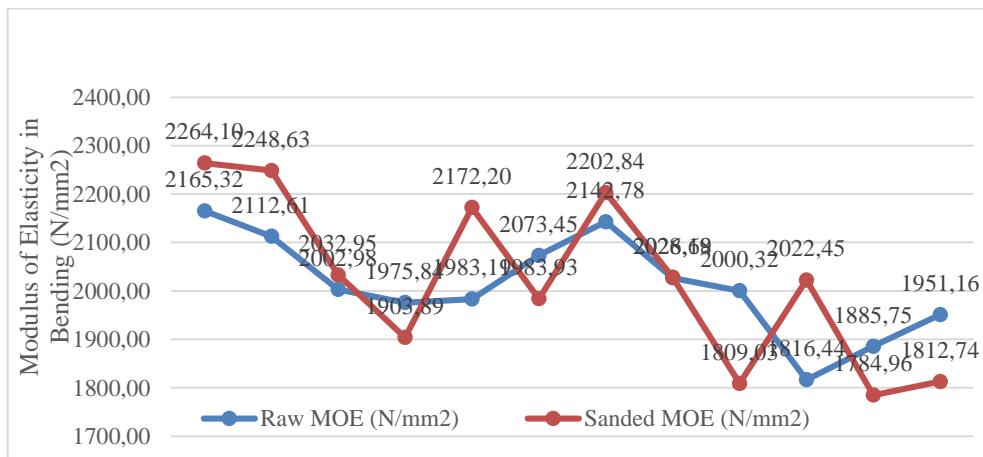


Figure 6. The effects of sanding process on modulus of elasticity in bending.

As shown in the graph, the modulus of elasticity in bending after sanding showed a more homogeneous distribution. It has been determined that on average, it increases by 1.1% after sanding. This increase was found to be due to the reduction of the thin chip ratio on the surface. The average value of the modulus of elasticity in bending was determined to be 2006 N/mm² before sanding and 2029 N/mm² after sanding.

In the production of wood-based panels, the surfaces of the panels are subjected to sanding process. This process removes the layer (crust) formed by early hardening on the panel surfaces, makes the panel thickness profile more homogenous, improves the surface smoothness and improves the roughness and prepares the panels for surface treatments. While some properties of the panels improve significantly at the rate of sanding, some properties are adversely affected. In this study, the effects of the sanding process on the panel properties were determined and the following results were obtained.

1. With the sanding process, the panel thickness decreases from 19.05 mm to 17.76 mm on average. The average thickness reduction is calculated to be 6.7%.
2. The panel surface density increased by 1.1%, but this increase was not found significant.
3. It was determined that the panel density reduced from 620 kg/m³ to 613 kg/m³ after sanding.
4. It was calculated that the surface soundness was the most increased after sanding process among the mechanical properties and the increase was determined as 32.7%.
5. It was found that the average bending strength was determined as 11.58 N / mm² while it was found as 10.61 N / mm² after sanding. The average bending strength reduction was found as 8.4%.
6. The modulus of elasticity in bending value increased by 1.1% after sanding.

According to the results obtained, it was determined that the sanding process caused the board thicknesses to decrease between 5% and 8%, thus causing mass loss significantly. However, this value was reported as maximum 50% lesser according to several studies in continue press technology. The board density tended to decline and it was found that it is decreased by 0.5% to 1.7% on average.

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Karabük Urban Forest Carbon Capture Potential

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Abstract: Urban forests are important in terms of landscape, as well as in community health and fresh air production. The Karabük urban forest selected as a study area was planted from the species of black pine and red pine. The diameter of the trees was measured in 27 samples area taken from the urban forest. Biomass amount were calculated using two different biomass equations. Biomass is important to determine the carbon that the trees absorb from the atmosphere. Using the different allometric biomass equations, it was estimated that the area contained 117.72/ 82.44 tons ha⁻¹ biomass in the field and 60.00 /42.34 tons ha⁻¹ carbon in stand biomass. If the trees increase their diameter by 0.5 cm in a year, it is determined that they produce 8.36 /5.68 ton ha⁻¹ biomass production and 4.26 / 2.90 ton ha⁻¹ year⁻¹ carbon. At this time, 10.03 /6.82 tons ha⁻¹ year⁻¹ of oxygen production was calculated.

Keywords: Biomass, Carbon capture, Oxygen production, Karabük Urban Forest

1.INTRODUCTION

Unnatural climate change is caused by human-induced activities. Unconsciousness in the use of natural resources, land use change, rapid population growth, and increased use of fossil fuels cause an increase in the amount of CO₂ in the atmosphere. Forests play an important role in the global climate change by the effect carbon cycle (Teobaldelli et al. 2009; Asan, 2011; Jagodzinski et. al.,2018). Terrestrial ecosystems have stocked about half of the global carbon, a significant part of this sink was forests (White et al., 2000). Carbon deposit in forests are calculated separately; for stand (aboveground, belowground), dead wood, litter and organic soil (IPCC, 2004; OGM, 2009). Stand carbon can vary from 70% to 80% in the forest ecosystem (Richter et. al.,1999; Vesterdal et. al.,2006). This makes forest ecosystems more valuable, compared to other terrestrial ecosystems such as grassland, pastureland, agricultural land. Accurate determination of carbon amount stocked in forest ecosystems allows us to better understand the terrestrial carbon cycle. It is also important for both effective arrangement of decision-making processes and for struggle global climate change.

It is essential to calculate the amount of biomass produced by trees in the determination of the carbon that is deposited in the forests. Biomass amount has been calculated using three basic approaches. These methods are: 1) Remote sensing 2) Method of achieving weight from tree volume using biomass expansion factor (BEF) 3) biomass equations developed for tree species based on allometry principle (Yolasiğmaz et. al., 2016;Durkaya et.al.,2017;Varol et.al,2018; Okan, 2018).

In the process of struggle against global climate change, Turkey which was in favor of the Kyoto Protocol, began to prepare a National Notifications and Greenhouse Gas Inventory from 2010 on. The amount of carbon contained in urban forests such as forest areas should be determined. 92% of the population of Turkey currently live in an urban area (Tuik, 2018). As a result of urbanization, the transformation of forest areas into settlement areas has increased the importance of urban forests. The concept of urban forests in the World arised from the need of the public for the green space, especially in line with the growing urban areas. (Bayram, 2004). The urban forests provide the social functions of the forests to the citizens in the city (Asan, 2015; Carter 1995).

Urban forests that are established from natural forests or afforestation are becoming increasingly important in urban life (Randrup et.al., 2005). Urban forests attract attention not only in terms of landscaping, but also community health and fresh air production in the changing world. The interest in green spaces in and around the city has increased with the impact of population migration from villages to cities and the effect of urbanization, which caused people to have various expectations from nature. Because of stressful working environment, heavy traffic, increasing concrete, noise, air pollution, people are getting to search for more natural environments due to the negativities of urban life.

In Turkey, urban forests are formed on the lands suitable for natural forest vegetation.They are natural recreational areas that have been preserved or afforested in or around cities. These areas should be at a distance where people can benefit directly or indirectly. It should also be of the structure that the existing ecosystem can sustain (Aslanboğa, 2004; Korkut ve Çilek, 2004).

Urban forests require a different planning and inventory compared to the that of the conventional forestry because of the various benefits and functions that are expected of them, such as the availability of clean water resources, climate change and carbon emission reduction (Sağlam-Özkan, 2012). In this study, it was aimed to determine the potential for carbon

sequestration and oxygen production of urban forests, many benefits of which are mentioned. In this regards, the calculations were made for the selected Karabük urban forest.

2.MATERIALS AND METHODS

The Karabük urban forest, which is selected as the study area, is located in the city center and is 100 ha in size. It was established in 1987 as afforestation (Şekil 1). The area consists of black pine (*Pinus nigra* Arnold.) and red pine (*Pinus brutia* Ten.) species.

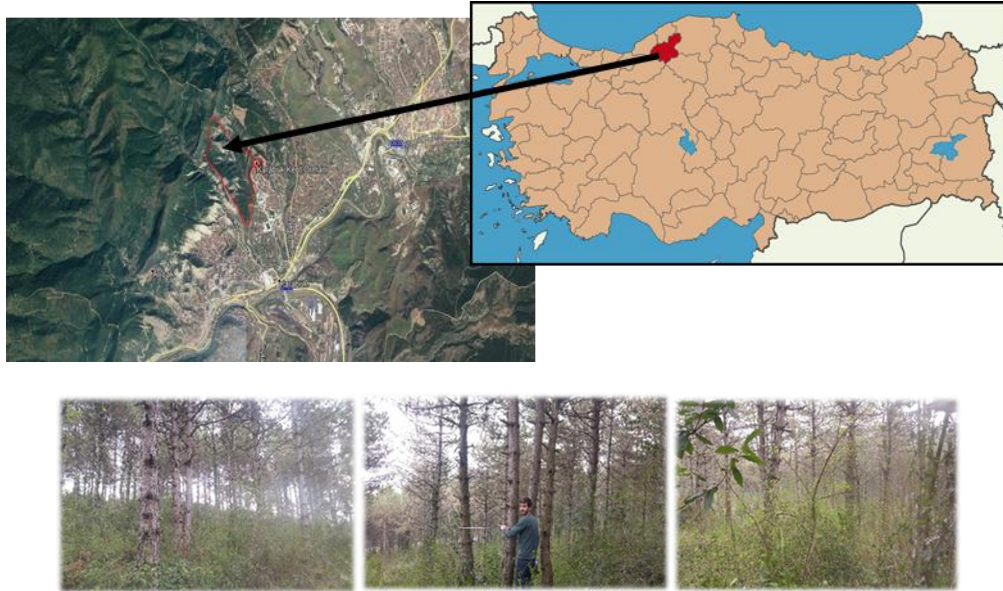


Figure 1.. Karabük urban forest location and the views of the area.

27 sample areas, each of which is 20x20m, were taken from the area. Black pines have a mean breast diameter of 11.88 and red pines have a mean diameter of 20.67 cm. Closure of the area is 2, partly 3. The diameter of $d_{1,30}$ of all trees over 8 cm diameter was measured in the sample areas. For black pine, Durkaya et al. (2015) and Güner-Çömez (2017) equations, for the red pine Durkaya et al. (2015) biomass equation was used to obtain above ground biomass values . (Table 1).

Table 1. Biomass models

	Aboveground biomass models	
<i>Pinus nigra</i> (Arnold.)	$= -2.969 + (0.4060d_{1,30}^2)$	Durkaya et.al. (2015)
	$= 4.9953 (1.1560)^{d_{1,30}}$	Güner-Çömez (2017)
<i>Pinus brutia</i> (Ten.)	$= -16.4154 + (0.4909d_{1,30}^2)$	Durkaya et.al. (2015)

After the calculated aboveground biomass (tons) , the amount of belowground biomass (tons) was determined (1);

$$\text{Belowground biomass} = \text{aboveground biomass} \times R \quad (1)$$

R: Root / Shoot Rate (FRA according to the 2013;R for coniferous forests in Turkey = 0.29)

In the determination of the amount of dead wood biomass (tons) in the dead wood, the equation (2) was used;

$$\text{Dead wood biomass} = \text{Aboveground biomass} \times 0.01 \quad (2)$$

In conifer species, the carbon account is obtained by multiplying the biomass by a coefficient of 0,51. The OGM (2014) proposed that the dead cover carbon is 7.46 (ton ha⁻¹) and the organic soil carbon is 76.56 (ton ha⁻¹)

Assuming that the trees in the area are increasing 0.5 cm in diameter per year, biomass values are calculated with the new diameters obtained. It was then determined how much annual biomass production was made in each hectare after the diameter increment. Finally, the amount of oxygen production was calculated by multiplying the total biomass increase by 1.2

3. RESULTS AND DISCUSSION

Results

In the calculation for determining the urban forest biomass of Karabük, when Durkaya et al.(2015) equation was used, 90.55 ton ha⁻¹ aboveground biomass; 26.26 ton ha⁻¹ belowground biomass was determined. Dead wood biomass was estimated as 0.91 ton ha⁻¹. Using the Güner-Çömez equation, these values were found as 63.91-18.53-0.64 ton ha⁻¹ and 83.08 ton ha⁻¹, respectively. (Table 2).

Table 2. Calculated biomass amounts

Biomass (ton ha⁻¹)		
	Durkaya et.al.(2015)	Güner-Çömez (2017)
Aboveground	90.55	63.91
Belowground	26.26	18.53
Living biomass	116.81	82.44
Dead wood	0.91	0.64
Total	117.72	83.08

The amount of carbon was calculated in the biomass based on the models used. According to the biomass equations used; when using Durkaya et. al. (2015), 46.18 tons ha⁻¹ aboveground carbon and 13.39 tons ha⁻¹ belowground carbon were obtained. When the Güner-Çömez (2017) equation was used, it was calculated as 32.59 tons ha⁻¹ aboveground carbon and 9.45 tons ha⁻¹ belowground carbon. These calculated values are the amount of carbon that the stand is connected to, the amount of carbon held in the litter and organic soil is not in the calculation. With the addition of the amount of carbon in the dead cover and organic soil, the first model was calculated 144.02.tons ha⁻¹ and the second model was calculated 126.36 tons ha⁻¹. With the addition of the amount of carbon in the litter and organic soil, the first model was calculated 144.02.tons ha⁻¹ and the second model 126.36 tons ha⁻¹. (Table 3).

Table 3. Calculated carbon amounts

Carbon (tons ha⁻¹)		
	Durkaya et. al. (2015)	Güner-Çömez (2017)
Aboveground	46.18	32.59
Belowground	13.39	9.45
Dead wood	0.43	0.30
Stand carbon	60.00	42.34
Litter	7.46	7.46
Soil	76.56	76.56
Total	144.02	126.36

Assuming that trees are doing 0.5 cm annual diameter increments, the annual biomass increment amounts and oxygen quantities released by production of this biomass were calculated. In these calculations, Durkaya et. al. (2015) model gave higher value than Güner-Çömez (2017) model. In the first model; 10.03 tons ha⁻¹ year⁻¹ and in the second model; 6.82 tons of ha⁻¹ year⁻¹ amount of oxygen production were reached. (Table 4).

Table 4. Annual amounts of biomass and released amounts of oxygen

	Durkaya et.al. (2015)		Güner-Çömez (2017)	
	Biomass production	Oxygen production	Biomass production	Oxygen production
	(tons ha⁻¹year⁻¹)		(tons ha⁻¹year⁻¹)	
Aboveground	6.48	7.77	4.4	5.28
Belowground	1.88	2.26	1.28	1.54
Total	8.36	10.03	5.68	6.82

Discussion

As the international agreements require, some research is carried out to prevent the increase in greenhouse gases in the atmosphere in order for the world to become more livable. Within the scope of struggle against global climate change, the amount of carbon stocked in forest ecosystems and their changes must be exactly identifiable. Increasing the amount of forest area is a simple and effective way to reduce the concentration of carbon dioxide in the atmosphere.

In this study, biomass-carbon sequestration capacity and annual oxygen production amounts of Karabük urban forest consisting of black pine and red pine species were determined. (Figure 2).

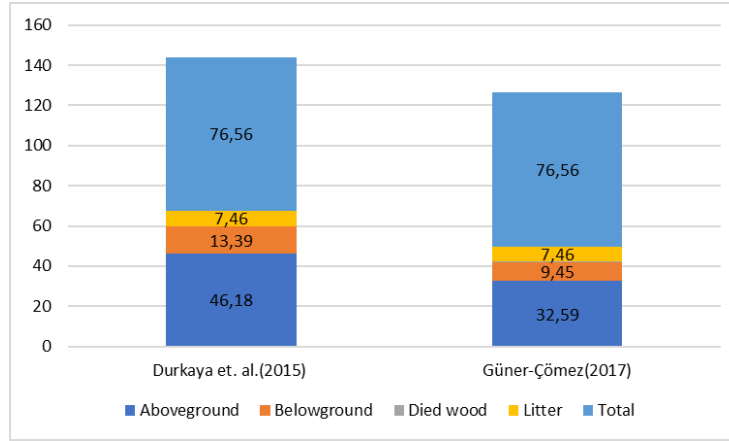


Figure 2. Carbon amount as different allometric equations

Rodger said that 73% of the stored carbon in the forest ecosystem exists in the soil. In this study; this value was calculated as 58% for the first biomass model (Durkaya et al., 2015) and 66% for the second model (Güner and Çömez, 2017).

It was determined that 170.21 tons ha⁻¹ of carbon was stocked in the study conducted for the Bartın urban forest. (Durkaya et.al.,2016). Karabük urban forest has stocked 60.00 tons ha⁻¹ carbon (according to first equation). The average diameter of the Bartın urban forest, consisting of black pine and established in 1990, was 28 cm whereas the average diameter of the Karabük urban forest established in 1987 was 16 cm. Because Karabük urban forest is on the 3rd site, class growth is slow. The difference in the diameters explain the difference in the amount of carbon. Furthermore, the fact that the equation used for Bartın urban forest (Durkaya et.al.2009) is polynomial is considered to be the reason to increase the difference.

According to the results, Durkaya et. al.(2015) 's equation provided 41% higher results. However, it is thought to give more real values since the Çömez - Güner (2017) equation is specific to afforestation areas,.

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Corrosion Properties of Coatings Produced on Surface of Weldox 700 Steel

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Abstract: In this study, it is aimed to improve the surface properties of Weldox 700 steel. Three different coatings were coated on the Weldox 700 steel surface using high speed oxyfuel (HVOF) spray method. The coating powder used was Diamalloy 2001, Sulzer Metco 5810 and Diamalloy 4454 commercial powders. The powders used contain NiCrBSi, WCCo and CoNiCrAlY, respectively. Constant parameters are used as overlay parameters. Microstructure, hardness and corrosion properties of the produced coatings have been examined in detail. Microstructure and phase composition of coatings were investigated by optical microscope (OM) and X-ray diffractogram (XRD). Hardness measurements were made only on the upper surfaces of the coatings using a microhardness equipment. Coatings were immersed in an aqueous solution of 3.5 wt.-% NaCl at pH 3 for potentiodynamic and corrosion rate measurements. NiCrBSi, WCCo and CoNiCrAlY based coatings have been successfully produced on the Weldox 700 steel surface with HVOF. SEM and optical photographs show that coatings have a generally homogeneous structure. It is also seen that the manufactured coatings have a lamellar structure positioned parallel to each other. Microstructure was determined by XRD analysis of double and triple carbides and hard phases. The mean hardness values of the coatings varied from 285 HV_{0.5} to 740 HV_{0.5}, respectively. There was a 2.8 times increase in hardness of the coatings to the lower layer (265 HV_{0.5}). This increase in hardness is related to the hard-metallographic phases occurring in the coating layer. Depending on the type of coating, there are differences in the corrosion resistance of the coatings.

Keywords: Weldox 700 steel, HVOF, surface coating, corrosion, hardness, microstructure

1. INTRODUCTION

High velocity oxygen fuel (HVOF) spraying method is widely used in the surface engineering industry due to the high speed of powder granules utilised for coating and low production temperature [1,2]. To achieve a very high particle velocity, combustion should be conducted between the liquid or gaseous fuel and the high-pressure oxygen gas. The coating powders are injected axially or radially into the gun. Very high velocity powders are coated on the material surface by the effect of burning gas [3,4]. Given the high bonding strength, excellent corrosion and abrasion resistance of nickel-based alloys, especially NiCrBSi alloys, coating materials produced by thermal spraying and melting processes are widely used in various industrial fields [5,6]. The boron in the chemical composition of the NiCrBSi-based coating powder reduces the melting point of the alloy and allows the formation of hard phases. Silicon is added to improve fluidity. Chromium provides high resistance to oxidation and high temperature corrosion. Carbon within the alloy increases wear resistance by forming carbides with high hardness values [7–9]. Ni-based coatings are widely used to improve the performance of surface properties in industrial areas, including chemical, oil, glass mold, hot work staple fan blades and industrial plants, such as mud disposal elements, coal boilers, heat exchangers, turbines, extruders, pistons and agricultural machinery in cement factories [10,15]. Cemented carbides or other hard metals exhibit exceptional qualities accompanied with the high hardness and strength of the carbides they contain (WC, TiC and TaC) and the toughness and plasticity of the metals (Co, Ni and Fe) used as binder phase. Thus, due to these properties, cemented carbides, which have many applications in the industry, have become the most preferred materials especially in the production of cutting tool. MCrAlY coatings protect the components against high temperature oxidation and hot corrosion attack. M represents Ni, Co, Fe, or combination of these elements. MCrAlY systems offer some benefits of Ni and Co-based superalloys. In particular, CoNiCrAlY alloy provides protection against high temperature oxidation, whereas NiCrAlY alloy provides excellent protection against molten salt corrosion. CoNiCrAlY alloy is now widely used as an option for applications that require protection against oxidation at high temperatures (hot corrosion) and where the thermal insulation is not a primary requirement due to the combination of the Ni + Co MCrAlY system. Providing an oxide layer that can be regenerated constantly to prevent the aggressive attack of chemical species, such as Cl⁻ and sulfides, which can be harmful to the coating and the base metal, is the aluminium effect of the MCrAlY system. Meanwhile, chromium helps in the stability of total oxide layer to maintain its protective features. However, excessive content of Cr affects the stability. Finally, yttrium helps maintain adherence of the oxide layer on the surface of the substrate [16–21].

Although the Weldox series steels can be welded well, the corrosion properties need to be partially improved. No literature is available to date on the surface modification of the Weldox steels. In this study, corrosion and microstructural properties of NiCrBSi, WCCo and CoNiCrAlY coatings produced by HVOF method on Weldox 700 steel were investigated.

2. MATERIALS AND METHODS

Commercial coating powders (Diamalloy 2001, Sulzer Metco 5810 and Diamalloy 4454) were used as coating material of Weldox 700 steel (substrate), and HVOF spraying method was used in the production of coatings. The Weldox 700 steel, which was used as the substrate at $20 \text{ mm} \times 5 \text{ mm} \times 60 \text{ mm}$, was sandblasted with Al_2O_3 sand having a grain size of 24–35 mesh for good bonding of the coating layer after cleaning in the acetone solution. Metco Diamond Jet (DJ) 2600 HVOF spray system was used in the production of the coatings. The spray parameters used in the coating process are O_2 flow 240 l/min, fuel gas (hydrogen) flow 600 l/min, powder feed amount 75 g/min, spray distance 250 mm and carrier gas (N_2) flow l/min. Nitrogen was used as the powder carrier gas and the lower layers were cooled with high pressure air jets after the coating process.

The samples coated with the HVOF method were baked and sanded by passing through coarse and fine sanding steps, respectively, and subsequently polished using diamond solutions, respectively. Nital solution was used for the etching of the samples. For optical examinations, Olympus GX41 inverted metal microscope (Olympus Co., Ltd., Japan) were used. X-ray analysis was performed to determine the phases formed in the coating layer. Hardness measurements were conducted under a load of 500 gf and at a waiting time of 15 s by using Shimadzu HMV-G21 model digital microhardness machine.

Corrosion measurements were obtained by using a system consisting of a Reference 3000 Potentiostat/Galvanostat/ZRA corrosion system. Corrosion experiments were carried out after the samples were left waiting for 1 h at room temperature in a 3.5 wt.% NaCl solution (pH 3). A conventional three-electrode cell was used for all the electrochemical measurements. A saturated calomel electrode was used as a reference electrode, platinum foil as a counter electrode and coatings as the working electrode. Potentiodynamic sweeping was performed in the range of $\pm 0.25 \text{ V}$ and 1 mV/s sweeping rate.

3.RESULTS AND DISCUSSION

It is seen that the coatings produced with HVOF spray have a lamellar structure arranged parallel to each other (Fig. 1). Lamellar structures come into the form of molten particles colliding with substrate, deformation and solidification. The lamella is formed in parallel with the substrate and the middle part of the lamella is thick and the thickness is decreased towards the end parts.

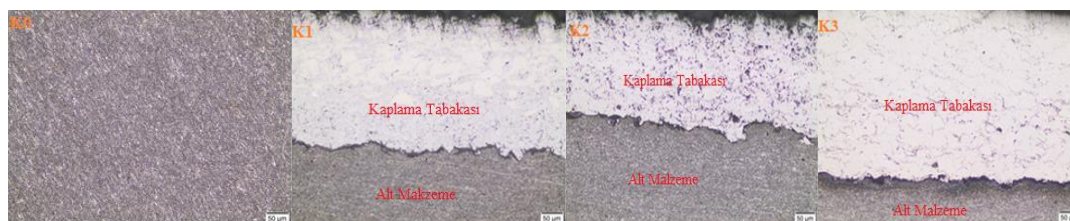


Figure 1. Optical photos of Weldox 700 steel and coating layers: (K0) Weldox 700, (K1) NiCrBSi, (K2) WCCo and (K3) CoNiCrAlY

XRD graphics of Weldox 700 steel and coating layers are given in Figure 2. In the substrate, $\text{Fe}_{9.7}\text{Mo}_{0.3}$, $\text{Cr}_{0.7}\text{Fe}_{0.3}$ and $\text{Cr}_{0.8}\text{Ni}_{0.2}$ phases were formed. No carbide phase in the substrate was observed. At the same time, boron phases were not formed because the boron ratio was also very low. $\text{Cr}_3\text{Ni}_2\text{Si}$, Cr_{23}C_6 , Cr_5B_3 , Cr_7BC_4 , SiC , CrSi and Si phases were formed in the NiCrBSi coating. WC , W_2C and $\text{Co}_6\text{W}_6\text{C}$ phases were formed in the WCCo coating layer. Cobalt formed ternary compound ($\text{Co}_6\text{W}_6\text{C}$) with tungsten and carbon, but no cobalt phase was found. $\beta\text{-(Ni, Co)Al}$, $\gamma\text{-(Ni, Cr, Co)}$ and $\alpha\text{Al}_2\text{O}_3$ phases were formed in the CoNiCrAlY coating layer. Oxidation has occurred due to the high affinity of Al for oxygen. Yttria element was not found in XRD graph because of 0.5% by weight of yttria element in the coating powder.

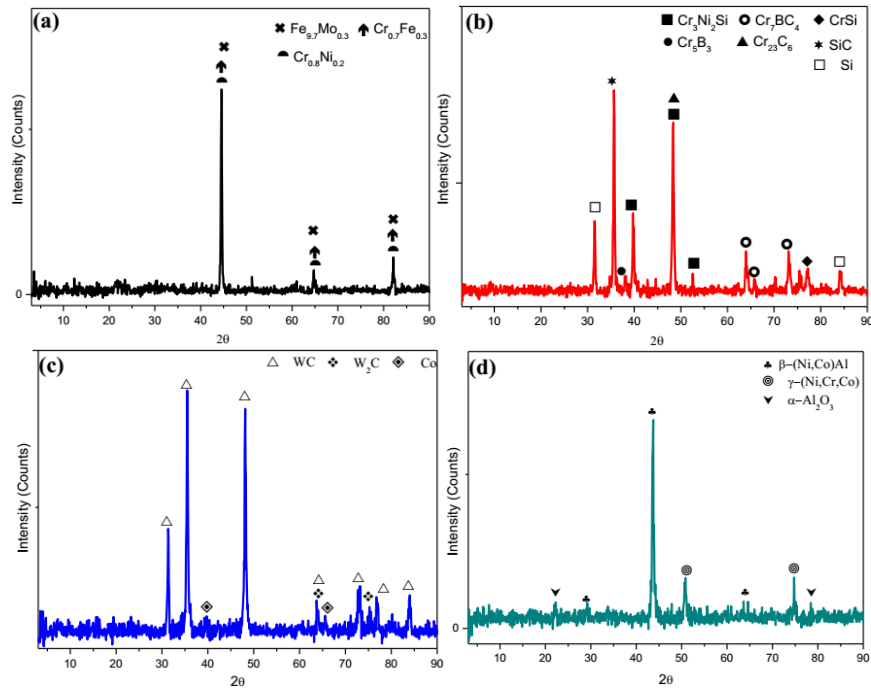


Figure 2. XRD graphics: (a) Substrate, (b) NiCrBSi, (c) WCCo and (d) CoNiCrAlY

Figure 3 shows the microhardness values obtained from the top surfaces of the substrate and coating layers. The mean hardness values of the substrate, NiCrBSi, WCCo and CoNiCrAlY coatings are 265 HV_{0.5}, 545 HV_{0.5}, 740 HV_{0.5}, 285 HV_{0.5}. It has been determined that the highest hardness value is in WCCo-based powder coated specimen. The obtained hardness value is about 2.8 times higher than the hardness value of the substrate.

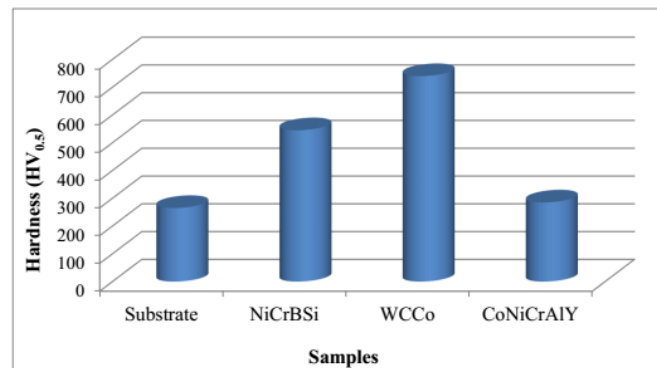


Figure 3. Hardness graphic of substrate and coatings

Potentiodynamic polarization curves of the substrate and the coatings in 3.5% NaCl solution are given in Figure 4. Notably, coatings significantly shifted the corrosion potential (E_{corr}) to positive values. The corresponding corrosion potential anodic and cathodic Tafel slopes (β_a and β_c), corrosion resistance (R_p), corrosion rate and corrosion current (I_{corr}) found from Tafel curves were extracted from Fig. 5 and summarised in Table 1. R_p was calculated by the Stern and Geary equation [22].

$$I_{corr} = \frac{\beta_a \times \beta_c}{2.303 \times R_p (\beta_a + \beta_c)} \quad (1)$$

where I_{corr} is the corrosion current density in $\mu A \cdot cm^{-2}$; R_p is the corrosion resistance in $k\Omega \cdot cm^2$, and β_a and β_c are the anodic and cathodic Tafel slopes in V or mV, respectively. The E_{corr} values of the substrate, NiCrBSi, WCCo and CoNiCrAlY coatings are slightly different. All coatings significantly shifted the E_{corr} to positive values. According to Table 1, the coatings are more resistant to corrosion than the substrate, and CoNiCrAlY coating is the most resistant to corrosion. The reason for the corrosion resistance of CoNiCrAlY ($2.06 \cdot k\Omega \cdot cm^2$) and NiCrBSi ($1.62 \cdot k\Omega \cdot cm^2$) coatings

being higher than the other specimens is the presence of Cr in the structure. Cr increases the resistance to corrosion by forming a chromia layer. WCCo coating has the lowest corrosion resistance ($1,32 \text{ k}\Omega \cdot \text{cm}^2$) amongst coatings. For this reason, the amount of pores in the WCCo coating is higher than other coatings.

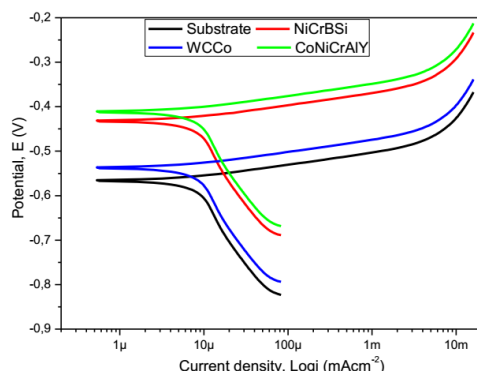


Figure 4. Potentiodynamic polarization curves of substrate and coatings

Table 1. Electrochemical results of substrate and coating layer.

Samples	E_{cor} (mV)	I_{cor} ($\mu\text{A cm}^{-2}$)	β_a (mV)	β_c (mV)	Corrosion rate (mpy)	R_p ($\text{k}\Omega \cdot \text{cm}^2$)
Substrate	-565	17,2	57,6	185	2,924	1,11
NiCrBSi	-435	9,8	47	165	2,141	1,62
WCCo	-545	10,4	51	84	2,185	1,32
CoNiCrAlY	-415	8,1	49,1	175	2,047	2,06

The microparticles, pores and microcracks are formed. These formations are caused by insufficient spray temperature. According to XRD analyses, two-component and three-component phases, such as solid solutions, carbides and borides, were formed in the coating layers. With the coating of the Wdow 700 steel, significant increases in hardness occurred. The highest hardness of $740 \text{ HV}_{0.5}$ was reached in WCCo coating layer. The corrosion resistances of all coatings are quite high compared with the substrate. It has been determined that the CoNiCrAlY coating has the highest corrosion resistance.

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Environmental Genotoxic Effects in Aquatic Organisms, Iskenderun Gulf Example

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Abstract: The increase in urbanization, demography and industrial activity, along with growing human needs have exponentially intensified pollution. In particular, the discharge of heavy metals into the marine ecosystem is a problem of global magnitude due to their toxicity, genotoxicity and bioaccumulation. Some aquatic organisms are indicators of the living conditions and genotoxicity. The accumulation of heavy metals such as lead (Pb), iron (Fe), zinc (Zn), cadmium (Cd) and chromium (Cr) has been extensively investigated in organisms usually in the first stage of the aquatic nutritional chain, such as crabs, shrimp or algae. This exposure of aquatic organisms to a variety of genotoxic chemicals raises the question about the potential effects of exposure on the health status of both current and future aquatic populations. Therefore, there are many studies on the genotoxic effect of these harmful wastes in the cells of aquatic organisms. In this context, there are studies on heavy metal pollution and antibiotic resistance and genotoxicity in aquatic living specimens from the Iskenderun Gulf. In this study, a broad summary of the genotoxicity studies carried out with samples from the Gulf of Iskenderun will be given and the genotoxic effects of environmental pollution will be highlighted. It is important to note that this genotoxicity have also negative effects on the sustainability of aquatic biodiversity. In addition, we should not ignore the negative effect of these aquatic products on human health.

Keywords: Genotoxicity, aquatic organisms, Iskenderun Gulf, pollution, sustainability, human health.

1.INTRODUCTION

Heavy metals, pesticides and agricultural chemicals have begun to attract public attention in waste water and aquatic ecosystems. Due to toxicity durability and the tendency to accumulate in water and sediment, heavy metals, metalloids, insecticides and agricultural chemicals at high concentrations become serious poisons for all living organisms in aquaculture. It is known that large-scale water pollution problems that could seriously damage the marine environment could be also harmful to human health. All these pollutants are known to have genotoxic effects in all other living cells, including humans (Dar, et al., 2016; Raknuzzaman, et al., 2016).

The increased pollution of groundwater and surface water from a wide range of industrial, municipal and agricultural sources has seriously polluted water quality in these sources. For example, the potential human health risks of heavy metals such as copper (Cu), zinc (Zn), arsenic (As), cadmium (Cd), mercury (Hg) and lead (Pb) in aquaculture were assessed frequently in recent years. All these factors have effectively reduced the sources of quality freshwater for human use.

Genotoxicity is a term that covers chemical or physical agent damage to chromosome and DNA structure. There is a relationship between the carcinogenic and mutagenic activities of chemicals. For this reason, genotoxicity studies that assess the potential risks and adverse effects of chemical and physical pollutant factors are becoming increasingly important. Many genotoxicity tests have been developed. These tests were applied to aquaculture to measure cytotoxic and molecular-based genotoxic effects of pollutants which are frequently exposed in everyday life, and which are evaluated as indicative of genetic damage in cells (Osman, et al., 2011; Osman, 2014).

As in many of the world's gulfs, there is also pollution in the Gulf of Iskenderun (Bıçkıcı, 2010; Çoğun, et al., 2017; Gündoğdu, 2017; Shenai-Tirodkar, 2018). The purpose of this study is to take attention on, through the Iskenderun Gulf example, the genotoxic potential damage caused by heavy metals, pesticides and agricultural chemicals in water and aquatic ecosystems, as well as potential proposals by reducing pollution for sustainability and water conservation.

2.MATERIALS AND METHODS

In this work, the environmental genotoxic factors in the aquatic systems, their effects and studies on this issue in the Iskenderun Bay have been examined and the potential hazards in the future have been highlighted. The negative impacts of global aquatic pollution on biological systems and human health have been emphasized. Studies on this subject made by scientists in Iskenderun Bay have been examined and attention has been paid to the importance of this subject.

3.RESULTS AND DISCUSSION

Chemical, physical or biological pollutants are one of the most important problems affecting the health of aquatic organisms. These pollutants can cause genetic alterations and carcinogenesis in aquatic organisms as genetic inducers and in the human consuming them. Genotoxicity is one of the major causes for cancer. The term of genotoxicity used in genetics describes cellular destructive effect of substances on DNA or RNA. Genotoxins are mutagens that can cause genotoxicity leading to the damage of DNA or chromosomal material. Genetic toxicology is the branch of science that deals with the study of agents or substances that can damage the cell's DNA and chromosomes.

This situation can also cause genetic erosion in the aquatic ecosystem. These threats in the water environment increase the importance of investigating the genotoxic potential of the aquatic environment and many tests have been developed for these researches. These pollutants affect the unity of the genome and lead to DNA damage. Genotoxicity tests such as the micronucleus test, comet assay are sensitive, reliable, and powerful techniques which are employed to assess the DNA damage. They can be applied on a wide variety of cells from any marine organism either in the field or in the laboratory (Siraj, et al., 2018). The micronucleus test and comet assay can also be used as biomarkers along with other biochemical tests to evaluate the toxicity status of a particular marine water body. This review explores the use of these tests in different organisms under varying degrees of marine pollution. In addition, it is advised to use more than one test in order to confirm the mutagenic vey a genotoxic effect of the test agents.

Some genotoxics in aquatic pollutants may interact at a specific location or base sequence of the DNA structure causing lesions, breakage, fusion, deletion, mis-segregation or nondisjunction leading to damage and mutation. These changes in the cells can be investigated by some standard genotoxicity tests. The names of some standard tests that are frequently used in the evaluation of genotoxicity are listed by Mohamed at al., (2017).

Bacterial Reverse Mutation Test (Ames Test)
Genetic Toxicology: Escherichia coli, reverse assay
In-Vitro Mammalian Chromosome Aberration Test
Mammalian Erythrocyte Micronucleus Test
Mammalian Bone Marrow Chromosome Aberration Test
In-Vitro Mammalian Cell Gene Mutation Test
Genetic Toxicology: Sex-linked Recessive Lethal Test in Drosophila melanogaster
Genetic Toxicology: Rodent Dominant Lethal Test
Genetic Toxicology: In-Vitro Sister Chromatid Exchange Assay in Mammalian Cells
Genetic Toxicology: Saccharomyces cerevisiae, Gene Mutation Assay
Global Journal of Pharmacy & Pharmaceutical Sciences
Genetic Toxicology: Saccharomyces cerevisiae, Mitotic Recombination Assay
Genetic Toxicology: DNA Damage and Repair, Unscheduled DNA Synthesis in Mammalian Cells In-Vitro
Mammalian Spermatogonial Chromosome Aberration Test
Genetic Toxicology: Mouse Spot Test
Genetic Toxicology: Mouse Heritable Translocation Assay
Unscheduled DNA Synthesis (UDS) Test with Mouse Liver Cells In-Vitro
In-Vitro Mammalian Cell Micronucleus Test

All environmental pollutants ultimately reach and accumulate in aquatic environments. Air, land and water pollutants are cumulatively located in the food chain from bottom to top. Due to anthropogenic activities, domestic, industrial and agricultural pollutants pollute the ecosystem, especially the aquatic systems. It is known that some aquatic organisms are good indicators for the follow-up of this pollution (Türkmen and Türkmen , 2005; Topcuoğlu et al., 2010). In the Iskenderun Bay sample, various local indicator living specimens were collected and analyzed during long-term monitoring studies of metal accumulation.

In this study, many articles investigating the accumulation of heavy metals and other pollutants in various sea creatures originated from the Iskenderun Gulf were examined (Dural et al., 2010a; Dural, et al., 2010b; Dural et al., 2011; Kaymacı, 2011; Duysak and Dural, 2015; Yanar, 2016; Yipel, et al., 2017; Yılmaz, et al., 2017). There are many studies in the Gulf of Iskenderun about dangerous amounts of pollutants such as heavy metals, antibiotics residues, agricultural chemicals known to be genotoxic by scientific studies. But there are not enough studies about the genotoxic effects of these pollutants on aquatic organisms living in the Gulf of Iskenderun and people consuming these aquatic products.

Genotoxicity studies can be defined as various in-vitro and in-vivo tests. These tests are designed to identify any substance or compounds which may induce damage to genetic material either directly or indirectly by various mechanisms. Heavy

metals from anthropogenic sources are continuously released into aquatic ecosystems and pose a serious threat to living organisms due to their toxicity and genotoxicity long durability, bioaccumulation in food chains. Heavy metals could damage especially in cellular DNA of some selected organs such as muscle, gills, intestine, skin liver of aquatic creatures. Genotoxic effects of cadmium (Cd) and mercury (Hg) are well known (Husejnovic, et al., 2018; siraj, et al., 2018). Some literature support that even when heavy metals are under allowable values of aquatic environment they can still cause bioaccumulation and DNA damage. In addition, aquatic systems are collectors for plastics, pesticides, antibiotics and many other pollutants other than heavy metals. There are also records of the existence of these pollutants in the Iskenderun Bay. Studies of cytotoxic and genotoxic effects on aquatic living cells of these pollutants are noteworthy (Yılmaz and Sönmez, 2018). The Gulf of Iskenderun which is a important maritime trade and industry should be protected within an action plan. Every citizen and authorities have responsibilities in this regard.

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Determination of Yield and Agricultural Characteristics of Chickpea (*Cicer arietinum* L.) Genotypes Yozgat Ecological Conditions

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Abstract: This study was conducted to grain yield and some agriculture characteristics of chickpea genotypes (*Cicer arietinum* L.) in Yozgat ecological conditions during 2010 and 2011 years. The experiment was arranged in a randomized complete block design with three replications. Twenty five genotypes (55-C, 63-C, 18-C, Işık-05, Sarı-98, Gökçe, Aziziye-94, Uzunlu-99, Gülümser, Taek-Sagel, Hisar, İnci, Yaşa-05, Küsmen-99, Canitez-87, Azkan, İzmir-92, Çağatay, Menemen-92, Akçin-91, Damla-89, Aksu, Cevdet bey ve Diyar-95 and local)were used in present study. In this study; duration to emergence, duration to flowering, pod period, duration to maturity, plant height, number of main branch, first pod height, number of pod per plant, number of grains per plant, thousand grain weight, biomass yield, grain yield and straw yield were investigated. According to combined results, duration to emergence and duration to maturity were ranged 16-20 and 94-97 day, respectively. The highest biomass yield, grain yield, and straw yield was obtained from cultivars Azkan (308.3, 149.0, and 159.3 kg/da, respectively), Çağatay (274.4, 112.7, 161.6 kg/da, respectively) and Diyar-95 (252.8, 112.9, 139.9 kg/da, respectively). The thousand grain weight was ranged 282.4 to 464.0 g. The lowest first pod height was determined 21.10 cm (local genotype), while the highest was measured 28.45 cm (cultivar Cevdetbey). According to two years results, cultivars Azkan, Çağatay, Diyar-95 and Cevdet Bey can be recommended in Yozgat ecological conditions for grain yield.

Keywords: Chickpea, Genotype, Grain Yield, Biomass Yield, Yozgat

1. INTRODUCTION

Chickpea (*Cicer arietinum* L.) is an annual grain legume (pulse) crop sold into human food markets and it is the third most important food legume crop. Chickpea to be a cool season grain legume of exceptionally high nutritive value and most resourceful food in use. The major producers, India, Pakistan, and Turkey, contribute 65%, 9.5% and 6.7% respectively, in the world harvest (Van der Maesen, 1972).

Chickpea is a plant grown in arid regions in the world and the second plant that after cultivated bean in our country. In Yozgat, no cultivation practices such as fertilization and irrigation are applied in the cultivation of chickpea, and it cultivation area account for 82% of total edible legumes. The chickpea germinates at 3-5 °C and it is tolerated to 12 °C (Malhotra et al., 1991). Therefore, it sowing is done in the early spring in the northern, central and eastern regions. On the other hand, Chickpea seed has 25.3-28.9% protein, 38-59% carbohydrate, 3% fiber, 4.8-5.5% oil, 3% ash, 0.2% calcium and 0.3% phosphorus. Digestibility of protein varies from 76-78% and its carbohydrate from 57-60 % (Hulse 1991).

This study was conducted to grain yield and some agriculture characteristics of chickpea genotypes (*Cicer arietinum* L.) in Yozgat ecological conditions.

2. MATERIALS AND METHODS

Experiments were conducted during the growing seasons of 2000 and 2011 in the Agricultural Research Field of Bozok University, Yozgat. Soil properties of the experiment field taken from 30 cm depth were clay-loam type with a pH of 8.15 and 7.93% CaCO₃, 8.48 kg ha⁻¹ phosphorus, and 1.82% organic matter.



Figure 1. Map of Yozgat province

Table 1. Meteorological data of experiment area in the longterm and studied years*

	Long-term		2010		2011	
	Temp. (°C)	Precipt. (mm)	Temp. (°C)	Precipt. (mm)	Temp. (°C)	Precipt. (mm)
May	13.0	62.7	14.7	21.1	12.0	82.0
June	16.8	41.7	18.7	65.2	15.9	63.7
July	19.7	13.3	22.1	17.7	21.2	13.9
August	19.6	8.9	24.0	0.2	19.3	0.7
Average	17.28		19.62		17.10	
Total		126.6		104.2		160.3

* Turkish State Meteorological Service

Table 1 shows the meteorological data of the experiment area during the growth season, including monthly average temperature and monthly total precipitation. During the growing season, total precipitation was 126.6 mm at the long-term, it was 104.2 mm for 2010 and 160.3 mm for 2011 year.

Twenty five genotypes (55-C, 63-C, 18-C, Işık-05, Sarı-98, Gökçe, Aziziye-94, Uzunlu-99, Gülümser, Taek-Sagel, Hisar, İnci, Yaşa-05, Küsmen-99, Canitez-87, Azkan, İzmir-92, Çağatay, Menemen-92, Akçin-91, Damla-89, Aksu, Cevdet bey ve Diyar-95 and local genotypes were used in present study. The experiment was arranged in a randomized complete block design with three replications. Parcels were constructed as 4 rows with 45 cm row spacing and 8 cm of intra-row spacing. All three years 3 kg /da N and 6 kg /da P₂O₅ of commercial fertilizer have been applied during plantation. In this study; duration to emergence, duration to flowering, pod period, duration to maturity, plant height, number of main branch, first pod height, number of pod per plant, number of grains per plant, thousand grain weight, biomass yield, grain yield and straw yield were investigated.

Data were statistically analyzed by repeated measure analysis in MSTAT-C statistical programme and means were separated by Duncan's Multiple Range test.

3.RESULTS AND DISCUSSION

Duration to emergence, duration to flowering, pod period, duration to maturity values of chickpea were give Figure 2. According to combined results, duration to emergence and duration to maturity were ranged 16-20 and 94-97 day, respectively.

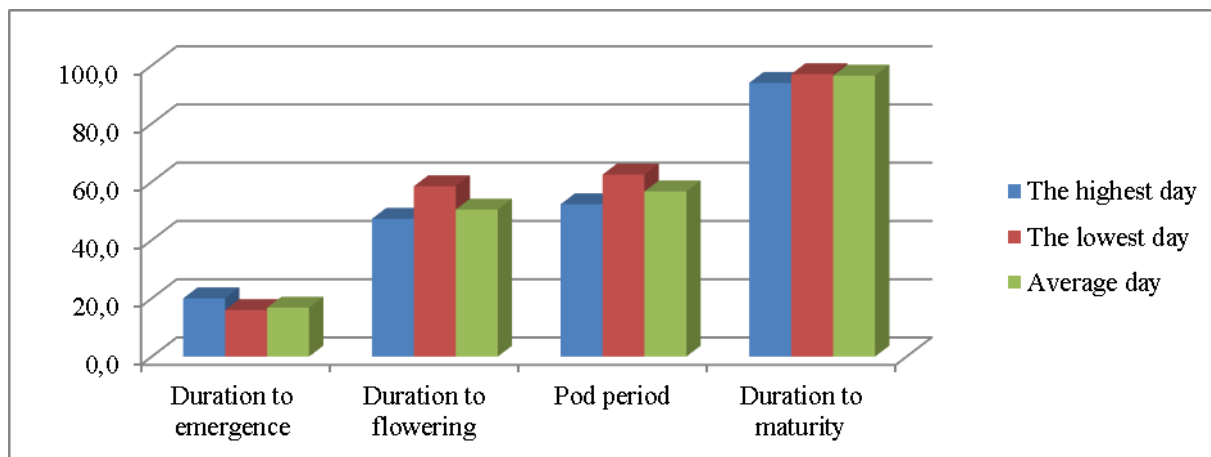


Figure 1. Duration to emergence, duration to flowering, pod period, duration to maturity of chickpea genotypes in combined years

According to combined years, plant height ($p \leq 0.05$) and first pod height were significantly ($p \leq 0.01$) different between genotypes, while it was not a significant number of main branch (Table 2). Plant height was ranged from 35.40 (Local genotype) – 47.47 cm (cultivar Hisar). The highest number of main branch was determined in 3.10 (Aksu), while the lowest was 2.23 (Işık-05). First pod height was ranged 21.10 (Local genotype) – 28.45 (cultivar Cevdet Bey) (Table 2). Karasu and Vural (2006) reported that the plant height, number of main branch and first pod height of chickpea genotypes were ranged 22.12 – 26.68, 2.60 – 3.15 and 15.52 -19.14 respectively (Tabl 2).

Table 2. Plant height, number of main branch and first pod height of chickpea genotypes in combined years

Genotypes	Plant height* (cm)	Number of main branch	First pod height ** (cm)
Işık-05	36.42 cd	2.23	21.75 gh
63-C	37.15 cd	2.87	22.78 f-i
Local	35.40 d	3.03	21.10 i
18-C	38.95 bcd	3.23	22.40 f-i
Sarı-98	43.37 a-d	3.57	25.12 b-g
Gökçe	41.27 a-d	2.47	22.23 f-i
Aziziye-94	43.53 a-d	2.47	24.52 b-i
Uzunlu-99	39.38 a-d	2.67	23.28 e-i
55-C	40.00 a-d	3.03	23.62 d-i
Gülümser	39.03 bcd	2.67	22.18 f-i
Hisar	47.47 a	2.97	27.70 ab
İnci	39.82 a-d	2.73	23.83 c-i
Aksu	42.85 a-d	3.10	23.35 d-i
Yaşa-05	39.90 a-d	2.67	21.38 h-i
Küsmen-99	36.63 cd	2.80	25.20 a-f
Canitez-87	46.12 ab	2.63	26.70 a-d
Azkan	45.50 ab	2.93	27.22 ab
İzmir-92	40.00 a-d	2.87	25.08 b-g
Çağatay	44.42 abc	2.63	27.05 abc
Menemen	44.47 abc	2.97	26.50 a-e
Taek-Sagel	46.35 ab	2.97	23.55 d-i
Akçin-91	40.68 a-d	2.45	24.70 b-h
Damla-89	40.12 a-d	2.87	22.65 f-i
Cevdet Bey	43.85 abc	3.03	28.45 a
Diğer-95	45.85 ab	2.93	27.71 ab

(*) 0.05, (**) 0.01.

According to combined years, thousand grain weight was significantly ($p \leq 0.01$) different between genotypes, while it was not a significant number of pod per plant and number of grains per plant (Table 3). Number of pod per plant and number of grains per plant were ranged 17.33 (cultivar Küsmen-99) – 33.63 (cultivar 18-C) and 1.07 (cultivar Aziziye-94 and Menemen) – 1.40 (cultivar Aksu) respectively. The highest thousand weight was determined 464.00 g (cultivar

Sarı-98), while it was lowest 282.43 (cultivar İnci) (Table 3). Bakaloglu and Aycicek (2005) and Babagil (2010) reported that the number of grains per plant was ranged from 21.6 – 25.5.

Table. 3. Number of pod per plant, number of grains per plant and thousand grain weight of chickpea genotypes in combined years.

Genotypes	Number of pod per plant	Number of grains per plant	Thousand grain weight ** (g)
Işık-05	17.93	1.13	435.23 b
63-C	30.53	1.23	359.70 gh
Local	17.43	1.27	383.57 d-g
18-C	33.63	1.20	351.70 hi
Sarı-98	21.73	1.20	464.00 a
Gökçe	23.87	1.30	399.33 cde
Aziziye-94	26.27	1.07	374.83 e-h
Uzunlu-99	23.33	1.37	383.67 d-g
55-C	28.73	1.27	347.93 hi
Gülümser	21.87	1.20	391.00 c-f
Hisar	24.83	1.27	363.77 fgh
İnci	27.17	1.23	282.43 j
Aksu	20.80	1.40	390.03 c-g
Yaşa-05	26.13	1.23	368.53 fgh
Küsmen-99	17.33	1.13	409.27 bcd
Canitez-87	23.40	1.10	392.47 c-f
Azkan	23.70	1.20	412.30 bcd
İzmir-92	22.27	1.20	372.27 e-h
Çağatay	19.10	1.37	363.23 fgh
Menemen	20.93	1.07	366.90 fgh
Taek-Sagel	21.97	1.23	436.47 b
Akçin-91	23.73	1.20	370.47 e-h
Damla-89	24.07	1.27	328.83 i
Cevdet Bey	23.47	1.17	416.33 bc
Diyar-95	21.70	1.22	385.77 d-g

(*) 0.05, (**) 0.01.

According to biomass, grain and straw yield was significantly ($p \leq 0.01$) different between genotypes. The highest biomass yield was determined in cultivar Azkan with (308.34 kg/da) and cultivar Çağatay and Diyar-95 was the same statistical group with cultivar Azkan (274.42 and 252.85 of respectively), while the lowest was in local genotype (111.77 kg/da). The grain and straw yield of chickpea genotypes were ranged 49.09 (cultivar Küsmen-99) – 149.00 kg/da (cultivar Azkan) and 59.17 (Local genotype) – 161.67 kg /da (cultivar Çağatay) (Table 4). Karasu and Vural (2006) found similar results in chickpea genotypes in terms of grain yield.

Table. 4. Biomass, grain and straw yield of chickpea genotypes in combined years.

Genotypes	Biomass yield**	Grain yield**	Straw yield**
Işık-05	236.24 b-e	120.63 abc	115.60 bcd
63-C	235.38 b-e	99.79 bcd	135.60 abc
Local	111.77 g	52.59 de	59.17 f
18-C	208.69 b-f	110.78 abc	97.90 c-f
Sarı-98	224.44 b-f	85.68 b-e	138.77 abc
Gökçe	209.88 b-f	124.22 ab	85.63 def
Aziziye-94	207.55 b-f	96.93 b-e	110.63 b-e
Uzunlu-99	189.16 c-f	74.13 cde	115.07 bcd
55-C	203.44 c-f	106.62 abc	96.83 c-f
Gülümser	210.63 b-f	114.74 abc	95.90 c-f
Hisar	183.85 def	85.05 b-e	98.80 c-f
İnci	247.48 bcd	95.61 b-e	151.87 ab
Aksu	228.52 b-f	109.35 abc	119.17 a-d
Yaşa-05	195.32 c-f	96.24 b-e	99.10 c-f
Küsme-99	164.16 fg	49.09 e	115.07 bcd
Canitez-87	203.57 c-f	92.64 b-e	110.90 b-e
Azkan	308.34 a	149.00 a	159.37 a
İzmir-92	196.18 c-f	81.22 b-e	114.97 bcd
Çağatay	274.42 ab	112.75 abc	161.67 a
Menemen	185.91 c-f	117.80 abc	68.10 f
Taek-Sagel	243.90 bcd	109.90 abc	134.00 abc
Akçin-91	238.57 bcd	118.20 abc	120.33 a-d
Damla-89	170.25 efg	100.92 abc	69.33 e-f
Cevdet Bey	240.84 bcd	104.26 abc	136.57 abc
Diyar-95	252.85 abc	112.91 abc	139.97 abc

(*) 0.05, (**) 0.01.

Yozgat is one of the major chickpea production centers of our country. For this reason, the increase in productivity will contribute significantly to the production of chickpea and the economy of the people of the region. Significant differences among genotypes examined to reveal the importance of selecting appropriate varieties.

According to two years results, cultivars Azkan, Çağatay, Diyar-95 and Cevdet Bey can be recommended in Yozgat ecological conditions for grain yield.

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Aquaculture Sustainability

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Abstract: Aquaculture is the farming of aquatic organisms in both coastal and inland areas involving interventions in the rearing process to enhance production. Eating fish is part of the cultural tradition of many people and in terms of health benefits; it has an excellent nutritional profile. Growth of aquaculture is absolutely necessary for meeting future demands for food. However, like any other sector of agriculture, it has its limitations. One of the biggest impacts of aquaculture is its environmental impacts. Some aquaculture practices that do not maintain standards and follow sustainable aquaculture practices, negatively impact the environment and also put pressure on wild fish growth by habitat modification and using wild caught fish as fish feed. Aquaculture is among the most sustainable of animal protein production systems. Growing aquaculture is needed to meet employment and food security targets in developing countries. Investment risk co-varies with environmental risk to influence sustainability. Sustainable aquaculture is a dynamic concept and the sustainability of an aquaculture system will vary with species, location, societal norms and the state of knowledge and technology. Several certification programs have made progress in defining key characteristics of sustainable aquaculture.

Keywords: Aquaculture, Sustainability, Fish

1. INTRODUCTION

Aquaculture

Aquaculture is the farming of aquatic organisms in both coastal and inland areas involving interventions in the rearing process to enhance production. It is probably the fastest growing food-producing sector and now accounts for 50 percent of the world's fish that is used for food. About 567 aquatic species are currently farmed all over the world, representing a wealth of genetic diversity both within and among species. Aquaculture is practiced by both some of the poorest farmers in developing countries and by multinational companies.

Eating fish is part of the cultural tradition of many people and in terms of health benefits, it has an excellent nutritional profile. It is a good source of protein, fatty acids, vitamins, minerals and essential micronutrients. Aquatic plants such as seaweed are also an important resource for aquaculture as they provide nutrition, livelihood and other important industrial uses. Eighty percent of current aquaculture production is derived from animals low in the food chain such as herbivorous, omnivorous fish and mollusks. Based on its dynamic performance over the last 30 years, and with fairly stable catches from capture fisheries, it is likely that the future growth of the fisheries sector will come mainly from aquaculture.

The world's population is estimated to reach 9.7 billion by 2050 from its current level of 7.3 billion; with most of the increase, occurring in developing countries. It is estimated that food production will need to rise approximately 70–100 % from the current production level by 2050. Currently representing 20% of all animal protein supply, fish will be a prominent future contributor to global food and nutrition security. Global demand for seafood continues to rise, driven by population growth, higher incomes, urbanization, growing international fish trade and increasing relative preference for seafood protein. Preliminary estimates for 2015 showed that global annual per capita fish consumption reached a new record high of more than 20 kg.

Table 3 – 2015 world aquaculture production by continent by main species group (thousand tonnes in live weight)

INLAND AQUACULTURE	Africa	Americas	Asia	Europe	Oceania	WORLD
1. Finfish	1 749 712	1 017 534	41 849 837	475 253	5 013	45 097 349
2. Crustacea	17	63 954	2 792 441	51	162	2 856 625
3. Molluscs		0	283 744			283 744
4. Other aquatic animals		531	521 106	0		521 637
Sub-total	1 749 729	1 082 019	45 447 128	475 304	5 175	48 759 355
MARINE AND COASTAL AQUACULTURE	Africa	Americas	Asia	Europe	Oceania	WORLD
1. Finfish	15 152	1 003 191	3 855 936	1 863 068	72 775	6 810 121
2. Crustacea	3 716	722 869	3 761 188	259	6 693	4 494 725
3. Molluscs	3 769	465 296	14 946 627	636 520	96 032	16 148 245
4. Other aquatic animals	25		381 831	8	5 593	387 456
Sub-total	22 662	2 191 356	22 945 582	2 499 855	181 093	27 840 547
TOTAL AQUACULTURE	Africa	Americas	Asia	Europe	Oceania	WORLD
1. Finfish	1 764 864	2 020 726	45 705 773	2 338 320	77 788	51 907 471
2. Crustacea	3 733	786 823	6 553 629	310	6 854	7 351 350
3. Molluscs	3 769	465 296	15 230 371	636 520	96 032	16 431 989
4. Other aquatic animals	25	531	902 936	8	5 593	909 093
TOTAL	1 772 391	3 273 375	68 392 710	2 975 159	186 268	76 599 902

Note: Several rows and columns may not add up to the total due to rounding.

Until the middle of the last century, the world's oceans were an almost inexhaustible source of high quality fish protein. Since then, the combination of human population pressure and technological progress in securing this resource has dramatically reduced the general availability of fishery resources. For the first time in human history, farmed fish production has outpaced wild capture fisheries in seafood destined for human consumption (World Bank, 2014). Seafood is a critical component of our diets, comprising one-sixth of global animal source food consumption (FAO, 2014). With rapid human population growth, looming food insecurity (Godfray et al., 2010), and declining marine and freshwater fish stocks affecting food and nutrition security (Golden et al., 2016; McIntyre et al., 2016), aquaculture is a potential solution for cheaply and easily providing animal source foods to poor and food-insecure populations around the world (Kobayashi et al., 2015).

Table 4: World top producers by selected measurements of aquaculture productions
(Unit: tonnes, live weight)

Top-10 producers: finfish – inland aquaculture			Top-10 producers: finfish – mariculture		
China	24 817 311	60.1%	Norway	1 245 399	21.6%
India	4 148 407	10.0%	China	1 123 576	19.4%
Indonesia	2 459 418	6.0%	Chile	736 310	12.7%
Viet Nam	2 369 903	5.7%	Indonesia	720 545	12.5%
Bangladesh	1 647 827	4.0%	Philippines	375 735	6.5%
Egypt	1 091 688	2.6%	Japan	242 905	4.2%
Myanmar	869 384	2.1%	United Kingdom	156 220	2.7%
Thailand	467 249	1.1%	Greece	124 740	2.2%
Brazil	388 700	0.9%	Canada	122 024	2.1%
Philippines	318 798	0.8%	Turkey	110 845	1.9%
Others	2 713 481	6.6%	Others	820 088	14.2%
WORLD	41 292 167	100%	WORLD	5 778 387	100%

Aquaculture now supplies half of the fish consumed directly by humans. Fish are beneficial to nutrition and health and will play an essential role in sustaining healthy diets (where culturally appropriate) in the future. Current levels of wild capture fisheries are unsustainable and declining. Aquaculture is a key component of closing the distance between demand and supply.

Sustainability

The term sustainability, although popular, is not particularly meaningful or valuable until the indicators—such as level of harvest, effluent discharge, feed use, or profit—are defined. Zero production may be sustainable, but not interesting or relevant. Sustainable aquaculture is aquaculture that is economically sustainable. That is, over the relevant time horizon, the present value of the industry after-tax profits is greater than zero. Once established, the expected after tax profits are greater than zero year after year, and the industry can manage its resources to absorb all exogenous shocks. All the other “sustainabilities” (environmental sustainability, sociopolitical sustainability, and others) are not relevant unless there is the possibility of economic sustainability.

Indicative General Relevance of Sustainable Development Goals to Aquaculture Development

A core vision of the post-2015 development agenda is a “healthy life for all” in a world where everyone consumes food that is “affordable and nutritious” (United Nations, 2015). Several of the Sustainable Development Goals (SDGs) (No. 2 and No. 14 in particular) speak to the importance of supporting consumer choice and enhanced nutrition by promoting agricultural productivity among small-scale producers and supporting links between local and global markets. Those goals focus on the importance of sustaining food production, on the one hand, and on securing year-round access to diverse foods, on the other.

Sustainable Development Goals



Global Sustainability Indexes and Criteria

There are many global criteria for sustainability that are used by organizations and profit-seeking investors, such as the

- Dow Jones Sustainability Indexes,
- The Ethibel Sustainability Index,
- Ethical Global Index, FTSE4Good Global 100 Index,
- Humanix 200 Global,
- Ethinvest Environmental Index Australia,
- Jantzi Social Index Canada,
- Johannesburg Stock Exchange/FTSE4Good Index South Africa, and the Humanix 50 Index Sweden.

TABLE. COMPARISON OF SUSTAINABILITY INDICATORS AMONG ANIMAL PROTEIN PRODUCTION SYSTEMS

	Food conversion (kg feed/kg edible weight)	Protein efficiency (%)	N emissions (kg/ton protein produced)	P Emissions (kg/ton protein produced)	Land (tons edible product/ha)	Consumptive freshwater use (m ³ /ton)
Beef	31.7	5	1,200	180	0.24–0.37	15,497
Chicken	4.2	25	300	40	1.0–1.20	3,918
Pork	10.7	13	800	120	0.83–1.10	4,856
Finfish (average)	2.3	30	360	48	0.15–3.70	5,000*
Bivalve mollusks	not fed	not fed	-27	-29	0.28–20.00	0

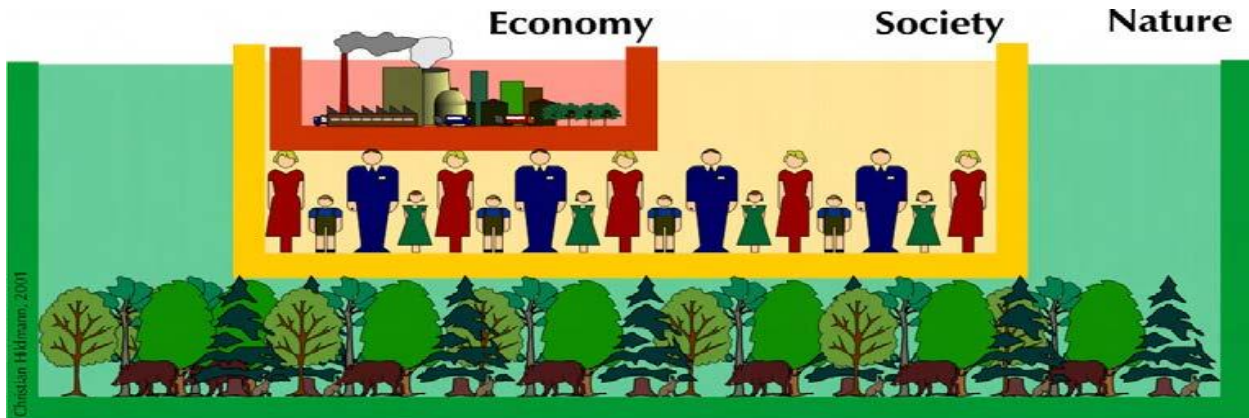
*Note: Consumptive use is difficult to compare across the wide spectrum of aquaculture production systems. In the vast majority of cases, water outfalls from aquaculture are much cleaner and more easily recycled than for land animals.

Source: Phillips, Beveridge, and Clarke 1991; FAO 2003; Hall et al. 2011; Bouman et al. 2013.

Many of the indices' criteria are related, but are written with specific emphasis on various sustainability issues. In many cases the various criteria appear vague for organizations to use in developing their corporate sustainability plans.

Sustainability is referenced by environmentalists as;

- ecological sustainability and by many in the business community as;
- economic sustainability, whereas sociologists reference it as
- social sustainability.



In case of Aquaculture, Sustainability

Environmental sustainability- Aquaculture should not create significant disruption to the ecosystem, or cause the loss of biodiversity or substantial pollution impact. Economic sustainability -Aquaculture must be a viable business with good long-term prospects. Social and community sustainability- Aquaculture must be socially responsible and contribute to community well-being.

Defining Sustainable Aquaculture

What is aquaculture? What is sustainability? Here are some necessary and appropriate definitions:

Sustainability: “Keep in existence; keep up; maintain” (Webster’s New World Dictionary 2005).

Aquaculture: “The propagation and rearing of aquatic organisms in controlled or selected environments, including, but not limited to ocean ranching” (U.S. National Aquaculture Act of 1980, Public Law 96-362, Stat. 1198, 16 U.S. Code 2801).

Aquaculture: “The husbandry of aquatic animals and plants” (NRC 1992).

Husbandry: “1. Agriculture. 2. Careful management or conservation of resources” (American Heritage Dictionary 2002).



Approaches for Sustainable Growth of Aquaculture

1. Investing in new technologies
2. Reduce dependency on ocean caught fish as feed
3. Focus on the environmental impacts beyond individual farms
4. Reward sustainable farming
5. Eat sustainable seafood

Key Messages

- Aquaculture is among the most sustainable of animal protein production systems.
- Growth of aquaculture is needed to meet employment and food security targets in developing countries.
- Investment risk co-varies with environmental risk to influence sustainability.
- Existing certification standards do not effectively address ecosystem sustainability.
- Priorities of local communities should inform target setting for employment and conservation.
- Locally adapted aquaculture zone management can reduce environmental and investment risk.

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The Effects of Bentonite and Copper Application on Water Quality Criteria of Rainbow Trout (*Oncorhynchus mykiss*)

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Abstract: In this study, samples of ammonia-nitrogen from water quality parameters were taken every two weeks for trout fed on 8 different doses of feed containing copper and / or bentonite. At the end of the study, the lowest NH₃-N value was found to be in the control group (A1) 115-130 days, with the highest NH₃-N value 0,08 ± 0,01 mg / It was detected in 45 days. During the study, pH, temperature and dissolved oxygen value were measured daily. The change of all three parameters by groups and days was statistically insignificant. In the samples taken from the experiment, the lowest value of copper concentration was measured as 0.00 ± 0.00 ppb in the first and second months in all groups. The highest values were 0,59 ± 0,02 ppb for A1 group, 1,37 ± 0,041 ppb for A2 group, 0,65 ± 0,05 ppb for A3 group, 1,50 ± 0,04 ppb for A4 group, 0,81 ± 0,03 ppb for group A5, 2,19 ± 0,05 ppb for group A6, 2,16 ± 0,05 ppb for group A7, 1,92 ± 0,04 ppb for group A8 and group A9 and 0.94 ± 0.01 ppb for 120 days.

Keywords: Bentonite, Rainbow trout, Water quality parameter

1.INTRODUCTION

Today, most of the feeds used for fish farming are largely derived from animal products such as fish oil. These feeds, which are largely digested by fish, are very important raw material as it include essential amino acids, essential fatty acids, energy and minerals (Glencross 2009). Most of the protein sources used in fish feed consist of fish and fish parts obtained by fishing. These raw material' price is high, so that search for alternative raw materials has been accelerated.

Bentonite, a clay from the montmorillonite group, is naturally found in Mg (II), Ca (II), Na (I), aluminum oxide and silicon oxide forms. The calcium bentonite protein, which is less swollen in water, is less adsorptive in its properties. According to calcium bentonite, sodium bentonite swells better in water and has higher potential for adsorbing substances in protein structure (Boulton et al., 1996). Natural bentonite is one of the most commonly used adsorbents for removal of heavy metals due to its high chemical and mechanical stability, easy availability and low cost.

Bentonite is used both in animal feed pelleting operations and as an animal feed supplement for a long time (Eya et al., 2008). Bentonite had been shown to positive effects on growth parameters in different studies (Walz. et al., 1998). However. in one study was reported that there was no beneficial biological effect on rainbow trout (Reinitz. 1984). In another study. it was found that there was no effect on growth rates of bentonite up to 40% in steelhead trout diets (Smith, 1987). It has been reported that the toxic effect of bentonite is low and the 96 hour LC₅₀ value for rainbow trout was 19 µg/L⁻¹ (Spehar et al., 1980).

2.MATERIALS AND METHODS

The project carried out Atatürk University Faculty of Fisheries Toxicology Trial Unit between December 2016 and April 2017. 900 rainbow trout with average weights of 15 ± 2 gr were distributed to tanks randomly. After the acclimatization period, fish were fed with copper and bentonite feed for 4 months, 4 times daily (Table 1).

Table 1. Groups and contents

Groups	Contents
A1	0 mg Cu/kg+ %0 Bentonite
A2	0 mg Cu/kg+ %1 Bentonite
A3	0 mg Cu/kg + %2 Bentonite
A4	500 mg Cu/ kg + %0 Bentonite
A5	500 mg Cu/ kg + %1 Bentonite
A6	500 mg Cu/ kg + %2 Bentonite
A7	1000 Cu/ kg + %0 Bentonite
A8	1000 Cu/ kg + %1 Bentonite
A9	1000 Cu/ kg + %2 Bentonite

Water temperature, dissolved oxygen and pH value were measured daily by YSI model multiparameter during the experiment.

The ammonia-nitrogen specification was determined according to the Nesslerisation method. In this method, the color intensity of the yellow color of the Nessler reagent was measured at 410 nm in the spectrophotometer (Anonymous 1995).

Urea-nitrogen technique was analyzed by colorimetric diacetyl monooxy method (Lauff and Wood, 1996). The copper value in the water was determined monthly in the ICP-MS device at Atatürk University Eastern Anatolia Advanced Technology Application and Research Center (DAYTAM).

One-Way (ANOVA) test using IBM SPSS20 was applied to statistical analyzes of water temperature, dissolved oxygen, pH, ammonia-nitrogen and copper values. The difference was evaluated according to the DUNCAN test.

3.RESULTS AND DISCUSSION

During the study, pH, temperature and dissolved oxygen values were measured daily. The change of all three parameters according to groups and days was statistically insignificant ($p>0,05$). The means value of water temperature in these groups was measured 10.35 ± 0.05 °C. The lowest and highest pH values of groups were found to be 7.62 ± 0.05 and 7.93 ± 0.03 , respectively. Dissolved oxygen concentration was changed among 6.15 ± 0.57 mgL⁻¹ to 8.11 ± 0.15 mgL⁻¹. The data for the parameters are given in table 2, 3 and 4.

Table 2. Change in water temperature (°C) depending on days and groups (mean±SD) in trout fed with different doses of copper and bentonite feed

Day Groups	0-15	15-30	30-45	45-60	60-75	75-90	90-115	115-130
A1	10.05±0.35	10.65±0.65	10.20±0.10	10.55±0.15	10.40±0.01	10.45±0.05	10.70±0.50	10.70±0.50
A2	9.50±0.30	10.25±0.35	10.20±0.30	10.40±0.10	10.45±0.05	10.40±0.10	10.45±0.25	10.45±0.25
A3	9.65±0.05	10.2±0.10	10.30±0.30	10.50±0.30	10.55±0.15	10.45±0.25	10.40±0.10	10.40±0.10
A4	9.85±0.25	10.15±0.05	10.50±0.20	10.65±0.25	10.60±0.30	10.70±0.40	10.35±0.05	10.35±0.05
A5	9.65±0.25	10.25±0.15	10.10±0.10	10.25±0.05	10.15±0.05	10.25±0.05	10.40±0.20	10.40±0.20
A6	10.25±0.25	10.2±0.30	10.15±0.05	10.15±0.05	10.10±0.01	10.15±0.05	10.60±0.40	10.60±0.40
A7	10.20±0.20	9.75±0.05	10.25±0.15	10.25±0.15	10.35±0.25	10.25±0.15	10.10±0.01	10.10±0.00
A8	10.10±0.09	9.70±0.00	10.60±0.50	10.80±0.50	10.95±0.65	10.15±0.05	9.95±0.05	9.95±0.05
A9	9.80±0.10	9.80±0.20	10.50±0.50	10.45±0.25	10.55±0.35	10.30±0.10	10.40±0.10	10.40±0.10

Table 3. The change of pH value depending on days and groups in the experiment of trout fed with different doses of copper and bentonite (mean±SD)

Day Groups	0-15	15-30	30-45	45-60	60-75	75-90	90-115	115-130
A1	7.72±0.13	7.65±0.04	7.67±0.04	7.69±0.02	7.74±0.01	7.93±0.03	7.83±0.05	7.67±0.08
A2	7.57±0.02	7.64±0.02	7.69±0.02	7.71±0.04	7.75±0.03	7.92±0.03	7.82±0.04	7.68±0.04
A3	7.62±0.06	7.64±0.01	7.71±0.01	7.78±0.01	7.80±0.07	7.93±0.02	7.83±0.06	7.67±0.04
A4	7.62±0.05	7.66±0.01	7.76±0.02	7.71±0.04	7.75±0.04	7.89±0.01	7.77±0.05	7.69±0.02
A5	7.57±0.25	7.66±0.0	7.75±0.03	7.73±0.04	7.76±0.02	7.90±0.01	7.77±0.01	7.71±0.01
A6	7.55±0.03	7.71±0.05	7.74±0.02	7.76±0.06	7.73±0.02	7.90±0.01	7.83±0.05	7.76±0.02
A7	7.56±0.02	7.74±0.01	7.64±0.04	7.67±0.00	7.71±0.01	7.88±0.02	7.75±0.01	7.75±0.03
A8	7.55±0.01	7.77±0.03	7.67±0.10	7.75±0.03	7.87±0.01	7.96±0.05	7.83±0.05	7.74±0.02
A9	7.56±0.01	7.70±0.01	7.16±0.50	7.72±0.02	7.85±0.01	7.89±0.05	7.78±0.04	7.68±0.01

Table 4. Change in dissolved oxygen (DO) value in the trout fed with different doses of copper and bentonite diet depending on days and groups (mean±SD) (mgL⁻¹)

Day Groups	0-15	15-30	30-45	45-60	60-75	75-90	90-115	115-130
A1	6.54±0.05	7.85±0.14	7.61±0.15	7.72±0.25	7.29±1.00	7.70±0.40	6.87±0.83	8.11±0.15
A2	6.46±0.03	7.17±0.21	7.05±0.73	7.81±0.60	7.37±0.73	7.94±0.20	6.83±0.92	7.28±0.19
A3	6.40±0.09	6.64±0.55	7.40±0.65	7.66±0.10	7.94±0.49	7.89±0.40	7.01±1.12	7.61±0.15
A4	6.42±0.10	6.53±0.51	7.69±0.44	7.28±0.61	6.65±0.23	7.45±0.55	6.93±0.76	7.05±0.73
A5	6.39±0.03	6.62±0.60	7.78±0.77	7.00±0.95	7.10±0.66	7.68±0.14	6.64±0.04	7.40±0.65
A6	6.38±0.01	6.99±0.74	7.77±0.74	7.13±0.11	7.27±0.69	7.74±0.36	7.25±0.47	7.69±0.44
A7	6.33±0.04	7.62±0.18	7.74±0.66	6.15±0.57	6.77±0.60	7.47±0.26	6.45±0.49	7.78±0.77
A8	6.43±0.06	7.77±0.10	6.43±0.59	8.32±0.06	8.42±0.06	8.05±0.00	7.19±0.41	7.74±0.03
A9	6.42±0.17	6.90±0.40	8.12±0.11	7.87±0.55	7.62±0.72	7.88±0.24	6.25±0.29	6.43±0.21

In this study, samples of ammonia-nitrogen from water quality parameters were taken every two weeks for trout fed on 8 different doses of feed containing copper and / or bentonite. The change of ammonia-nitrogen parameters according to groups, and days was statistically insignificant ($p > 0.05$). The lowest NH₃-N value was found in the control group 115-130 days, with the highest value NH₃-N value 0.08 ± 0.01 mg / It in the A1 group (Table 5).

Table 5. Alternations in the ammonia-nitrogen (NH₃-N) concentration of the waters in the trout fed with different doses of copper and bentonite, depending on the days and groups (mean±SD) (mgL⁻¹)

Day Groups	0-15	15-30	30-45	45-60	60-75	75-90	90-115	115-130
A1	0.47±0.06 ^{a*}	0.47±0.06 ^a	0.41±0.13 ^a	0.15±0.04 ^b	0.09±0.03 ^b	0.10±0.02 ^b	0.18±0.08 ^b	0.08±0.01^b
A2	0.38±0.05 ^a	0.38±0.05 ^a	0.68±0.44^a	0.18±0.09 ^b	0.11±0.05 ^b	0.15±0.06 ^b	0.25±0.08 ^b	0.10±0.05 ^b
A3	0.34±0.02 ^a	0.34±0.03 ^a	0.17±0.01 ^b	0.12±0.03 ^b	0.13±0.01 ^b	0.10±0.01 ^b	0.12±0.03 ^b	0.15±0.06 ^b
A4	0.45±0.03 ^a	0.45±0.03 ^a	0.19±0.09 ^b	0.16±0.04 ^b	0.07±0.01 ^b	0.09±0.01 ^b	0.16±0.04 ^b	0.10±0.01 ^b
A5	0.55±0.03 ^a	0.55±0.03 ^a	0.18±0.04 ^b	0.20±0.02 ^b	0.12±0.01 ^b	0.11±0.02 ^b	0.20±0.02 ^b	0.09±0.01 ^b
A6	0.46±0.05 ^a	0.43±0.02 ^a	0.23±0.03 ^b	0.19±0.02 ^b	0.11±0.02 ^b	0.15±0.01 ^b	0.19±0.02 ^b	0.11±0.05 ^b
A7	0.39±0.06 ^a	0.39±0.05 ^a	0.13±0.28 ^b	0.15±0.01 ^b	0.10±0.01 ^b	0.17±0.01 ^b	0.15±0.00 ^b	0.05±0.01 ^b
A8	0.39±0.04 ^a	0.42±0.07 ^a	0.20±0.04 ^b	0.09±0.03 ^b	0.17±0.02 ^b	0.12±0.07 ^b	0.09±0.03 ^b	0.07±0.03 ^b
A9	0.44±0.05 ^a	0.47±0.08 ^a	0.20±0.05 ^b	0.11±0.01 ^b	0.18±0.03 ^b	0.15±0.05 ^b	0.13±0.00 ^b	0.11±0.01 ^b

a.b.c.d .: Lower case letters are statistically significant ($p < 0.05$)

The change of copper value according to groups, and days was statistically insignificant ($p > 0.05$). In the samples taken from the experiment, the lowest value of copper concentration was measured as 0.00 ± 0.00 ppb in the first and second months in all groups. The highest values were 0.59 ± 0.02 ppb for A1 group, 1.37 ± 0.04 ppb for A2 group, 0.65 ± 0.05 ppb for A3 group, 1.50 ± 0.04 ppb for A4 group, 0.81 ± 0.03 ppb for group A5, 2.19 ± 0.05 ppb for group A6, 2.16 ± 0.05 ppb for group A7, 1.92 ± 0.04 ppb for group A8 and group A9 and 0.94 ± 0.01 ppb for 120 days (Table 6).

Table 6. Alternations in copper (Cu) value in the water of trout fed with different doses of copper and bentonite diet depending on days and groups (mean±SD) (ppb)

Day Groups	0	30	60	120
A1	0.00±0.00 ^{a*}	0.00±0.00 ^a	0.17±0.01 ^b	0.59±0.02 ^b
A2	0.00±0.00 ^a	0.00±0.00 ^a	0.65±0.02 ^b	1.37±0.04 ^b
A3	0.00±0.00 ^a	0.00±0.00 ^a	0.45±0.03 ^b	1.65±0.05 ^b
A4	0.00±0.00 ^a	0.00±0.00 ^a	0.52±0.04 ^b	1.50±0.04 ^b
A5	0.00±0.00 ^a	0.00±0.00 ^a	0.07±0.01 ^b	0.81±0.03 ^b
A6	0.00±0.00 ^a	0.00±0.00 ^a	0.18±0.01 ^b	2.19±0.05 ^b
A7	0.00±0.00 ^a	0.00±0.00 ^a	0.19±0.01 ^b	2.16±0.05 ^b
A8	0.00±0.00 ^a	0.00±0.00 ^a	0.24±0.01 ^b	1.92±0.04 ^b
A9	0.00±0.00 ^a	0.00±0.00 ^a	0.72±0.02 ^b	0.94±0.01 ^b

a.b.c.d .: Lower case letters are statistically significant ($p < 0.05$)

Discussion:

In this study, the difference between pH, temperature and dissolved oxygen values was not statistically significant ($p > 0.05$). The amount of urea was measured too low level.

During the study, while the $\text{NH}_3\text{-N}$ value did not differ among the groups, the difference between the values in different days in the same group was statistically significant ($p < 0.05$). The mean $\text{NH}_3\text{-N}$ values of the groups (A1, A2, A3, A4, A5, A6, A7, A8, A9) were 0.25 mg / L, 0.27 mg / L, 0.21 mg / L, 0.23 mg / L, 0.19 mg / L, 0.19 mg / L and 0.20 mg / L, respectively. These values were above the limit values (0.1 mg / L) given for trout culture. It has been reported that the high value of ammonia value in cultivation may be due to the intensive stocking of fish or feeding with high protein containing feed (Pulatsu and Topcu, 2012). During the trial, the $\text{NH}_3\text{-N}$ value between 0-30 was detected high and decreased after 45 days. This can be explained by the decrease in stock density. In this study, the copper value was measured once a month. While the copper value did not differ between the groups, it was statistically significant ($p < 0.05$) between the monthly samples. At the beginning of the experiment and at the end of the first coin no copper element was found in the water. It was detected in all groups at the end of the third month. The copper value was determined to be below the limit value (0.006 mg/L) for trout cultivation (Pulatsu and Topcu, 2012).

In this study, the copper value in the water was measured once a month. While the copper value did not differ between the groups, it was statistically significant ($p < 0.05$) among the samples monthly. At the beginning of the experiment and at the end of the first period; no copper element was found in the water. It was detected in all groups at the end of the third month. The copper value was determined to be below the limit value (0.006 mgL^{-1}) for trout cultivation (Pulatsu and Topcu, 2012).

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Feed Alternatives for Ornamental Fish

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Abstract: Aquarium fish breeding has spread all over the world as well as in our country. Thanks to its high adaptability, fish grown almost everywhere have quickly become the focus of people's attention. After economic development, people have begun to grow aquarium fish for stress, for interior design, or other reasons such as responsibility awareness for children. Ornamental fish whose homeland is not our country. They come as imports goods and we pay severely according to fish species. Especially the fish which are rare or have different qualities are sold at high prices. So much so that the museum-shaped aquarium complexes were built in the big cities and they were seen.

It is also important to feed the aquarium fish, which is part of our life. Particularly suitable for mouth structure and high protein value feeds should be preferred for growing offspring. Nutrient elements that are necessary for coloration, health status, development of immune systems, and good reproductive performance should not be forgotten. Large amounts are paid to these imported goods and cause economic losses. In this research, some of the affordable and high nutrient alternative live baits (especially the cultivation is easy and feasible) that can be used in the feeding of aquarium fish will be explained. These nutrient sources are both cheap and easily obtainable species. Such as *daphnia magna*, white worm, *artemia salina*, sea monkey fresh water mussels, some crustaceans etc.

Keywords: Ornamental fish, fish feed, live feed, crustacea, aquarium.

1. INTRODUCTION

Ornamental fish trade is important sector in all over the world (Winfree, 1989). Trade of aquarium fish is a million dollar business which includes a lot of countries. They are an important output of overseas benefit for many rustic communities in Africa, South America and South East Asia etc. Lots of types of aquarium fish (commonly, poeciliids, guppy and cichlids etc.) are kept by hobbyists. Largest part of the aquarium fish industry is the freshwater aquarium fish sector (Helfman, 2007).

In addition these, internet trade in ornamental species via online buyers are getting popular (Kay and Hoyle 2001, Padilla and Williams 2004)

Although it has many good contributions, the ornamental fish trade may have adverse effects as a result of the introduction of nonnative species and spread of different agents as over priced feeding/breeding and diseases.

Prior to 1980, it was observed that only a small number of individuals from abroad and imported aquarium fish from abroad were imported as a study, and it was an important sector in this regard.

On the other hand, it is obvious that this issue is too late when considering that tropical fish species in Europe started to be introduced after 1950s.

Our aim is to make it easier for people to feed the appropriate feed for their own aquarium fish and to reduce costs and diseases to a minimum.

2. MATERIALS AND METHODS

In our research, some of the live baits suitable for the feeding and development of aquarium fish will be explained. White worm, *daphnia magna*, *artemia salina*, sea monkey species will be given information about their cultivation.

Atatürk University, aquarium fish application and research center grown live feeds, cheap and easy to grow because they are remarkable. Some are extracted from eggs and some are produced directly. The production of water fleas, white wolves and freshwater crustaceans is very easy and there is information about how to produce them almost everywhere.

In addition to these, alternative feeds with more nutritive properties will be mentioned. It is thought that aquarium enthusiasts will contribute to cheaper and healthier fish production.

Trade data on the internet for these researches have also been examined. For this purpose blog comments and the thoughts of aquarium lovers are also taken into consideration.

3.RESULTS AND DISCUSSION

International trade provides vastly expanded opportunities for species to be carry to new places through a wide range of paths. Those lessepsian species for ornamental purposes may have serios negative effects on the new habitat and native species as well. For example disease trasnfer, consupion of fish eggs, reduction of fish stocks, consupion of large amounts of macophytes, direct and indirect effects on other aquatic species (Ploeg, 2008).

It is important that the fishes imported routes are cheaper and survive for a longer time. They must be healthy for this and should be fed with cheap and quality food. In this study, some cheap and high quality live feeds and their cultivation tecniques which can be alternative in the feeding of aquarium fish are explained. In this respect, aquarium fish lovers are more conscious and will be able to contribute to their economies.

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Mushroom Cultivation Facilities in Aquaponics System

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Abstract: Aquaponic systems are based on the co-existence of fish, plant and nitrification bacteria in the same system, in other words on the production of animal and vegetable products that people can consume via these three live things to benefit from each other in a way. Aquaponic systems that allow intensive production by integrating hydroponics agriculture crops into fish breeding, provide fish production, an important part of human nutrition, and the production of organic vegetable food at high quality at the same time. In this way, these systems also contribute to the reduction / rehabilitation of nutrient waste and / or waste as well as providing more efficiency from the unit area. On the other side, mushrooms in plant group with high nutritional value are also very important in human nutrition. Natural medicine mushrooms are excellent sources of nutrients, including vitamins (B complex), minerals (copper, potassium), enzymes, antibiotics, hormones and antioxidants as well as protein. For this reason, in this study, it is aimed to obtain information about the production of oyster mushroom (*Pleurotus ostreatus*) and king mushroom (*Pleurotus eryngii*) in aquaponics system. In trial, tilapia was used as fish source. The mushroom mycelium were inoculated on hydrotone bed and covered over. Mycelium growth was very rapid in both mushrooms species in the experiment and their winding the bed material hydrotone took quite a short time. Oyster mushrooms and king mushrooms achieved harvest size in 13 days and in 15 days respectively. Nevertheless, in the later period green mould or olive colour mould on the mycelium took place and the growth of mycelium was observed to halt. This disease was estimated to be contaminated by water in fish tanks.

Keywords: Aquaponics systems, mushrooms, myceliums, green mould, nitrification bacteria.

1.INTRODUCTION

The word of “aquaponics” is formed by combining two other words: aquaculture (fish breeding) and hydroponic (plant breeding without soil). It refers to a kind of recirculating cultivation system where aquaculture is integrated with plants used in hydroponic systems (Chalmers, 2004; Rakocy et al., 2006; Somerville et al., 2014).

Besides fish and plants defined in the aquaponic system, there is also third living organism, nitrification bacteria. Nitrification bacteria play a critical role in the nutrient cycle since the system would stop running without them. Nitrification bacteria lead to the conversion of ammonia formed by the wastes of fish and nutrition to nitrite and then nitrate to be used by plants. In other words, the system is based on the mutual benefit of three organisms from each other. Thus, it is possible to grow animal and vegetable products for human consumption. This aspect has encouraged the researchers to study on this subject (Rakocy et al., 2006; Diver, 2000; Lennard, 2004; Nelson, 2008; Somerville et al., 2014).

Nutrient film technique (NFT) and the bench bed hydroponic systems or media based systems are most common used in hydroponic systems and also adapted to aquaponics systems. Another system is deep water or floating raft method. It is suitable for plants like lettuce crops (Resh 2013; Tyson et al., 2013).

Although there have been many researches on the cultivation of various plants in aquaponic systems up to the present, the studies on the production of culture mushrooms have been carried out by aquaculture method using only perlite, volcanic tuff and peat substrates (hydroponics) (Aksu, 1999; Bechara, et al., 2006). In other words, no study has been done on culture mushroom cultivation in the aquaponics system yet. However, aquaponics system may have the potential to cultivate culture mushrooms according to the authors of this study.

Whereas more than 200 mushrooms species have been used for the purpose of nutrition (Kalac, 2013), approximately 35 species have been commercialized (Sadler, 2003; Aida et al., 2009). Since ancient era, they have been regarded as one of the most delicious food and consumed commonly. They are sources of rich carbohydrates with protein, amino acids and vitamin contents (Sadler, 2003; Madbouly and Al-Hussainy, 1996; Xu et al., 2011).

Due to their considerable importance in the human nutrition, they are recommended for developing countries as a good quality protein source (Croan, 2000; Zervakis et al., 2001; Alananbeh, et al., 2014). Some researchers point out that they can contribute to the compensation of protein deficit in these countries (Dunkwal et al., 2007).

In addition, mushrooms make it possible to evaluate agro-industrial wastes leading to many health and environmental problems (Garg and Gupta, 2009; Khan et al., 2012).

Their grown environments include straws, crusts, sawdust, leaves and other agro-wastes (Chang, 1989). Besides these materials, perlite, volcanic tuff and peat are also used as mushroom substrates (Aksu, 1999; Bechara et al., 2006).

The aim of this research is to acquire information on the production of cultured mushrooms, oyster mushroom (*Pleurotus ostreatus*) and king mushroom (*Pleurotus eryngii*) in the aquaponics system.

2. MATERIALS AND METHODS

In the study, tilapia (*O. aureus*) fry were used as fish material and stocked at 50 kg/m³ in the aquaponics system. The fish were fed with a trout diet of 45% protein at 2% of their body weight for 90 days (Table 1). The fish were not subjected to any treatment.

Table 1. Amount of nutrients used in the experiment

Nutrient quantities (%)	
Protein %	45,0
Fat %	20,0
Moisture %	8,5
Ash %	11,0
Cellulose %	3,0
NFE %	12,5
Phosphorus %	1,5
GE (Gross energy) kcal/kg	5124
DE (Digestible energy) kcal/kg	4125
ME (Metabolizable energy) kcal/kg	3742
DP/DE g/MJ	22,15
Vitamin A IU/kg	5.000
Vitamin D IU/kg	1.500
Vitamin E IU/kg	100
Vitamin K IU/kg	20

The experiment was carried out in three replication random blocks (Table 2).

Table 2. Trial plan of research

Group	Replications	Stock quantities kg/m ³	Number of fish (piece)	Trial period (day)
I	1.1	50	7	90
	1.2	50	7	90
	1.3	50	7	90
	2.1	50	7	90
II	2.2	50	7	90
	2.3	50	7	90

Each of the experimental groups was designed as a separate closed circulation system. Temperature was equalized in each group. A blower was used for ventilation. The temperature and oxygen values were measured daily. In the experiment, 6 aquariums of 95x30x40 cm were used and media based system / the bench bed hydroponic systems was organized. In the system, 60x40x30 cm plastic tanks were used for the beds where mushrooms were placed. Hydrotone as a plant bed and the BioDigest (French brand) as nitrification bacterial culture was used.

Aquarium type water pumps capable of providing 400 litres/hour for water circulation were utilized. The amount of water in the aquarium was adjusted as to be 50 litres considering the fish stocking density. Chlorine-free water was used. Marble in gravel size was used to regulate pH. The average water quality parameters in the aquariums are given in Table 3. Daily water change was by 2%. No artificial light source was used.

Table 3. Average water quality parameters in aquariums during the trial

Temperature (°C)	pH	Oxygen (mg/l)	NH ₄ (mg/l)	NO ₂
25.57 ± 0.236	6.95 ± 0.228	6.70 ± 0.212	0.73 ± 0.422	0.245 ± 0.178

In the experiment, miscellaneous of oyster mushroom (*Pleurotus ostreatus*) and king mushroom (*Pleurotus eryngii*) obtained from the Atatürk Horticultural Central Research Institute were used. Before the mushroom mycelium were inoculated on hydrotone, the hydrotone were treated for 30 minutes at 10% commercial sodium hypochlorite, then rinsed with boiled water.

3.RESULTS AND DISCUSSION

The mushroom mycelium was inoculated on hydrotone bed and covered over. Mycelium growth was very rapid in both mushrooms species in the experiment and their winding the bed material hydrotone took quite a short time. Oyster mushrooms and king mushrooms achieved harvest size in 13 days and in 15 days respectively (Figure 1). Nevertheless, in the later period green mould or olive colour mould on the mycelium took place and the growth of mycelium was observed to halt. This disease was estimated to be contaminated by water in fish tanks.



Figure 1. The developments of oyster mushroom (*Pleurotus ostreatus*) and king mushroom (*Pleurotus eryngii*) in aquaponics system

The studies on the production of culture mushrooms in hydroponics systems were conducted by aquaculture method using only perlite, volcanic tuff and peat substrates (Aksu, 1999; Bechara et al., 2006). Considering aquaponics systems constituted by integrating hydroponics systems into aquaculture, it is also realized that mushroom production in aquaponics systems has a great potential. For this purpose, it should be necessary to conduct further studies to define

- Hygienic conditions for the appropriate development of mushrooms in aquaponic systems
- The production possibilities of other mushrooms' species,
- The yield and quality of mushrooms species in the aquaponic systems,

It is expected that the results of this research will make significant contributions to the researches to be conducted later.

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The Effect of Rosehip Seed Supplementation into Laying Hens Diets on Performance, Egg Quality Traits, Yolk Lipid Profile and Serum Parameters

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Abstract: This study was carried out to determine the effect of dietary rosehip seed (RS) supplementation into layer diets at different levels on performance, egg quality traits and some serum parameters. A total of 72 Lohmann layers, 46 weeks old, were divided into three treatment groups, each of which included six cages, each of which housed four hens. The control group was fed with commercial layer diet (K), and the other two groups were fed with basal diet + 10% ground rosehip seeds (K1) and basal diet + 15% ground rosehip seeds (K2) for 12 weeks. The water and feed were provided as ad-libitum during the trial. The rosehip seed supplementation level at 15% into layer diets increased the feed consumption and egg yield ($p < 0.05$), and decreased the damaged egg ratio. Though some egg quality traits such as the yolk colour, shell thickness and shell weight increased ($p < 0.05$) in eggs from K2 group, there were no significant differences ($p > 0.05$) among the groups in respect to other egg quality traits such as shape index, shell strength, albumen and yolk indexes and Haugh unit values. Total cholesterol, cholesterol esters, free fatty acids and triglyceride contents in the egg yolks from treatment groups were not affected by dietary treatments ($p > 0.05$). Serum parameters such as albumin, total cholesterol, VLDL, triglyceride and ALT values increased ($p < 0.05$) with the RS supplementation at level of 15% into layer diet. Results showed that rosehip seed supplementation into layer diets may be beneficial to improve egg quality traits especially such as shell thickness and to decrease damaged egg ratio. But further investigations are needed to clarify the use of rosehip seed in layer diets and its effects on performance, egg quality and serum parameters.

Keywords: Laying hen, rosehip seed, performance, egg quality, serum parameters

1. INTRODUCTION

The poultry sector plays an important role in Turkey. However, inadequate of animal feed resources in both quantitatively and qualitatively is most often the limiting factor of the development of livestock production in Turkey (Çelebi et al., 2013). In this context, feed producers and scientist have researched to alternative feed materials. Many agricultural and agro-industrial products have the potential as animal feeds (Garipoğlu 2004). Rosehip seed (RS) is one of this fruit wastes. RS is as a waste after processing into products such as fruit juice, jam, marmalade and tea. It has been reported that the remaining seeds are rich in energy and do not cause metabolic disease by grains-based feeds.

RS represents approximately 20% to 44% of *R. canina* fruit and has 93.48% dry matter, 8.72% crude protein, 6.0% digestible protein, 7.97% crude fat, 1.87% crude ash, 31.56–44.05% crude fiber, 30.87% nitrogen free extract, 64.44% acid detergent fiber, 64.78% neutral detergent fiber, and 1800 Kcal. ME/kg ground *R. canina* seed (Nichita et al. 1981; Macit et al. 2002). In another study on the content of mineral substances (Kadakal and Nergiz 1999), it was found that RS has an average of 4181.2 mg / kg potassium, 2724 mg / kg calcium, 1045.2 mg / kg magnesium, 46 mg / kg iron, 39.8 mg / kg sodium, 29.6 mg / kg of nickel, 9.8 mg / kg of zinc, 4.9 mg / kg of copper, 0.1 mg / kg of cadmium, 55.08% linoleic acid, 20% arachidic acid and 19.31% oleic acid. In addition, it has been stated that RS reduce serum cholesterol and triglyceride value in animal experiments (Anonymous 2018). Andersson et al (2012) reported that the total plasma cholesterol and the LDL-cholesterol levels were reduced by 4.9% and 6%, respectively.

Little or no published information is available on the quality of feed provided by Rosehip fruit or on how it could be evaluated as feed ingredient in poultry diets.

This study was carried out to determine the effect of dietary rosehip seed supplementation into layer diets at different levels on layer performance, egg quality traits, egg yolk lipid profiles and some blood parameters in layers.

2. MATERIALS AND METHODS

A total of 72 Lohmann layers, 46 weeks old, were divided into three treatment groups, each of which included six cages, each of which housed four hens reared in poultry houses of Food and Livestock Application and Research Center of Atatürk University. The control group was fed with commercial layer diet (K), and the other two groups were fed with basal diet + 10% ground rosehip seeds (K1) and basal diet + 15% ground rosehip seeds (K2). The water and feed were provided as ad-libitum during the trial. After one week of the adaptation period, the chickens were weighed and randomly divided into three groups, and experiment lasted for twelve weeks.

Formulation and chemical composition of diets on dry matter basis are shown in Table 1. The RS was obtained from a fruit juice plant in Gümüşhane.

Table 1. Chemical composition of commercial layer diet and RS

Chemical composition (%)			
		Commercial layer diet	Rosehipseed
Soybean meal	Dry matter	89.47	93.4
Maize	Crude protein	16.50	8.7
Barley	Ether extract	4.88	8.00
Full fat soy	Crude fiber	4.49	44.1
Sunflower meal	Ash	11.70	1.9
Ground corn	ME (kcal kh ⁻¹)	2720	1899*
Soya oil			
Ground limestone			
Salt			
DCP 18			
D-L Methionine 99			
L-Lysine			
Vitamin Premix ¹			

¹Premixes were formulated to meet recommended levels for minerals and vitamins (NRC, 1994)

*Calculated by Pehlevan (2014)

Egg production and feed consumption were measured daily, egg weight was measured biweekly and body weight was measured monthly. Shape index, shell strength, shell thickness, shell weight, yolk color, yolk index, albumen index and Haugh unit were determined monthly (Kaya and Macit, 2012). At the end of the experiment, 6 animals from each group were selected and blood samples were taken from the wing vena using heparinized tubes and centrifuged at 3000 x g for 5 minutes. Plasma lipid profile, some mineral and enzyme contents were determined by using commercial kits (DDS Spectrophotometric Kits, Istanbul Turkey) in the Mindray Perfect Plus 400 brand autoanalyzer in the Faculty of Medicine, Department of Biochemistry. In order to determine the lipid profile of egg yolk, a total of 18 eggs taken from each sub group at the end of the experiment were immediately broken and egg whites and yolk were separated. Egg yolks were placed in pre-weighed 50 ml capillary fragments. To determine the egg yolk cholesteryl ester (CE), triglyceride (TG), free fat acid (FFA), cholesterol (COL), phosphatidylserine (PS) and phosphatidylcholine (PC) of egg samples the HPTLC methods were used (Hara and Radin 1978; Macala et al. 1983).

The data were analyzed using general linear model procedure of SPSS 10.0 (1996) program. Significant differences among means were tested using Duncan's Multiple Range Test (Duncan 1955).

3.RESULTS AND DISCUSSION

The results of the performance parameters are given in Table 2. It was found that there were significant differences among the groups in terms of performance parameters such as feed consumption, egg production, cracked egg yield and egg weight. Egg production and feed consumption were increased ($p < 0.01$) and cracked egg yield was decreased ($p < 0.05$) in the group fed with diet including 15% ground rosehip seed (K2). Eggs from K1 were heavier than eggs from K and K2 ($p < 0.01$). There is a negative correlation between energy content and consumption of diet (Özkan and Açıkgöz 2007). Due to the high fiber and low energy content of the RS, the chickens in the K1 and K2 groups consumed more feed to meet their nutritional needs, especially their energy needs. Some researchers reported that feed consumption increased in broiler groups fed with the addition of rosehip seed (Nichita et al., 1981). Vlaicu et al. (2017) reported that the diets including high cellulose content of rosehip powder negatively affected the feed consumption of the layers.

Table 2. Least squares means for performance parameters of laying hens

Gruplar	FC (g/day)	EP (%)	CEY (%)	EW (g)	FCR (kg feed/ kg egg)
K	95.03 ^b	72.49 ^b	4.41 ^b	65.89 ^b	2.21
K1	111.29 ^a	79.87 ^b	4.34 ^b	68.38 ^a	2.09
K2	118.51 ^a	89.29 ^a	1.39 ^a	64.85 ^b	2.08
SEM	2.84	3.35	1.98	0.76	0.20
P	**	**	*	**	ns

a, b: Means in rows with different superscripts are significantly different *(P<0.05), ***(P<0.01), ns: non significant, EW: Egg weight; EP: Egg production; FC: Feed consumption; FCR: Feed conversion ratio; CEY: Cracked egg yield

It was determined that there was no significant differences among the groups in terms of shape index, shell strength, yolk index, white index and Haugh unit. The birds in K2 group produced better eggs in terms of shell thickness, shell weight and yolk color significantly than the control group. Calcium is an important macro mineral for egg shell formation of laying hens. The improvement in external quality parameters such as cracked egg yield, shell thickness and shell weight obtained from the birds in the K2 group may be due to the fact that the RS is rich in Ca (2724 mg / kg) (Kadikal and Nergiz 1999). On the other hand, it has been reported that the RS is rich in carotenoids (Gao et al., 2000). The increase in egg yolk color with the addition of 15% RS may be due to the carotenoid content of RS.

Table 3. The effect of RS on egg quality traits of laying hens

Gruplar	Shape index (%)	Shape strength (kg/cm ²)	Shell thickness (mm×10 ⁻²)	Shell weight (g)	Yolk color	Yolk index (%)	Albumen index (%)	Haugh unit
K	73.59	0.569	0.338 ^b	7.03 ^b	7.19 ^b	38.84	7.54	78.03
K1	74.61	0.521	0.338 ^b	7.39 ^b	7.58 ^b	39.10	8.11	80.78
K2	76.01	0.800	0.375 ^a	7.98 ^a	8.20 ^a	38.84	7.22	77.26
SEM	0.84	0.089	0.036	0.22	0.18	0.83	0.57	2.64
P	ns	ns	*	**	**	ns	ns	ns

a, b: Means in rows with different superscripts are significantly different *(P<0.05), ***(P<0.01), ns: non significant,

The egg yolk lipid profile of the eggs collected at the end of the experiment are given in Table 4. There were no differences among the groups. It has been determined that the addition of RS to the laying hens diets increased egg yolk phosphatidyl serine content.

Table 4. The effect of Rose canina seed on egg yolk lipid profiles of laying hens

Gruplar	CE	TG	FFA	COL	PS	PC
K	4.86	56.25	0.389	20.43	0.278 ^b	6.44
K1	4.87	56.04	0.420	20.65	0.503 ^a	6.77
K2	5.94	56.03	0.303	21.24	0.468 ^a	5.95
SEM	0.47	1.21	0.646	0.36	0.062	0.367
P	ns	ns	ns	ns	*	ns

a, b: Means in rows with different superscripts are significantly different *(P<0.05), ***(P<0.01), ns: non significant, CE, cholesteryl ester; TG, Triglyceride; FFA, Free fat acid; COL, cholesterol; PS, Phosphatidylserine; PC, Phosphatidylcholine

There was no significant difference (p> 0.05) in uric acid, total protein, globulin, HDL, LDL, but albumin, ALT, cholesterol, triglyceride, VLDL and Ca were increased by addition of RS 15% (Table 5). In the study carried on broiler, it was found that the serum urea, creatinine, uric acid, triglyceride, total protein, glucose, K and Cl were not affected by the addition of rosehip, but cholesterol level decreased because of high cellulose content and flavonoids (Tekeli 2014). In the different study, it has been reported that phenolic compounds such as flavonoids, anthocyanidins and anthocyanins reduced endogenous cholesterol absorption and synthesis (Nurulhuda et al., 2012). It is also emphasized that the RS may have hypocholesterolemic activity because it is rich in phenolic compounds.

Table 5. The effect of RCS on serum parameters of laying hens

Blood Parameters	K	K10	K15	SE	P
Uric acid ($\mu\text{mol/L}$)	4.65	3.66	3.65	0.52	ÖS
Total protein (g/L)	3.36	4.07	4.29	0.47	ÖS
Albumin (g/L)	1.02 ^b	1.39 ^{ab}	1.71 ^a	0.16	*
Globulin (g/L)	2.33	2.69	2.58	0.33	ÖS
ALT (U/L)	7.5 ^b	8.5 ^b	30.0 ^a	6.15	*
Triglycerides (mg/L)	699.5 ^b	1146.3 ^{ab}	1644.8 ^a	365.6	*
Cholesterol (mmol/L)	86.08 ^b	137.5 ^{ab}	164.5 ^a	20.69	*
HDL (g/L)	18.25	25.5	28.0	4.41	ÖS
VLDL (g/L)	139.92 ^b	229.33 ^{ab}	329.00 ^a	74.7	*
LDL (g/L)	64.25	55.50	61.00	11.72	ÖS
Ca	12.11 ^b	19.08 ^a	19.83 ^a	2.21	*

a, b: Means in rows with different superscripts are significantly different *($P<0.05$), **($P<0.01$), ns: non significant,

As a result, it was determined that the addition of 15% RCS into the laying hen diets improved the egg yield and egg quality traits especially such as shell thickness and yolk color, and decreased cracked egg yield. But further investigations are needed to clarify the use of rosehip seed in layer diets and its effects on performance, egg quality and serum parameters.

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The General Situation of Mulberry Cultivation in Uşak and Determining the Potential of Silkworm Growing

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Abstract: Mulberry cultivation, which is located in fruit-growing berries is mostly grown for leaf. Mulberry is one of the important fruit species in terms of both human health and contribution to the country's economy. Almost every country produces mulberries in our country. Mulberry leaves are the most important factor in the production of silkworms because silkworm is the only food source. Silkworm, which is an activity that starts with the provision of the mulberry leaf which is the only food source of the Silkworm and continues until the silk is obtained; Is an auxiliary agricultural activity having historical, cultural, economical and traditional features which are 1500 years old history in Anatolia, which is a center of silk exchange for a period. The rural population, which was 40 % in the 2000 census, was 29.5 % in 2007 and 91.8 % in 2014, which rose to 92.1 % in 2015 and 7.9 % in towns and villages. Employment-based agricultural activities such as silkworm production play an important role in slowing the rapid migration of our population in developed countries to developed industrial regions in our country. Both silkworm breeding, flattening, bending, dyeing and silk carpet exports, with an annual foreign exchange input of around 3 million dollars, have made a significant contribution to our economics. In this study; When Uşak province climate and geographical position were evaluated, a questionnaire study was carried out in order to determine the current situation of mulberry cultivation, to determine silkworm breeding and potential problems. According to the survey results; It has been determined that Usak Ilin is suitable for mulberry cultivation. Our producers, whose main livelihood is different, intend to supplement with mulberry farming. A large majority (79 %) of our participants did not have information on silkworm breeding, and 35 % wanted to receive information on this subject. It has been determined that about 18 % unstable producers can raise awareness of more than half of the participants to increase their awareness on this subject, to make training activities, potentially participate in unstable (25 %) and make 50-55 % silkworm breeding and contribute to their families.

Keywords: Silkworm, Mulberry, Cultivation, Production

1.INTRODUCTION

Silkworms, a 1500-year old history in Turkey, as an activity traditional and help, among other agricultural activities, usually on a small scale, carried out by small family businesses and does not require much investment, as soon as additional income to businesses with 35-45 day short production period is an agricultural activity. Silkworm farming is mostly carried out in mountainous areas where land is not suitable for other agricultural activities and is an important economic activity for low-income producers (Taşkaya Top, 2014).

Most of our country is suitable for silkworm breeding in terms of climate conditions. Social and economic conditions, such as the fact that most of the agricultural enterprises are in the form of small family enterprises and the productivity and income levels are low in the rural areas, are suitable for silkworm cultivation (Keskin G, 2003).

Although Turkey found on silkworm breeding and an important center and trade route since ancient times in the silk trade, a decline in prices in the nineties, began a decline, it has become the extinction point decrease in silkworm breeding (Table 1). In declining production, China's monopolistic status with 70% of the world's cocoa production is the main reason for the decline in prices. Besides this, it is another factor for the Turkish republics to easily enter the country with cocoons and raw materials at very low prices. Observing an unstable pricing policy also led to a rapid fall in production (Şahan and Kara 1996). Bursa, Bilecik, Sakarya, Balıkesir and Eskişehir make up 90% of the total production (Anonim, 1997), compared to 23 silkworm cultivation in our country.

Table 1. Turkey distributions by years of data silkworm.

Year	Number of villages where silkworm farming was carried out (Number)	Number of households doing silkworm production (Number)	Number of boxes opened (Number)	Wet silk corpse (Number)
1991	1 635	29 689	50 623	1 353
1992	1 009	17 703	27 732	782
1993	951	14 544	25 884	724
1994	647	12 151	17 953	452
1995	532	7 493	9 702	271
1996	398	5 756	7 529	215
1997	325	3 863	5 741	161
1998	255	3 115	4 543	136
1999	260	3 019	4 964	133
2000	230	2 210	3 147	60
2001	213	1 555	2 445	47
2002	327	2 356	3 839	100
2003	280	2 758	5 097	169
2004	273	2 888	5 161	143
2005	277	2 677	5 669	157
2006	233	2 527	5 699	127
2007	212	2 274	5 273	125
2008	195	2 193	5 564	125
2009	203	2 295	5 683	136
2010	194	2 134	5 477	126
2011	295	2 623	5 808	151
2012	342	2 572	5 576	134
2013	327	2 343	5 261	121
2014	340	1 760	3 739	80
2015	474	1 956	4 674	115
2016	576	2 001	5 303	103

(Türk 2016).

While the number of silkworm breeding farms in our country increased from 1635 in 1991 to 194 in 2010 due to the economic crises of 1990, 1995 and 2001, it increased by 194 and increased after 2010, reaching to the number of villages with 576 aquaculture (Table 1).

The number of households that made silkworms in 1991 was 29,689. This figure fell to a very severe decline in 1995, reaching 7,493 liras by 2016, and by about 15 times the number of households with 576 silkworms (Table 1).

The number of opened boxes, which was 50,623 in 1991, decreased to 17,953 in 1994, 5741 in 1997 and 2,445 in 2001. In the years following 2001, it increased slightly with government incentives and reached 5.303 in 2016. The age of silk was 1353 tons in 1991 and 782 tons in 1992, down by half. This figure dropped to 271 tons in 1995 and to 47 tons in 2001. In the following years, it increased at least to 100 tons excluding 2014.

When the recent history of silk bugwort is examined; Our cocoon production, which was 2000 tons in 1983, decreased to 160 tons in 2007 and 22 tons from 310 tons of raw silk production. According to DIE 2007 data, the number of provinces in our country still being silkworm cultivation was 42 in 2007, whereas this figure decreased to 22 in 2007 (Anonymous 2007). Especially Bursa, Bilecik, Sakarya, Balıkesir, Eskişehir, Hatay and Antalya are the most intensive productions, and the total production is about 90%. The Marmara Region is the region where production is most concentrated in the region (Anonymous 2007, Table 1).

It seems that the mulberry production used to feed back the increase of government incentives for the development of silkworm production has also been inadequate. The difficulties encountered in leaf supply, the low cost of cocoa, the exposure of pesticides to mulberry leaves, the exposure of poisoned insects to poisoning, the unfavorable climate and natural conditions, environmental pollution and irregular feeding are other factors that affect production negatively (Şahinler N. and Şahinler S, 2002) .

For these reasons, mulberry cultivation, which is used as a single source of nutrition for silkworm breeding, is of utmost importance.

In today's conditions, fruit cultivation is important for agriculture. Mulberry cultivation, which is located in fruit growing grape berries, is mostly grown for leaf. In addition, because of the high content of vitamins, minerals and phenolic compounds in their composition, it is one of the important fruit species in terms of both human health and contribution to the country's economy. It is accepted that Dut symbolizes reason and patience with the reason that it has the most cautious trees that do not start to drive their buds without passing cold weather conditions among cultivated fruit species. As a matter of fact, mulberry emerges as a kind of fruit which can be grown even in regions where continental climate prevails. Almost every country produces mulberries in our country. It develops well in deep soils and is suitable for growing on calcareous, dry, dry and sandy soils. It can reach salty-alkaline soil containing less than 0.2% salt. In other words, it is sensitive to saltness.

In our country, the mulberry culture is made from the past for different purposes and is produced in almost all the illusions. However, the north of Central Anatolia, the east of the Black Sea, the west of Eastern and Southeastern Anatolia are more dense production areas (Ağaoğlu S, Gerçekçioğlu R, 2013).

Table 2. Turkey year of distribution according to the General Mulberry yield (tons)

	2002	2009	2010	2011	2012	2013	2014	2015
Mulberry	55.000	67.986	75.096	76.643	74.170	74.600	62.879	69.334

TÜİK 2016

The yield of around 55,000 tons in 2002 was 20% up until 2009 and about 75,000 tons in the period up to 2013 with an increase of about 50%. In the year 2015, an output of about 70000 tons was obtained.

Table 3. Changes in mulberry production (ton) over the years in Usak (Anonymous, 2015)

Districts	2010	2011	2012	2013
Banaz	22.5	23	19	19
Eşme	12	12	12	12
Karahallı	8.25	8	8.25	10
Merkez	16.5	17	17	17
Sivaslı	40.68	33	33	41
Ulubey	32.2	28	28	32
İl Geneli	132	90	109	119

When mulberry yield values are examined in total in Usak, it is seen that a total of 119 tons of production is obtained according to the year 2013 data. A total of 74600 tonnes were produced in the Uşak region, about 0.15% of the country's overall yield value. The district with the highest production potential is Sivaslı District with a yield of 41 tons. Ulubey with 32 tons of Sivaslı district, followed by Banaz with a yield of 19 tons. Karahallı District is the least produced region. Provincial Geneli The production amount, which was 132 tons in 2010, decreased by 25% in 2011 and reached to 90 tons, but increased in 2012 and 2013 to 129 tons.

2.MATERIALS AND METHODS

Material

In Uşak province, 100 questionnaires were filled out in order to determine the present condition of mulberry cultivation and silkworm cultivation, and a survey study was conducted.

Method

The questionnaire forms contain various information on silkworm cultivation and mulberry cultivation. The main topics will be summarized briefly. The topics such as residence of farmer, education level, amount of production, encountered problems, experience of breeding, producer cooperative relation, marketing style and optimum maintenance of kozes, applicability of feeding and environmental conditions There. The questionnaires were analyzed using SPSS package program.

3.RESULTS AND DISCUSSION

Information on Socioeconomic Situations of Manufacturers

According to the survey, research visits and survey results;

Educational Status, Number of Individuals in the Family and Number of Employees in the Family;

According to the results of the statistical analysis, it is determined that the educational levels of our operators are high, 20% are university graduates, 32% are high schools and 45% are primary, secondary and literate. Şahinler and Şahinler

(2002) found that the educational status of silkworm breeders in the study they are doing; 48% had no literacy, 40% had primary school education, and 12% had secondary school education. Barıtcı et al. 2017; In their study in Diyarbakır province, 44.29% of cocoon producers reported farmers, 10% were housewives, 18.57% were tradesmen, and the rest (27.14%) had no regular occupation. Silkworm breeders with low levels of education are not able to apply appropriate techniques in cultivation and obtain low yields by cultivating them with old information and inappropriate cultures.

It is seen that the number of individuals participating in the survey has 4 individuals, 25% 3 persons, 24% 3 persons, 20% sinus 5 persons, 17% sinus 2 persons and 14% person 5 and more individuals. Bartıcı and Ark. 2017. In the study conducted in Diyarbakır province, the ratio of 5 children and over households was found to be 37,14%, although the number of the producers is high and the wider families are expected to be more. Compared with this figure, it is estimated that the difference arises from the cultural and socioeconomic differences of the regions. The number of employees working in the family survey shows that there are at most one person with 48% of the respondents, 31% with two people, 16% with three people, 4% with four people and at least 1% with five or more It has been identified.

Income Status, Occupation

Looking at the income situation, it is determined that they have a income between 2000 and 3000 TL with a maximum of 34%. Bartıcı et al. 2017. In their researches, the income level of the producers are reported as having 42.86% TL 1.000-2.000 TL, 15.71% TL 2.000-3.000 TL, 27.14% TL 3.000-5.000 TL and 14.29% TL 5.000 TL and the income level.

According to the results obtained in occupational situations, our operators were observed to be 46% students, 25% retired, 18% farmers, 10% civil servants and 1% others. Hawks and Hawks 2002, in their research; reported that 58% of silkworm breeders were farmers, 8% were workers, and 34% were of other professions, and most of the breeders had silkworm breeding in order to earn additional income besides the actual profession. The fact that silkworm breeding is not economical is the main reason for this. In addition, the work force that can not be assessed in other agricultural activities such as elderly, disabled and children is evaluated in this area.

Information about Mulberry Cultivation

Mulberry farming

According to the statistical evaluation of the survey results, it was determined that half of the region was mulberry cultivation. According to anonymous 2016 data; Usak province is the most fruit berries strawberries produced as grape fruit, and the second product is mulberry cultivation. In addition, almost every establishment makes mulberry cultivation with a rate of 97% in the mulberry cultivation made in the half of the region. Çolak and Çetin In their research they conducted in 2017; Competition in mulberry production in Uşak province indicated that all the provinces of Usak province were also seen.

According to the statistical results, 97% of mulberry cultivation is made as a hobby, 29% as a hobby garden and 1% as a production horticulture.

Mulberry field, the purpose of making mulberry cultivation from the economic point of view

When the results are evaluated, the mulberry field is reduced by 93% to 1%. According to anonymous 2016 data; A total of 74600 tons of mulberry produced in Turkey, about 0.15% of the country's average yield is produced in Uşak, and the producers of mulberry producers earn 94% of their income, 5% of them as a hobby, and 1% as a main source of livelihood.

Other than mulberry cultivation, what he is trying to do is fertilization and pruning applied to mulberry trees

According to the results of the survey, 23% of the respondents said that they are farming other agricultural products, 8% are workers, 5% are civil servants and 64% are engaged in other jobs. They stated that 69% of the participants did not fertilize the trees but they pruned 76%.

When the mulberry leaf buds woke up in the area and when their leaves were laid

In the survey results, it was determined that leaf buds woke up at different times according to the regions. Participants stated that the buds were awakening in February, 1-13 March, 40-35% in March, 27% in April and 1-15% in the month of February. Mulberry leaves are 4% in September, 51% in October and 45% in the month of November according to the regions they live in.

How to evaluate the products obtained from the cultivation of the mulberry

It was determined that 81% of the producers did not have a market problem and 80% of their products consumed freshly dried products in the family. % 19 Participants who stated that they had problems in marketing stated that they sold their products as molasses and jam by 18% and dried fresh on the other hand by 2%. Russel et al. According to 1997; Due to the intensive production in fresh seafood and the softness of the fruit, the fact that it is difficult to transport has caused

various difficulties in the fresh processing of this product. It has also been stated that drying and mulberry fruits are consumed and marketed outside the normal season and also mulberry fruits can be processed industrially.

Evaluation of the mulberry leaves, Follow up the developments related to the mulberry cultivation

It was observed that only 34% of the respondents did not evaluate the mulberry leaves by 66%. When the survey results were examined, it was seen that 92% could not follow developments related to mulberry cultivation. The followers were found to have access to 1% of the provincial and district directorates of agriculture, 2% of the books and 5% of the magazines.

It is known that the mulberry leaves are the food source used in the silkworm feeding, the mulberry and silkworm breeding aim to provide economical contribution to the family by evaluating the mulberry leaves

It was determined that 50% of the respondents did not know that the mulberry leaves were the only nutritional source used for feeding silkworms. Would you like to evaluate your mulberry leaves and make an economical contribution to the community, would you like to do silkworm breeding? 46% of the respondents answered negatively, 25% said they were unstable and only 29% said they could do silkworm breeding.

Whether or not they have information about silkworm breeding, whether they want to work if necessary information about silkworm breeding is obtained

In our survey study, it was determined that a large majority (79%) did not have any information about silkworm breeding, while 47% of the participants did not want any training on Silkworm breeding, indicating that 35% wanted to study and 18% were undecided. If you have information about silkworm breeding, they would like to work on this subject and they stated that they do not want to participate in the question, they do not want to participate in the question, they want to work 32% and they are ambivalent to 20% participant.

Information on the support and services the State has given to silkworm breeders

In our survey, 85% of respondents stated that they did not have any information about the support and services they gave to silkworm breeders. Only the participants stated that they had 6% of the information.

According to the result of the survey, it was determined that Usak Ili is suitable for mulberry cultivation. 97% of the participants are making mulberry cultivation as a hobby and their production areas are under a decade. Our producers, whose main source of livelihood is different, aim at additional income with mulberry farming. In the mulberry production they have done as a hobby, they do not apply fertilizer to the trees (69%) and they give importance to tree trimming (76%). It was determined that the producers did not follow the publications related to mulberry cultivation (92%) and that they did not receive agricultural support and that the products obtained (80%) consumed fresh and dried in their own family.

A large majority (79%) of our participants did not have information on silkworm breeding, and 35% wanted to receive information on this subject. It has been determined that about 18% unstable producers can raise awareness of more than half of the participants to increase their awareness of this issue, to make training activities, potentially involve participants in the unstable (25%) and make 50-55% silkworm breeding and contribute to their families.

Silkworm breeding has been determined that producers in our country, which have traditionally been built since many years and have great potential, have faced various problems in recent years and lost their importance by decreasing their breeding. In parallel with this, mulberry gardens have been destroyed and the loss of economic importance of the crop has reduced the number of breeders and decreased the number of breeders, the loss of crops and the quality of the crops have fallen (Sahinler and Şahinler, 2002). In order to solve these problems and bring your cultivation to a more profitable and efficient farming activity, the necessary things to be done in order to spread silkworm breeding are briefly summarized below.

1. Silk imports from foreign countries should be limited and modern filtration facilities should be widespread.
2. Especially in recent years, illegal trafficking of illegal cocoon entering my country illegally from countries like Iran and Azerbaijan should be prevented.
3. Low interest loans should be provided to encourage silkworm breeding.
4. A stable price policy should be followed throughout the country.
5. mulberry silkworm breeding in Turkey and the potential for climate, while complying with the 2 year supply 2 is not widely practiced in our country nutrition. In addition to spring feeding, autumn feeding should also be encouraged and widespread. Beginning from areas such as Belen, Erzin, Dörtöyl and Hassa, where there are existing mulberry fields in the region, measures should be taken to protect the mulberry gardens and encourage new mulberry gardens.

6. Leaf harvesting and maintenance work is easier because of the best snack raising facilities in terms of sericulture; it is only "closed mulberry gardens" grown by mulberry trees. Mixed mulberry cultivation with other fruit trees and producers should be encouraged to establish aquaculture gardens to determine the field boundary.
7. Producer unions or cooperatives should be established.
8. Various practical courses and seminars on silkworm breeding should be given by experts in public institutions in order to increase the technical knowledge level of producers on aquaculture, diseases and pests.

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Investigation of Microbiological Water Quality of Beyler Dam Lake

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Abstract: This study was conducted in 2017 to assess microbiological water contamination of Beyler Dam Lake in Kastamonu, Turkey. In order to take necessary measures in the aquatic environment private microbiological and evaluate all the biological factors. Therefore, this dam was divided into four stations. The samples were collected to determine the microbiological quality of the lake water during the winter in April and in the summer in September, from each station. After conducting the microbiological analysis, which gives an indication of the amount of pollution in the dam area, the average temperature and pH of the samples during winter were 10.0 and 8.5 respectively, and in the summer were 23.5 and 7.96 also respectively. The average microorganism quantities of water samples in the winter and summer were 2.1×10^3 , 9.2×10^4 cfu/ml for Total plate count, 3.7×10^2 , 7.6×10^2 cfu/ml for Total coliforms, 1.1×10^2 , 1.2×10^2 cfu/ml for Fecal coliforms, 3.6×10^3 , 7.7×10^3 cfu/ml for Mesophilic, 1.4×10^4 , 5.2×10^4 cfu/ml for Psychrotrophic, 1.4×10^2 , 3.1×10^2 cfu/ml for *Staphylococcus aureus* and 1.0×10^2 , 2.8×10^2 cfu/ml for Enterococci, respectively.

Keywords: Beyler dam lake, microbiological, seasons, contamination, pollution, bacterial count.

1.INTRODUCTION

Today, water as well as being of vital importance for humans and ecosystems is a key requirement in the development of the country and that is one of the essential components of sustainable development. (Ozturk et al., 2012; Hazelnut, 2013). Turkey is surrounded on three sides by the sea, 8333 km of coastline, 80791 km² of sea area of 10,000 km² natural lake, 15,000 ha of ponds, 30,000 has ha reservoir and 200, 714 km of an important potential with streams (DSI, 2015). Natural lakes, large reservoirs, rivers and seas made aquaculture operation, (Onchorynchus mykiss, Walbaum 1992) importance is very high and production is increasing. In aquaculture system which is cheap compared to the quality of fish and other animal foods. Quality water; species composition, productivity affects the physiological state of abundance and aquatic species (Akyurt, 1993). Therefore, the properties of water should be protected very well known and ecological balance in the water. In order to take necessary measures in the aquatic environment physical, chemical, microbiological and should periodically evaluate all the biological factors. This study was conducted in 2017 to assess microbiological water contamination of Beyler Dam Lake in Kastamonu, Turkey. The volume of the dam is 600,000 m³, the height from the river bed is 42 m. The lake volume is 25.00 hm³ in normal water level and the lake area is 2.30 km² in normal water level. The dam was divided into four stations as shown in (Fig.1).



Figure 1. Sampling stations on Beyler Dam Lake

2. MATERIALS AND METHODS

Water samples were taken from four locations designated on the lake. Samplings were carried out both in winter and summer seasons. Water samples were brought in ice boxes to analyses in the laboratory, approximately one hour after they were taken. two replicate water samples were taken 10 cm below the surface. Samples were collected in dark, sterile bottles sizes 200 ml from stations. Indicator bacteria were measured as a concentration, usually expressed as an estimate of the number of individual organisms per ml of water

3. RESULTS AND DISCUSSION

Measurement of temperature and pH is important when assessing the degree of contamination in water. The results, as shown in (Table1). Show that the average temperature and pH of the samples during winter were 10.0 and 8.5 respectively, and in the summer were 23.5 and 7.96 also respectively, The average microorganism quantities of water samples in the winter and summer were 6.1×10^3 , 2.2×10^5 cfu/ml for Total plate count, 5.2×10^2 , 7.8×10^2 cfu/ml for Total coliforms, 3.1×10^2 , 6.3×10^2 cfu/ml for Fecal coliforms, 3.6×10^2 , 7.7×10^3 cfu/ml for Mesophilic, 4.6×10^2 , 2.9×10^3 cfu/ml for Psychrotrophic, 1.4×10^2 , 3.4×10^2 cfu/ml for *Staphylococcus aureus* and 1.1×10^2 , 2.4×10^2 cfu/ml for Enterococci, respectively, as shown in (Table3).

Table 1. Temperatures and pH for seasons.

Stations	Hot season		Cold season	
	Temperature C°	pH	Temperature C°	pH
Station 1	10.3	8.71	22.8	8.38
Station 2	10.5	8.84	23.3	8.83
Station 3	10.3	8.26	23.2	8.07
Station 4	09.7	8.19	23.5	7.96
Average	10.0	8.5	23.2	8.31

Table 2. Types Microbiological analysis for water in winter (April)

Type of analysis	Station 1	Station 2	Station 3	Station 4
Total plat count	4.8×10^3	1.7×10^4	1.3×10^3	1.1×10^3
Total coliform	4.8×10^2	5.3×10^2	8.1×10^2	3.2×10^2
Fecal coliform	5×10^2	3.9×10^2	2.1×10^2	2.8×10^2
Mesophilic	3.3×10^2	3.3×10^2	2.3×10^2	5.3×10^2
Psychrotrophic	4.2×10^2	4.3×10^2	5.7×10^2	4.3×10^2
<i>Staph. Aureus</i>	1.3×10^2	1.5×10^2	1.5×10^2	1.4×10^2
Enterococci	$<0.3 \times 10^2$	1.2×10^2	1.3×10^2	1.4×10^2

Table 3. Types Microbiological analysis for water in summer (September)

Type of analysis	Station 1	Station 2	Station 3	Station 4
Total plat count	1.4×10^5	8.8×10^4	8.4×10^4	5.5×10^5
Total coliform	8.5×10^2	8.9×10^2	8.8×10^2	4.8×10^2
Fecal coliform	9×10^2	7.6×10^2	7.1×10^2	$.6 \times 10^2$
Mesophilic	8.7×10^3	6.6×10^3	7.7×10^3	7.8×10^3
Psychrotrophic	4.2×10^3	7.3×10^3	8.8×10^3	8.4×10^3
<i>Staph. aureus</i>	3.4×10^2	2.6×10^2	3.2×10^2	3.3×10^2
Enterococci	2.3×10^2	3.2×10^2	2.4×10^2	3.3×10^2

Table 4. Average Number of bacteria cfu/ml in water samples at the cold and hot seasons for each station.

Type of analysis	Cold season	Hot season
Total plate count	6.1 x10 ³	2.2 x10 ⁵
Total coliform	5.2 x10 ²	7.8 x10 ²
Total fecal coliform	3.1 x10 ²	6.3 x10 ²
Mesophilic	3.6 x10 ²	7.7 x10 ³
Psychrophilic	4.6 x10 ²	2.9 x10 ³
<i>Staph. aureus</i>	1.4 x10 ²	3.4 x10 ²
Enterococci	1.1 x 10 ²	2.4 x 10 ²

The study showed that there were significant differences in the Total plate count, Mesophilic and Psychrophilic of bacteria, which were less in the winter than it was in the summer. The study also showed significant differences in temperature and pH during the summer and summer seasons. Results there were no significant differences between sampling stations for all types of microbial analysis through statistical analysis of the microbial results shown in Tables 1 and 2 for types Microbiological analysis for water in winter (April) and summer (September).

The results of this study indicate that degree of microbiological contamination were relatively not high in the lake, but it was within the limits allowed both in Turkey and some international standard specifications. This increase is due to population activity such as animal grazing and the use of organic material in the agricultural process near the lake, therefore:

- Should periodically evaluate the biological factors.
- More studies are needed in order to check on other parameters.
- Action should be taken to prevent further contamination of the lake.
- More studies are needed in order to check if ammonia is reliable for a preliminary screening for emergency fecal pollution outbreaks.
- Financial resources should be devoted to a better understanding of the ecology and behavior of human and animal fecal bacteria in environmental water.

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Loss of Apical Dominance Affects the Shoot Branching in *Phalaenopsis* Orchid

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Abstract: *Phalaenopsis* orchids grow roots, leaves and flower spikes from one stem by displaying strong apical dominance. The main shoot controls and inhibits the outgrowth of other shoots. They do not create new growths as part of their normal monopodial growing pattern. Instead, as they grow vertically, old leaves and roots are replaced with new ones. The initial studies of apical dominance in *Phalaenopsis* orchids were presented here. Little is known about how architecture of monopodial *Phalaenopsis* is genetically determined. Thus the sequences of the key genes involved in the regulatory network of branching were obtained from the NCBI database by blasting known protein sequences of branching regulatory network against the annotated genome sequence of *Phalaenopsis equestris*. Furthermore, the differences between the gene regulatory sequences of monopodial and sympodial plants will be analyzed using *Phalaenopsis* as a model organism for the monopodials in the future studies.

Keywords: Apical dominance, *Phalaenopsis*, monopodial branching, auxin, cytokinin, strigolacton, sugar, branching transcription factors

1. INTRODUCTION

The shoot branching determines the plant architecture, which influences adaptation, survival, and competition. It is inhibited by signals from the apex of the main shoot in some plant species. This phenomenon is called as apical dominance. The underlying regulatory network is complex and involves phytohormones and transcription factors.

Phalaenopsis are important ornamental flowering plants with high demand and economic value. These plants are epiphytic monopodials with distinguished reproductive and ecological adaptations. They grow upward, sprouting new leaves from the apex of the plant and sprouting roots and inflorescences from the axillary buds adjacent to the leaves. *Phalaenopsis* have short height with a small distance between the leaves. Their leaf wraps around the base of the preceding leaf, so there appears to be no stem. Monopodial structure of *Phalaenopsis* is genetically defined.

Branching involves two developmental stages: the formation of axillary meristems in the leaf axils and the growth of axillary buds. They are regulated in response to multiple environmental (Girault et al., 2008; Gonzalez-Grandio et al., 2013) and developmental (Pin & Nilsson, 2012; Niwa et al., 2003; Bhogale et al., 2014) cues. Apical shoot inhibits branching through the hormone auxin derived from the shoot apex (Thimann & Skoog, 1933). Numerous signaling elements in addition to IAA are known to be required for bud outgrowth. Recently, it has been shown that, rather than simply auxin supply, strong sugar demand of the shoot tip inhibits axillary bud outgrowth by limiting the amount of sugar translocated to those buds (Mason et al., 2014). Strigolactones (Gomez-Roldan et al., 2008), which is a carotenoid-derived hormonal signal inhibits shoot branching in plants. Furthermore, the transcription factor *BRANCHED1* plays a central role in the control of axillary bud development (Braun et al., 2012).

The present study were performed to provide an understanding of regulation of genes involved in apical dominance and their roles in survival and architecture of *Phalaenopsis* orchid.

2. MATERIALS AND METHODS

This research was carried out in a greenhouse with mini *Phalaenopsis* orchids. A total of 10 *Phalaenopsis* plants were decapitated and their response were observed over the time. Five more plants were also used to observe the changes occur during the defoliation.

Genes involved in apical dominance were documented and compared with the transcriptome of *Phalaenopsis equestris*. The putative regulatory regions (promoter) of the genes (2 kbp upstream of the translation start site) were retrieved from the NCBI database. The regulatory regions were analyzed using PLACE tool (<http://www.dna.affrc.go.jp/htdocs/PLACE/>) and PlantCare: (<http://bioinformatics.psb.ugent.be/webtools/plantcare/html/>). The cis-elements obtained were compared with each other and discussed in light of literature available.

3. RESULTS AND DISCUSSION

Results

Strong apical dominance in a mini *Phalaenopsis* cultivar was removed by decapitation of the shoot apex. This process led to the outgrowth of compact embryonic shoots (axillary buds) at the leaf axil into lateral shoots along with accumulation of cytokinin in the absence of suppressing effect of auxin. Therefore decapitated plant started to sprout new

plantlets after 1.5 months. Besides lateral bud induction, decapitation was also resulted in the inhibition of inflorescence stem formation because of the probable modification in auxin (IAA) and sugar fluxes (Mason et al., 2014).

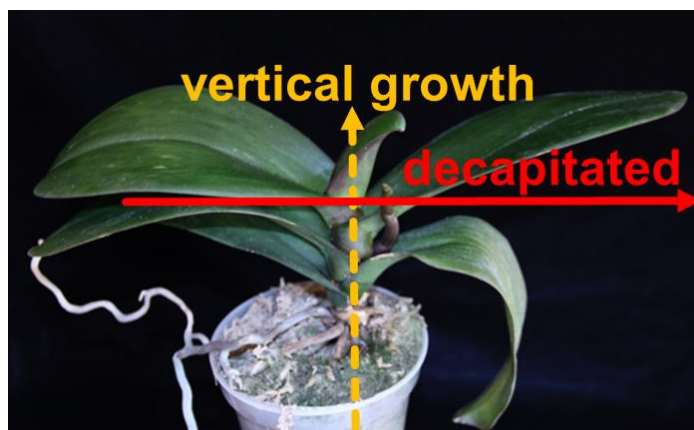


Figure 1. *Phalaenopsis* exhibits complete apical dominance having one main stem with no lateral branches (like sunflower, pea, *Arabidopsis*). Decapitation removed the strong apical dominance of *Phalaenopsis* by drastically changing its morphology.

According to the preliminary results removal of apical dominance resulted in shoot formation in mini *Phalaenopsis* plants. Eventually, each newly formed plant had its own aerial shoot system which allows the individual plant survive its own. On the other hand, defoliation of the plant resulted in the newly formed aerial roots at the location where the leaf was removed.

Discussion

Without using any additional hormone or technique only breaking the apical dominance by decapitation it became possible to force the plant to produce more shoots. The plant started to produce shoot, adversely stopped producing flower spikes. This suggested that more energy was diverted to new shoot formation.

These results led to the conclusions relating to apical dominance, root and bud outgrowth. Auxin depletion caused by defoliation was not sufficient to trigger bud outgrowth. Instead, it induced the formation of aerial roots. Only shoot apex removal caused the release of apical dominance by allowing the formation of new lateral shoots.

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Improved Primer Extension Method for Enhanced Detection and Quantification of Small RNAs in Plants

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Abstract: An improved primer extension analysis has been applied for detection of small inhibitory RNA (siRNA) and microRNA (miRNA) species. Total RNA isolated from wild type or transgenic *Arabidopsis* plants can be used for the analysis without subsequent enrichment of low molecular weight RNAs. The primer extension protocol has been optimized to increase efficiency, repeatability and accuracy for the analysis of limited amount of samples. The results have strongly suggested that primer extension is a powerful method to validate the expression and quantify the small RNAs in transgenic lines. Due to consistent and rapid implementation, this method can find use to monitor temporal and spatial patterns of miRNA expression in plant tissues and in samples derived from experimentally tractable organisms. Moreover, it can be employed to investigate RNA interference of engineered siRNAs in model systems. Therefore there is a need for a detailed written protocol and the studies are underway.

Keywords: Small RNA detection, primer extension, sRNA, miRNA, siRNA, sequencing gel

1. INTRODUCTION

Non-coding small RNA (sRNA) are involved in plant development, reproduction, defense and genome reprogramming. Two main classes of sRNA, the small-interfering RNA (siRNA) and microRNA (miRNA) are well documented and several experimental approaches have been developed for their detection from plant tissues. Four major technologies are often preferred for miRNA profiling in plants: Northern blotting (Valoczi et al 2004), quantitative reverse transcription PCR (qRT-PCR) (Chen et al. 2005; Varkony-Gasic et al. 2007; Zhang & Wang 2015), microarray (Barrera-Figueroa et al 2013; Pritchard et al. 2012), and high-throughput sequencing (Gao et al. 2015; Ren et al. 2015). In addition, primer extension has been demonstrated useful for the detection of miRNAs (Zeng & Cullen 2003).

Previously primer extension has been used to detect depurination by ribosome inactivating proteins in vivo in yeast (Iordanov et al., 1997; Baykal & Tumer, 2007) and in mammalian cells (Zhabokritsky et al., 2014). It has been demonstrated as a powerful method for the detection and quantification of depurination (Baykal & Tumer, 2007) and miRNAs (Zeng & Cullen, 2003). Description of the method by Zeng & Cullen (2003) is not comprehensive to apply for the small RNAs, therefore it was optimized for plant and used by Baykal et al. (2016). The method will be detailed later.

2. MATERIALS AND METHODS

The assay involved the separation of radioactively labeled extended primers (short cDNAs) by sequencing gel electrophoresis, gel drying and autoradiography. *CHLORINA 42* (*CH42*) gene in *Arabidopsis* has been silenced via artificial trans-acting siRNA (atasiRNA, atasiSUL)-mediated silencing using *miRNA173* as trigger. The expression of atasiSUL has been assayed using primer extension method in different transgenic lines. Primers (16-18 nt) complementary to 3' end of small RNAs have been used. When reverse transcriptase extends these primers without interruption to the 5' end of the small RNAs, the product (siRNA) length is 21 nt. The primer extension products are resolved on 10% denaturing polyacrylamide gel. Quantification can be achieved with a phosphorimager. Sample to sample variation of siRNA expression in *Arabidopsis* has been corrected by β -Tubulin (internal control) normalization (Baykal et al., 2016).

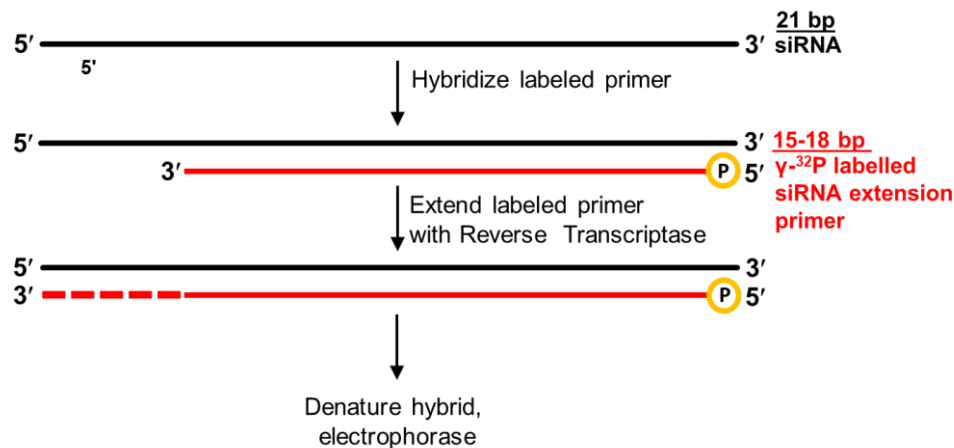


Figure 1. Overview of primer extension analysis of siRNAs.

3.RESULTS AND DISCUSSION

Results

Variations of siRNA accumulation has been observed among the transgenic lines. The expression profile of *CH42*-targeting siRNA (*atasiSUL*) by primer extension correlates with the expression profile of *CH42* mRNA determined by qRT-PCR (Baykal et al., 2016). As the amount of *atasiSUL* increases, expression of *CH42* monitored by qRT-PCR decreases due to silencing by *atasiSUL*. The assay is also capable of discriminating between related small RNAs that differed by subtle sequence differences at 3' ends.

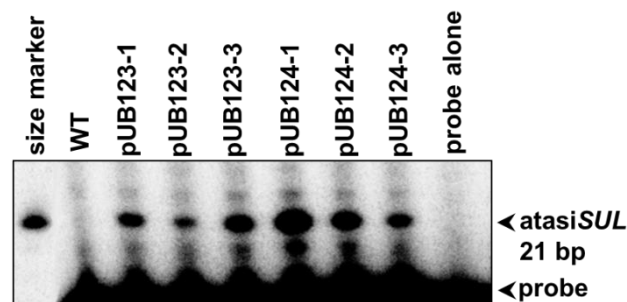


Figure 2. High resolution analysis of siRNA *atasiSUL* by primer extension. Total RNA was isolated from wild type or transgenic plants of *Arabidopsis* UB123-1, UB123-2, UB123-3, UB124-1, UB124-2, UB124-3 (Baykal et al., 2016).

Discussion

These results strongly suggested that primer extension is a powerful method to validate the expression and quantify the small RNAs in transgenic lines. Due to consistent and rapid implementation, this method will find use to monitor temporal and spatial patterns of miRNA expression in plant tissues and in samples derived from different eukaryotic organisms. Moreover, it can be employed to investigate RNA interference of engineered siRNAs in model systems.

Reverse transcription of sRNAs by primer extension have made it possible to detect even a small amount of either siRNA or miRNA in the mature form. Having high resolution, the method can even detect one base difference. This method has a potential to be applied to many eukaryotic species.

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Relationships Between *Prl/RsaI* Polymorphism and Some Performance Traits in Holstein Cattle

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ABSTRACT: The aim of this study was to determine the *RsaI* polymorphism of the Prolactin gene of 186 organically reared Holstein cattle by PCR-RFLP method, to reveal the genetic variation of the population, to examine the relationship between *Prl/RsaI* genotypes and some milk yield traits. In the study, the *RsaI*^{-/-} genotype frequency, *RsaI*^{+/+} genotype frequency and *RsaI*^{+/-} genotype frequency of Holstein cattle were determined as 0.26, 0.22 and 0.52, respectively. The *RsaI*⁻ genotype frequency was 0.52, and the *RsaI*⁺ genotype frequency was 0.48. According to the Hardy-Weinberg genetic balance test performed, the distribution of genotype frequencies was seen to be in equilibrium ($p > 0.05$). The relationships between *Prl/RsaI* polymorphism and the examined milk yield traits were not significant ($p > 0.05$).

Keywords: Prolactin, PCR-RFLP, Polymorphism, Marker, Cattle.

1. INTRODUCTION

Animal breeding has been carried out by selection based on the prediction of the additive genetic data of animals, which are superior with regards to phenotypic or yield traits. Molecular biology techniques allowed the possibilities to identify the genetic variation in specific loci and to examine the relationship between the variation in QTL (quantitative trait loci) and yield traits. The main goal is to amplify the genetic gain obtained from selection by estimating the genetic value of the animal with higher accuracy. For this purpose today, obligation to use MAS (Marker Assisted Selection) arises. Thus, it has been expressed in investigations that genetic variations on genes affecting physiological events associated with phenotype may affect quantitative variations in the related phenotype (Tambasco et al., 2003). In order to better understand the effects of existing polymorphisms within the selected candidate genes, the association with quantitative traits can be tested and related polymorphic regions can be used in MAS programs (Wu et al., 2005). Applying the traditional selection method to animals with long generations, such as cattle, sheep and goats, resulted in slow genetic progression. Therefore, the speed of selection can be increased by taking advantage of genetic markers that can be determined at an early age regardless of gender bias. Genetic polymorphisms with important functional effects on yield traits have been seen to have the most usage area in association studies.

On Chromosome 23 (Hallerman et al., 1988) the Prolactin is 10 kb in size, consists of 5 exons and 4 introns (Camper et al., 1984). It synthesizes a total of 229 amino acids, including 30 signal amino acids and 199 active amino acids (Wolf et al., 1990; Gothard et al., 1996; Cao et al., 2002). The prolactin hormone is mainly secreted by the anterior pituitary of the brain and has multiple functions. The target organ for the prolactin is the mammary gland, which stimulates development and differentiation here (Schradin et al., 2004). Their high levels in the blood, inhibit synthesis and secretion of hypofizar gonadotropins and steroid synthesis in ovaries. In addition to stimulating milk secretion, it accounts for growth, reproduction, osmoregulation immunology, gonadotropin secretion of the sexual glands, water, sodium and potassium excretion from the kidneys, initiation and continuity of lactation, as well as mammary gland growth and lactogenesis (Horseman et al., 1997; Tucker 1974; Collier et al., 1984). For males, it contributes to the continuation of normal testosterone production in physiological doses and have more than 300 effects, such as affecting sperm motility and fertility (Horseman et al., 1997). For these reasons, prolactin gene (PRL) may be an excellent candidate gene for use in breeding livestock.

RsaI endonuclease polymorphism have been identified by using PCR-RFLP with Genetic polymorphism studies on cattle *Prl* gene sequences (Mittra et al. 1995; Brym et al. 2005). The statistical relationships between these polymorphic variants and milk yield traits in cattle were examined by many researchers and significant associations were reported (Dybus et al. 2005; Brym et al. 2005; Khatami et al. 2005; He et al., 2006; Miceikiene et al. 2006; Zhou et al. 2006b; Li et al. 2006; Alipanah et al. 2007; Alipanah et al. 2008; Öztapak et al. 2008; Wojdak et al. 2008; Mehmanavaz et al. 2009; Ghasemi et al. 2009; Rorie et al. 2009; Alfonso et al. 2012; Boleckova et al. 2012; Ishaq et al. 2012; Akyüz et al. 2012; Vikas et al. 2012; Bukhari et al., 2013; Akyuz and Cinar, 2014 Özkan Unal et al. 2015). In these researches, A allele gene frequency of prolactin gene polymorphism was found to be higher than B allele gene frequency. It has also been suggested in the majority of researches that Prolactin variants may be useful in direct breeding programs to improve milk traits in animals (He et al. 2006; Alipanah et al. 2008; Rorie et al. 2009; Alfonso et al. 2012; Boleckova et al., 2012; Akyüz et al. 2012). Generally, the results show that the PRL / *RsaI* (-) allele is unfavourable for milk and protein yield, but for fat yield the

PRL / RsaI (+) allele effect is significant for milk and protein yield. In some literatures it is seen that PRL/RsaI (+/-) polymorphism is reported as A/B or A/G (GG=AA, AG=AB, AA=BB) (Ozdemir 2018).

2. MATERIALS AND METHODS

186 outbred Holstein cattle which were grown in the Kelkit region of Gümüşhane were used as material. Genomic DNA was obtained by commercial DNA isolation kit (Purgene DNA kit (Gentra Systems, Minnesota, USA)). PCR was performed to replicate the related gene region of the obtained DNAs, qualitative and quantitative controls of the analysis results were carried out by 2% agarose gel electrophoresis.

Prl/RsaI Forward: 5'-TTC ATG AAG CTG CTC ACC TG-3', Revers: 5'-TTG ATT CTT GGG TTG CTG CG-3' primers (Sonmez and Ozdemir 2017) were used in the analysis. For PCR amplification, to complete a final volume of 20 µl, about 50-100 ng genomic DNA, Buffer (pH: 8.5) 5.0 µl (10X), F Primer; 10 pmol/µl, R Primer; 10 pmol/µl, MgCl₂; 1.2 µl, Taq; 0.5-1.0 units, dNTP; 2.5 µl assembled and with ddH₂O the total volume was supplemented to 20 µl. At the first step of the PCR cycle conditions denaturation for the examined PRL gene region were programmed as 1 cycle at 94°C for 5 min.; at the second step including 30 cycles at 5'UTR and 4th exon, for 1 cycle consisting of 94°C for 45 sec and 30 sec, annealing temperatures of 58°C for 45 sec and 61°C for 48 sec; initial extension temperatures of 72°C for 45 sec, and 40 sec; the final extension temperatures of 72°C for 5 min, respectively.

Approximately 8-10 µl of each amplified sample was performed in 0.2 ml sterilized eppendorf tubes and restriction enzyme for 2-5 U related region, 2-5 µl RE buffer, 5 µl ddH₂O were added on each sample and sealed with 10-15 µl mineral oil. Then placed into the etuve, the incubation process was performed at 37 °C for 12 hours.

GenAlEx 6.5 (Peakall and Smouse, 2012) program was used for H-W genetic equilibrium test of genotype frequencies and allele gene and genotype frequencies of PRL locus of examined Holstein cattle. The SPSS 20.0 statistics package software was used in case of evaluating the yield records of the obtained polymorphic systems.

In the study, to test the effect of the prolactin genotypes belonging to cattle obtained at various periods on some milk yield performance, the following mathematical model was used in terms of least squares method.

$$Y_{ijk} = \mu + a_i + b_j + c_k + e_{ijkl}$$

In the equation: Y_{ijk} ; reviewed answer variable, μ ; expected mean, a_i ; the effect of genotype, b_j ; the effect of the order of lactation, c_k ; the effect of open days number of and e_{ijkl} ; the random error.

3. RESULTS AND DISCUSSION

4th exon of the Prl gene was obtained in three bands of 210/120/90 bp by cutting 210 bp PCR product with the RsaI enzyme. The identification and cutting regions of the restriction enzyme and the number and size of the bands of the genotypes are given in Table 1.

Table 1. Cutting region and fragments of RsaI restriction enzymes on Prolactin gene

PCR product (bp)	Recognition sequence (5'→3')	Genotype and fragment size (bp)
210	GT [^] AC	RsaI ^{-/-} =210
		RsaI ^{+/+} =120, 90
		RsaI ^{+/-} =210, 120, 90

As a result of PCR-RFLP analysis, a total of 186 animals were genotyped successfully and in the polymorphic region of the Prl gene, the frequencies of ^{-/-}, ^{-/+} and ^{+/+} genotypes were determined as 0.26, 0.52 and 0.22, respectively. In the population examined, the 4th exon RsaI allele gene frequency was 0.52 and the RsaI⁺ allele gene frequency was 0.48 (Table 2).

The most common genotype frequency of the exon 4 is the RsaI^{+/-} genotype and the value is 0.52. The lowest genotype frequency has been the RsaI^{+/+} genotype in population.

Table 2. Genotype and allele frequencies of PRL gene belonging to Holstein population

Genotype			Allele Frequency	
RsaI ^{-/-}	RsaI ^{-/+}	RsaI ^{+/+}	RsaI ⁻	RsaI ⁺
0.26	0.52	0.22	0.52	0.48

In all of the studies, including previous studies with different breeds (Alipanah et al., (2008) Russian Black and Red dairy cattle breeds, Wojdak et al., (2008) Holstein-Friesian dairy cattle, Rorie et al., (2009) Holstein Friesian, Jersey and Zebu cattle, Miceikienė et al., (2006) Lithuanian cattle breed, Vikas et al., (2012) and Bukhari et al., (2013) Frieswal dairy cattle, Alfonso et al., (2012) American Swiss breed, Boleckova et al., (2012) Çek Fleckvieh cattle, Kaplan and Boztepe (2010), Anatolian Buffalo and Brown Swiss breeds, Ghasemi et al., (2009) Montebeliard cows, Dybus et al., (2005), Black and White, and Jersey breeds, Dybus (2002), Black and White dairy cattle) to determine the polymorphism in the *RsaI* polymorphic region of the *Prl* gene, performed to determine *Prl* polymorphism, the *RsaI* allele frequency was found to be high and the frequency of the *RsaI*⁺ low and seemed to be in accordance with our findings.

According to the Hardy-Weinberg genetic balance test performed, the distribution of genotype frequencies was seen to be in equilibrium ($p > 0.05$) (Table 3).

Table 3. Genotype Frequencies of *Prl/RsaI* polymorphism and H-W Genetic Balance Test

N	Observed			Expected			(X ² Test)
	<i>RsaI</i> ^{-/-}	<i>RsaI</i> ^{+/-}	<i>RsaI</i> ^{+/+}	<i>RsaI</i> ^{-/-}	<i>RsaI</i> ^{+/-}	<i>RsaI</i> ^{+/+}	
186	49	96	41	50	93	43	0.22 ns

$p > 0.05$.

Least square means and standard errors for lactation milk yield, 305d milk yield, peak milk yield and lactation length of *PRL* genotypes are shown in Table 4.

Table 4. Least Squares Means and Standard Errors For Actual Lactation Milk Yield, 305d Milk Yield, Peak Daily Milk and Lactation Length Milk Yield.

Trait Effect		N	Actual Lactation Milk Yield (Kg)	305d Milk Yield (Kg)	Peak Daily Milk (Kg)	Lactation Length (d)
PRL Genotype	AA	102	7190,5±269,0	7281,5±209,1	35,4±0,7b*	318,7±10,6
	AB	287	6989,2±189,0	7257,1±143,5	35,5±0,5b	313,2±7,3
	BB	141	7479.0±245,9	7543,3±179,1	37,1±0,6a	317,4±9,7
Lactation Parity	1	195	6110,4±204,2**	6579,15±213,2**	31,6±0,5**	290,8±8,2**
	2	195	7825,7±193,6	7721,2±133,9	35,2±0,5	328,2±7,8
	3	105	8612,9±259,9	7570,0±179,0	38,0±0,6	390,3±9,0
	4	35	6329,4±438,1	7572,273±300,0	39,7±1,2	256,5±17,6
Open Days	1	138	7791,5±232,6**	7077,9±157,7**	35,7±0,6*	391,9±9,3**
	2	31	7655,8±445,1	7197,4±325,1	35,6±1,1	350,7±17,3
	3	40	7071,2±398,3	7023,1±295,5	35,1±0,9	306,3±15,2
	4	61	7087,2±328,0	7489,6±288,6	36,9±0,8	281,5±12,9
	≥5	260	6492,4±168, 5	8015,3±130,4	37,5±0,5	251,8±6,5
Overall		530	7219,6±174,9	7360,7±132,1	36,1±,454	316,5±6,9

* $p < 0.05$, ** $p < 0.01$.

There was no significant association between lactation milk yield, 305 day milk yield and lactation length milk yield with the detected *Prl* genotypes, only a significant association was found for peak milk yield ($p < 0.05$) (Tablo 4). In general, it appears that *Prl/RsaI* polymorphism is associated with milk yield traits in cattle and therefore is not in line with the results of other published studies (Brym et al., 2005; Khatami et al., 2005; He et al., 2006; Miceikienė et al., 2006; Zhou et al., 2006b; Li et al., 2006; Alipanah et al., 2007; Alipanah et al., 2008; Öztürk et al., 2008; Wojdak et al., 2008; Mehmanavaz et al., 2009; Ghasemi et al., 2009; Rorie et al., 2009; Alfonso et al. 2012; Boleckova et al., 2012; Ishaq et al., 2012; Akyüz et al., 2012; Vikas et al., 2012; Akyuz and Cinar, 2014; Özkan Unal et al., 2015). However, due to the genotype environment interactions or from the samples conducted the results may differ.

The different results reported in the literature and in this study show that *Prl/RsaI* polymorphism is not directly accountable for phenotypic variations and these contradictions can be explained by differences in genetic linkage balance as well as genotype, breed and environment interactions. Nevertheless, further investigation is necessary to determine whether there is an association between *Prl/RsaI* genotypes and milk traits in different cattle breeds that were reared in various environments.

A successful breeding study in terms of various yield traits in animals can be achieved by first revealing the genetic structure in a good way. Researches in genetic structure determination, significant distances have been covered in recent years over direct DNA techniques. Nowadays, the aim of most researchers is to use new techniques at the molecular level to help both breeding their countries' breeds and protect them as a native gene resource and to produce detailed results about the genetic structure of various breeds at the DNA level studies.

Polymorphisms, unlike mutations, do not cause dysfunction in the organism and do not cause a pathology. Since the polymorphisms in the cattle genome are at a high size, the size and qualities of these polymorphic structures must be determined on a preferential basis accurately and detailed in terms of breeding.

The results obtained in the study can be considered satisfactory in terms of revealing Holstein breeds prolactin polymorphism. However, in subsequent researches, it is necessary to carry out a larger number of sampling to replicate researches, and to associate polymorphic structures of prolactin gene with different yield traits of the animals.

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Use of New Bacteriological Mediums in the Isolation of Bacterial Fish Pathogens

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Abstract: Along with the developing aquaculture industry and the increasing production rates, it is important to identify the fish diseases accurately and quickly which cause great economic loss during the production cycle. Accurate and quick identification is the most important step for diagnosis of the fish diseases. Selective mediums are used in microbiology in recent years but these mediums were used for the first time for fish pathogens in this study. *Lactococcus garvieae*, *Pseudomonas fluorescens*, *Vibrio anguillarum*, *Yersinia ruckeri* and *Aeromonas hydrophila* were isolated from different rainbow trout farms in the southwest Aegean Region all year long. API identification products (BioMerieux, France) were used to determinate the biochemical profiles of the bacteria and molecular identifications were conducted in order to identify for sure. chromID® CPS® Elite / Columbia CNA +5% sheep blood, chromID® CPS® Elite, chromID® S. aureus Elite, chromID® Vibrio from BioMerieux (France) and Pseudomonas Aeromonas Selective Agar acc. to. Kielwein, Glutamate Starch Phenol Red Agar (GSP) agar (Merck), Cetrimide agar (Merck), Yersinia CIN agar (Merck), Thiosulfate Citrate Bile Sucrose (TCBS) agar (Merck) and Waltman-Shotts medium were used for each bacteria and compared with each other. The selective mediums which have not been previously used in the isolation of bacterial fish pathogens were tested and concluded that they are suitable for accurate and quick isolation of bacterial strains. At the end of the study, each bacteria's colonial growth and pigmentation were determined differently on each medium. The practical use of these selective mediums bring easier prediagnosis.

Keywords: Selective medium, fish disease, fish pathogen, rainbow trout, fish health

1. INTRODUCTION

Along with the developing aquaculture industry and the increasing production rates, it is important to identify the fish diseases accurately and quickly which cause great economic loss during the production cycle. *Vibrio anguillarum*, *Yersinia ruckeri*, *Pseudomonas fluorescens*, *Aeromonas hydrophila* and *Lactococcus garvieae* are the most essential fish pathogens for freshwater species and accurate and quick identification is the most important step for diagnosis of them.

Vibrio anguillarum, also known as salt-water furunculosis, ulcer disease and boil disease is a Gram-negative polar flagellated, comma-shaped rod bacterium that belongs to the Vibrionaceae family (Bagge and Bagge, 1956; Rucker, 1963; Kubota and Takakuwa, 1963; Actis et al 1999). From cultured sea bass (Çağırhan, 1993) and rainbow trout (Tanrikul, 2007) *V. anguillarum* was reported from Turkey. Currently, additional isolates were described from different fish farms and species as a result of the expansion of the aquaculture industry. The aetiological agent of yersiniosis or enteric redmouth disease (ERM), *Yersinia ruckeri*, causes main losses in fish farms, particularly affects salmonid fish (Davies, 1989; Raida and Buchmann, 2008; Bastardo et al., 2012). It was first reported by Çağırhan and Yureklitürk (1991) in Izmir/Turkey and since then observed from different locations such as Denizli (Timur and Timur 1991) and Marmara region (Karatas et al., 1997). *Pseudomonas* infection caused by *Pseudomonas fluorescens* is also known as Red skin disease has been reported from a wide range of fish species including rainbow trout (Li and Flemming, 1967; Li and Traxler, 1971; Sakai et al., 1989; Austin and Austin, 2007) with fin or tail rot in the infected area (Schäperclaus, 1979) and haemorrhagic lesions (Austin and Austin, 2007) and ulcerative conditions (Mastan, 2013). *Aeromonas hydrophila* is a Gram-negative motile, opportunistic microorganism that is widely distributed in water, soil, food and determined from aquatic environments and gastrointestinal tracts of healthy fish (Laith et al., 2013; Rey et al., 2009). The pathogen is known as Bacterial Hemorrhagic Septicemia, Aeromonad Septicemia and Red Pest (Roberts and Shepherd, 2001) and cause skin ulcers, hemorrhage and necrosis of visceral organs as major symptoms (Huizinga et al., 1979; Austin and Austin, 2007; Cipriano et al., 2001). *Lactococcus garvieae* is Gram (+), non-motile, bacteria that cause septicemia and meningoencephalitis in many marine and freshwater fish species (Eldar et al., 1996; Teixeira et al., 1996; Barnes et al., 2002). In Turkey, it was firstly isolated from a rainbow trout farm as *Enterococcus* sp. (Çağırhan and Tanrikul, 1995) then in the following years reported from Konya and surrounding (Kav and Erganiş, 2007), Black Sea region (Türe and Savaş, 2010) and Mediterranean region (Ozer et al., 2008).

In this study, selective mediums that are used in microbiology in recent years have tested for the first time for these fish pathogens. It is aimed to determine the practical use of these selective mediums which is demanded to bring easier prediagnosis.

2. MATERIALS AND METHODS

Lactococcus garvieae, *Pseudomonas fluorescens*, *Vibrio anguillarum*, *Yersinia ruckeri* and *Aeromonas hydrophila* were isolated from different rainbow trout farms in the southwest Aegean Region all year long. API identification products (BioMerieux, France) were used to determinate the biochemical profiles of the bacteria and 16SrRNA gene sequence was polymerase chain reaction (PCR) amplified in order to ensure the strains with The EurX GeneMATRIX Tissue Bacteria DNA Isolation Kit (EURx, Poland) and 27F and 1492R primers then DNA samples were sent to MacroGen direct sequencing service (MacroGen, Holland) and sequences were checked with the BLASTN 2.6.1. database.

ChromID® CPS® Elite / Columbia CNA +5% sheep blood, ChromID® CPS® Elite, chromID® S. aureus Elite, chromID® Vibrio from BioMerieux (France) and Pseudomonas Aeromonas Selective Agar acc. to Kielwein, Glutamate Starch Phenol Red Agar (GSP) agar (Merck), Cetrimide agar (Merck), Yersinia CIN agar (Merck), Thiosulfate Citrate Bile Sucrose (TCBS) agar (Merck) and Waltman-Shotts medium were used for each bacteria and compared with each other.

3. RESULTS AND DISCUSSION

The biochemical properties of isolated pathogens were presented in Table 1. After the PCR amplification of isolated bacteria, the gene sequences were registered in BLASTN 2.6.1 database and the nucleotide identity of *Yersinia ruckeri* (Sequence ID: KF413425.1), *Aeromonas hydrophila* (Sequence ID: MF111726.1), *Vibrio anguillarum* (Sequence ID: CP023208.1), *Lactococcus garvieae* (Sequence ID: KY486014.1) and *Pseudomonas fluorescens* (Sequence ID: KT767961.1) were conducted.

Table 1. The morphological and biochemical properties of isolated fish pathogens (API 20E and API Strep, BioMerieux, France)

Properties	<i>Vibrio anguillarum</i>	<i>Yersinia ruckeri</i>	<i>Pseudomonas fluorescens</i>	<i>Aeromonas hydrophila</i>	Properties	<i>Lactococcus garvieae</i>
Gram strain	-	-	-	-	Gram strain	+
Motility	+	+	+	+	Motility	-
Oxidase	+	-	+	+	Oxidase	-
Catalase	+	+	+	+	Catalase	-
ONPG	+	+	-	+	VP	+
ADH	+	-	+	+	Hippurate	-
LDC	-	+	-	-	Aesculin	+
ODC	-	+	-	-	Pyrrolidonylarylamidase	+
Citrate utilization	+	+	+	-	α -Galactosidase	-
H₂S	-	-	-	+	β -Glukoronidase	-
Urease	-	-	-	-	β -Galactosidase	-
TDA	-	-	-	-	Alkaline phosphatase	-
Indole	-	-	-	+	Leucine arylamidase	+
VP	+	+	+	+	ADH	+
Gelatin	+	+	+	+	Ribose	+
Glucose	+	+	+	+	Arabinose	+
Mannitol	+	+	-	+	Mannitol	+
Inositol	+	-	-	-	Sorbitol	-
Sorbitol	+	-	-	+	Lactose	-
Rhamnose	-	-	-	-	Trehalose	+
Sucrose	+	-	-	+	Inulin	-
Melibiose	-	-	+	-	Raffinose	-
Amygdalin	-	-	-	+	Amygdalin	-
Arabinose	+	-	+	+	Glycogen	-
					β -hemolysis	-

To determine the new mediums for fish pathogens, each bacteria were streaked on classically known and firstly use mediums. *V. anguillarum* was seen as purple colonies on Chrom ID Vibrio medium and bright orange colonies on CPSE/CNA and CPSE medium. Yellow coloured (sucrose-fermenting) colonies was observed on TCBS media (Figure 1). *Y. ruckeri* colonies were detected on WS medium which were surrounded by a zone of precipitation caused by degraded Tween 20 and calcium chloride, CPSE/CNA and CPSE medium with bright orange colonies but there was no actual colonial growth detected on Chrom ID Vibrio medium (Figure 2).

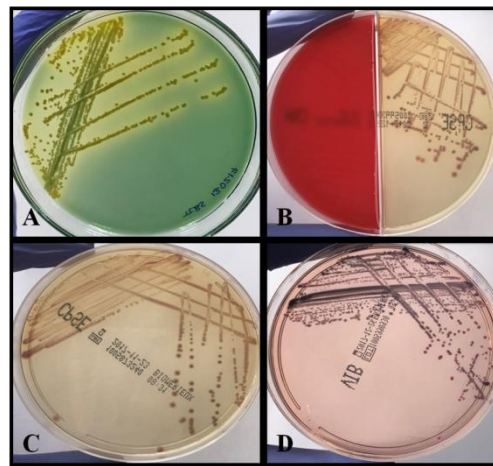


Figure 1. A: *V.anguillarum* colonies on TCBS medium, B: *V.anguillarum* colonies on CPSE/CNA medium, C: *V.anguillarum* colonies on CPSE medium, D: *V.anguillarum* colonies on Chrom ID Vibrio medium

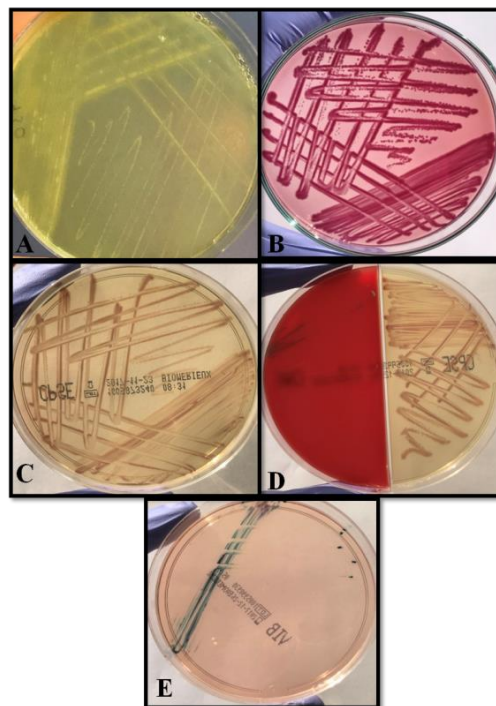


Figure 2. A: *Y.ruckeri* colonies on WS medium, B: *Y.ruckeri* colonies on CIN agar, C: *Y.ruckeri* colonies on CPSE medium, D: *Y.ruckeri* colonies on CPSE/CNA medium, E: *Y.ruckeri* colonies on Chrom ID Vibrio medium

Off-white *P.fluorescens* colonies were observed on CPSE/CNA and CPSE medium but orange colonies were determined on ChromID Vibrio medium (Figure 3).

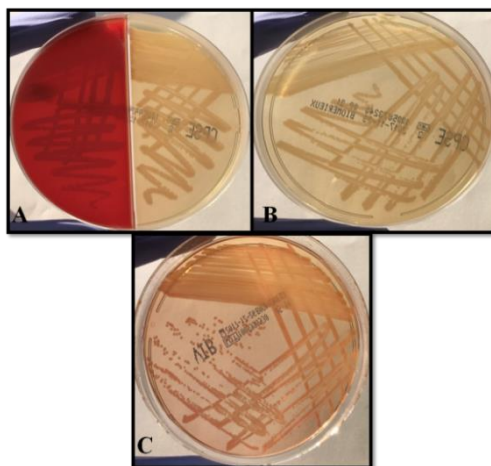


Figure 3. A: *P.flourescens* colonies on CPSE/CNA medium, B: *P.flourescens* colonies on CPSE medium, C: *P.flourescens* colonies on Chrom ID Vibrio medium

A.hydrophila was observed on GSP agar with yellow colonies and seen only in CPSE and CPSE/CNA medium along the new mediums in this study (Figure 4).

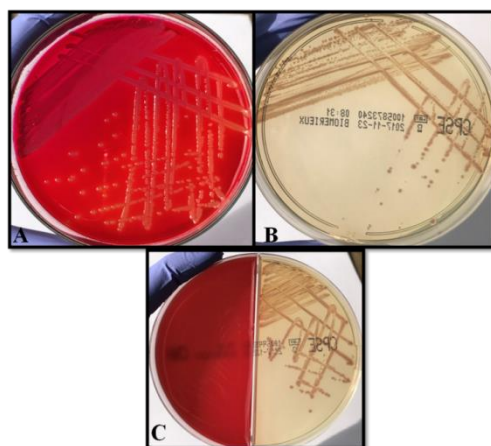


Figure 4. A: *A.hydrophila* colonies on GSP agar, B: *A.hydrophila* colonies on CPSE medium, C: *A.hydrophila* colonies on CPSE/CNA medium

L.garvieae was detected with green colonies on CPSE and CPSE/CNA mediums but no other growth was observed on other mediums (Figure 5).

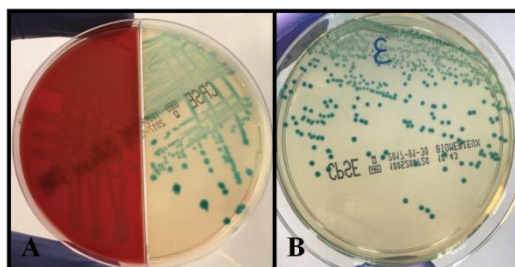


Figure 5. A: *L.garvieae* colonies on CPSE/CNA medium, B: *L.garvieae* colonies on CPSE medium

All 5 fish pathogens didn't grow on Chrom ID MRSA and Chrom ID *S.aureus* Elite mediums (Figure 6).

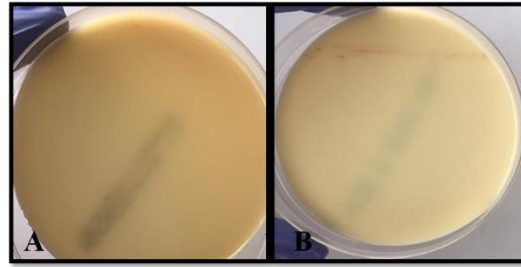


Figure 6. A: *V.anguillarum* streaked on Chrom ID MRSA Smart, B: *V.anguillarum* streaked on Chrom ID *S.aureus* Elite

Chromogenic media is used for its selective and differential benefits in order to cost saving and quicker confirmation of pathogens in clinical microbiology recently. The target pathogens' enzyme activity with synthetic chromogenic enzyme substrates enables them to grow as colored colonies and lead researchers to reduce time, labor, use of reagents and other confirmation tests (Perry, 2017). It is especially important for detecting specific pathogens within polymicrobial cultures (Perry and Freydiere, 2007). In this study, different morphologies of bacterial colonies enable to observe them easier than classical media.

In conclusion; new culture media should be developed and used for quick, time and cost saving diagnosis. In this study, it is determined that CPSE and CPSE/CNA ready to use mediums are useful for fundamental fish pathogens, besides Chrom ID *Vibrio* is useful for detection of *V.anguillarum*. The enzyme mechanism of these pathogens with chromogenic mediums couldn't describe in this study because the mediums are commercial products and the whole contents of the mediums aren't declared. But the aim with these results is to help researchers for routine diagnostics and shorter time to result.

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The Effect of Gender on Ultrasound Measurement in Karayaka Lambs

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Abstract: Real-time ultrasound technology is widely used in breeding programs aimed at meat quality; it is a technology that is increasingly used to define meat quality and to obtain estimation parameters. The study was carried out to determine the effect of gender on ultrasound measurements and the relationship between ultrasound measurements and carcass characteristics in Karayaka lambs. Total of 20 Karayaka lamb was used, 7 females and 13 males aged 6 months, in this study. The lambs were fed dry hay and 150 g of lamb starting feed in addition to mother's milk from 3 months to weaning. The lambs were weaning from the milk at 3 months of age. After weaning, the lambs were grazed in a meadow during daylight hours and fed 200 g of lamb growth feed in the evening. The ultrasound measurements were performed with a portable real-time ultrasound device with a 3.5-MHz, 12.5-cm linear transducer. Measurements were taken of skin thickness, subcutaneous fat thickness, muscle depth, muscle width, and muscle area between the 12th and 13th thoracic vertebrae using real-time ultrasound in lambs. The lambs were slaughtered after the ultrasound measurements, and then their warm and cold carcass weights, chilling loss and dressing percentage were determined. In the study, the difference between ultrasonic muscle depth for male and female lambs was statistically significant ($P<0.05$). In addition, there was high positive correlation relationships between subcutaneous fat thickness, muscle width and live weight, hot and cold carcass weight ($P<0.05$). In conclusion, subcutaneous fat thickness and muscle width related with carcass characteristics and the relationship may use in estimation for carcass characteristics in lambs.

Keywords: Carcass weight, sheep, subcutaneous fat thickness, ultrasound measurements

1. INTRODUCTION

Determination of carcass composition and meat yield before slaughter is important for animal breeders and for the meat production sector in order to select animals with desired carcass qualities (Teixeira et al., 2006). The evaluation of carcass composition in sheep has been done with subjective methods such as carcass grading after slaughter and objective methods like ultrasound and computed tomography before slaughter (Silva and Cadavez, 2012; Akdag et al., 2015). Real-time ultrasound is a non-invasive technique used to determine carcass traits and composition, based on the depth (ULD), width (ULW) and area (ULA) of the *Longissimus Thoracis et Lumborum* muscle, the subcutaneous fat thickness around the muscle (UFT) and its skin thickness (UST) (Akdag et al., 2017). In the prediction of carcass composition with ultrasound, species, age, sex, live weight and technical equipment can all have an influence (Stanford et al., 1995; Silva et al., 2005; Akdag et al., 2017).

The study was carried out to determine the effect of gender on ultrasound measurements and the relationship between ultrasound measurements and carcass traits in Karayaka lambs.

2. MATERIALS AND METHODS

Total of 20 Karayaka lamb was used, 7 females and 13 males aged 6 months, in this study. The lambs were fed dry hay and 150 g of lamb starting feed in addition to mother's milk until 3 months of age. The lambs were weaning from the milk at 3 months of age. After weaning, the lambs were grazed in a meadow during daylight hours and fed 200 g of lamb growth feed in the evening. Water was available ad libitum.

The ultrasound measurements were performed with a portable real-time ultrasound device with a 3.5-MHz, 12.5-cm linear transducer. All measurements were taken on the left side, 4 cm from the vertebral column. Measurements were taken of skin thickness (UST), subcutaneous fat thickness (UFT), muscle depth (ULD), muscle width (ULW), and muscle area (ULA) between the 12th and 13th thoracic vertebrae using real-time ultrasound in lambs (Akdag et al., 2015).

After ultrasound measurements were completed, the lambs were not fed in the 12 h immediately before slaughter, for determination of the carcass traits. The head, hide and all internal organs were removed and warm carcass weight determined. Cold carcass weights were recorded after chilling at 4 °C for 24 h. Dressing percentages and chilling loss were determined from the live weights taken before slaughter and from the carcass weights after chilling 24 hours (Akdag et al., 2017).

3.RESULTS AND DISCUSSION

Comparisons of ultrasound measurements according to female and male lambs are shown in Table 1. In the study, the difference between ULD for male and female lambs was statistically significant ($P < 0.05$). Gokdal et al. (2004) previously stated that the accuracy of ultrasound measurements are directly affected by the animal's sex, breed and live weight, along with the ultrasound device and user's experience. Stanford et al. (2001) reported that, ultrasound measurements from gender were found to be statistically insignificant.

Comparisons of carcass traits according to gender are shown in Table 2. In the study, the difference between live weight for male and female lambs was statistically significant ($P < 0.05$). Similar to this result, Aksoy et al. (2007) reported that the live weight of male lambs was higher than that of female lambs.

Table 1. Comparisons of ultrasound measurements according to female and male lambs.

Traits	Female		Male		P value
	Mean	S.E.	Mean	S.E.	
UST (mm)	2.70	0.06	2.70	0.15	0.99
UFT (mm)	1.91	0.02	2.27	0.02	0.31
ULD (mm)	19.21	0.47	21.98	0.94	0.02
ULW (mm)	46.28	2.06	46.40	1.70	0.96
ULA (cm ²)	12.11	0.26	13.05	0.36	0.08

UST: Ultrasound skin thickness; UFT: Ultrasound subcutaneous fat thickness;

ULD: Ultrasound muscle depth; ULW: Ultrasound muscle width; ULA: Ultrasound muscle area

Table 2. Comparisons of carcass traits according to gender

Traits	Female		Male		P value
	Mean	S.E.	Mean	S.E.	
Live weight (kg)	29.10	1.81	35.09	1.53	0.025
Warm carcass weight (kg)	13.97	1.05	15.78	0.79	0.182
Cold carcass weight (kg)	13.67	1.06	15.35	0.79	0.217
Chilling loss (%)	2.22	0.35	2.79	0.31	0.263
Dressing percentage (%)	46.79	1.43	43.79	1.25	0.144

The phenotypic correlation coefficients between the ultrasound measurements and live weight and carcass traits are shown in Table 3. In the measurements from the 12-13T, there was a high positive correlation between UFT and live weight, warm and cold carcass weight; ULW and live weight, warm carcass weight and cold carcass weight; ULA and live weight ($P < 0.01$).

Table 3. The phenotypic correlation coefficients between the ultrasound measurements and carcass traits.

Traits	UST	UFT	ULD	ULW	ULA
Live weight	-0.256	0.760*	-0.034	0.652*	0.657*
Warm carcass weight	-0.426	0.837*	-0.121	0.654*	0.411
Cold carcass weight	-0.431	0.836*	-0.121	0.658*	0.397
Chilling loss	0.297	-0.367	0.055	-0.332	0.094
Dressing percentage	-0.397	0.250	-0.161	0.066	-0.460

* $P < 0.01$; UST: Ultrasound skin thickness; UFT: Ultrasound subcutaneous fat thickness; ULD: Ultrasound muscle depth; ULW: Ultrasound muscle width; ULA: Ultrasound muscle area

In studies where the relationship between ultrasound measurements and carcass traits were investigated, high positive correlations were found between the UFT and cold carcass weight (Ripoll et al., 2010) and live weight (Teixeira et al., 2006) these results are supported by the present study. It's also reported ULW values have a significant positive correlation with live weight by Agamy et al. (2015) and cold carcass weight by Ripol et al. (2010).

In conclusion, gender was determined to be effective only on muscle depth (ULD) from ultrasound measurements. In addition, ultrasonic measurements are related with carcass traits. Subcutaneous fat thickness and muscle width related with carcass characteristics and the relationship may use in estimation for carcass characteristics in lambs.

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Performance of Zinc Application Methods on Durum Wheat

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ABSTRACT: The trail was carried out to determine the effects of different zinc doses and application methods on grain yield, yield components and plant zinc concentrations of durum wheat (cv. Diyarbakir 81) in Southeastern Anatolia region at two years. The treatments were soil, seed and leaf applications of zinc to wheat. The amounts of 0, 1800, 3600 and 5400 g zinc ton⁻¹ seed⁻¹ for the seed application, 0.0, 2.3, 4.6 and 6.9 kg zinc ha⁻¹ for soil application and 0.0, 110, 330 and 550 g zinc ha⁻¹ for the leaf application were used. The results showed that zinc doses significantly affected all the investigated properties. The highest value for all investigated properties, except protein content, was obtained by the highest zinc doses. Compared to the control, grain yield at third and fourth doses increased 15.0 and 17.4 %, over all application methods, respectively. Yield components, *i.e.*, spike length, spikelet number, grain number per spike and thousand grain weight were increased approximately 10 % upon the addition of third and fourth doses. Application methods significantly affected to grain yield, zinc concentration, protein content of grain and plant height. The highest doses of soil, leaf and seed applications increased grain yield up to 26.9, 12.5 and 12.2 %, respectively. The application of 6.9 kg zinc ha⁻¹ to soil or 5400 g zinc ton⁻¹ seed⁻¹ to seed or 550 g zinc ha⁻¹ solution to the plants may be more efficient in terms of their economically feasibility and yield increases.

Keywords: Durum wheat, Fertilization, Zinc, Yield, Protein content

1. INTRODUCTION

Zinc deficiency is one major micronutrient deficiency in humans, particularly in developing countries, where cereals with very low levels of Zn are the primary stable food for human consumption (Graham and Welch, 1995). High consumption of cereals with low concentrations and bioavailabilities of zinc has been a major reason for the widespread occurrence of zinc deficiency in humans (Graham and Welch, 1995; Prasad, 1984).

On the other hand, zinc deficiency in plant growth is a worldwide nutritional constraint, particularly in calcareous soils of arid and semi-arid regions (Takkar and Walker, 1993). Eyüboğlu *et al.* reported that 50 % of the cultivated area in the Southeastern Anatolian region was deficient in zinc because of the high level of clay and lime in the soils, low precipitation and high evaporation. There are numerous studies on the effects of rates and application methods of fertilizers containing zinc employed in the compensation of the deficiency on the yield and yield components of the grain crops (Bansal *et al.*, 1990; Yilmaz *et al.*, 2000). For instance, Yadav (1991) investigated the effects of fertilizers containing N and Zn on the wheat yield. The grain yield of 3.72 t ha⁻¹ was obtained with 50 kg ZnSO₄ ha⁻¹ while the yield was 3.43 t ha⁻¹ without zinc application. Ibrahim and Shalaby (1994) applied the fertilizers containing Fe, Mn, Zn and Cu by the method of soil, leaf and seed to wheat. The seed application was found to most effective method over all different fertilizer. The soil, leaf and seed application methods of zinc to wheat increased yield and yield components and seed application was superior to seed and leaf applications (Ozbek and Ozgumus, 1998).

Grain yield of cereal species grown under zinc deficiency conditions was *ca.* 35 % lower than that of the soils had sufficient zinc (Torun *et al.*, 1998). Aydın *et al.* (1998) reported that grain yield of barley significantly increased with 5 kg zinc ha⁻¹ application. Raghbir *et al.* (1995) also showed that 5 mg zinc kg⁻¹ application to soil in a pot experiment increased grain content of protein and sulphur content of barley. On the other hand, there was no significant effect of the fertilizers containing zinc in irrigated and rainfed conditions of Harran Plain. However, significant differences in response to zinc among barley cultivars were found for grain yield (Colkesen *et al.*, 1997). Taban *et al.* (1998) determined that zinc applications increased grain yield and 1000 grain weight. Soil, leaf and seed zinc application methods increased grain yield of bread wheat and durum wheat at 76, 61 and 52 %, respectively (Yilmaz *et al.*, 2000).

This study was conducted to determine the effects of different application methods and the amount of zinc fertilizers on zinc content of plants, yield and yield components of durum wheat (c.v. Diyarbakir 81), grown in the South-eastern Anatolian region, where zinc deficiency reached to the considerable levels in the soils.

2. MATERIALS AND METHODS

The durum wheat cultivar 'Diyarbakir 81' was used as plant material for present experiment. Field experiments were conducted at rainfed conditions at the Experimental and Research Station of Agricultural Faculty of Dicle University, Diyarbakir during the years of 2000-2002 under rain-fed conditions. Precipitation in the first and following year of the experiments were recorded as 537 and 474 mm, respectively. Some characteristics of soils (0-30 cm) in the experimental site were as follows: Soil texture is clayey loam and the other parameters such as CaCO_3 , pH, organic matter and available P were 7.8 %, 7.7, 1.8 % and 7.5 mg kg^{-1} , respectively. The concentration of DTPA-extractable micronutrient Zn of soil was 0.37 mg kg^{-1} . Seeding rate was 450 seeds m^{-2} and plot sizes were 8 m^2 at sowing and 4.8 m^2 at harvest. The interval between plots was 0.5 m to prevent the interaction of the fertilizer. Plots were sown after the first rain and received 120 kg ha^{-1} N in two applications (60 kg N at sowing and 60 kg N at stem elongation) and 60 kg ha^{-1} P_2O_5 was applied each year.

Zinc application methods were soil, leaf and seed applications. At the soil application, $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ fertilizer were sprayed to plots before planting at the doses of 0, 2.3, 4.6, $6.9 \text{ kg Zn ha}^{-1}$ and incorporated into the soil to 10 cm depth by a rototiller. At the leaf application, the four doses 0.0, 110, 330, $550 \text{ g zinc ha}^{-1}$ of the solutions prepared from $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ were applied into leaves three times at 15 d intervals starting from the period of stem elongation onward. At the seed application, 100 mL solution of Teprosyn F-2498 which contains the doses of 0, 1800, 3600 and $5400 \text{ g zinc ton}^{-1} \text{ seed}^{-1}$ was sprayed on 1 kg seed and then seeds were mixed thoroughly and air dried with 12 h duration. First, second, third and fourth zinc doses of all application methods were described as Zn0, Zn1, Zn2 and Zn3 for all investigated traits in present studies.

Ten plants from each plot at the period of the spike formation selected randomly were taken at the height of 10 cm from the ground cutting by a non-rusting steel scissors so as to determine the zinc concentrations of the wheat (Bergmann, 1988). The zinc concentrations of the plants were determined (Cakmak et al, 1996) by atomic absorption spectrophotometer after ashing samples at 550°C and dissolving ash in 3.3 % HCl. The plant height, the spike length, the number of the spikelets, the grain number per spike, the grain weight per spike, the thousand grain weight, the grain yield (Genç, 1974) and the protein rate in the grain (Mark Leco FP-528 protein/nitrogen analyzer apparatus) were determined. Linear or non-linear regression models were tested to find the best zinc dose to give the highest grain yield. Cubic regression curves which better explain the effects of zinc for all application methods were used.

Experimental design was a split plot design with three replications. Differences among means and treatments were compared by the least significant differences (LSD) at $p < 0.05$ and $p < 0.01$ using MSTAT-C software program. Regression analysis was done by using SPSS software program.

3. RESULTS AND DISCUSSION

The effects of the application doses on all investigated properties were found to be significant (Tables 1-3). For all investigated traits, except protein content, the highest results were obtained by Zn3 dose, while the highest protein content was obtained by Zn2 dose. Application of Zn2 and Zn3 doses resulted in ca. 10 % increment at spike length, spikelet number, grain number per spike and 1000 grain weight. Also grain yields at Zn2 and Zn3 over all application methods were 15.0 and 17.4 % higher than that of Zn0.

The effects of the application methods on plant height, zinc concentration, grain yield and protein content were significantly different (Tables 1 and 3), while spike length, spikelet number, grain number per year, grain weight per spike and 1000 grain weight were not affected by application methods. Soil application significantly increased the grain yield more than seed and foliar application (Table-3). Soil, foliar and seed application methods increased grain yield up to 15.5, 7.9 and 6.7 %, respectively.

Table 1. Effects of fertilizers containing zinc on plant height, spike length and spikelet number per spike of durum wheat

Treatments		Plant height (cm)			Spike Length (cm)			Spikelet number per Spike		
		2001	2002	Means	2001	2002	Means	2001	2002	Means
Seed	Zn ₀	105.3	114.0	109.7	7.20	8.10	7.65	20.6	21.0	20.8
	Zn ₁	106.4	112.6	109.5	7.57	8.47	8.02	21.5	21.6	21.6
	Zn ₂	107.2	115.6	111.4	8.03	8.95	8.49	22.1	23.5	22.8
	Zn ₃	108.6	119.7	114.1	8.23	8.85	8.54	23.0	23.0	23.0
Soil	Zn ₀	104.6	119.8	112.2	7.03	7.98	7.42	20.8	20.7	20.8
	Zn ₁	106.3	122.9	114.6	7.53	8.09	7.81	22.8	21.7	22.2
	Zn ₂	107.0	124.6	115.8	7.83	8.30	8.07	22.3	22.5	22.4
	Zn ₃	107.8	125.3	116.6	8.10	8.54	8.32	21.9	23.3	22.6
Leaf	Zn ₀	105.9	116.5	111.2	7.20	7.82	7.51	20.8	21.5	20.6
	Zn ₁	107.4	120.4	113.9	7.50	8.24	7.87	22.8	22.1	21.7
	Zn ₂	108.7	124.1	116.4	8.10	8.70	8.39	22.3	23.0	22.8
	Zn ₃	109.6	126.2	117.9	8.20	8.43	8.31	21.9	23.2	23.4
Interaction (Application x Dose)										
LSD		N.S.			N.S.			N.S.		
Applications means	Seed	111.2 b			8.18			22.04		
	Soil	114.8 a			7.90			22.00		
	Leaf	114.9 a			8.02			22.10		
LSD		2.523*			N.S.			N.S.		
Doses Means	Zn ₀	110.0 b			7.53 b			20.71 b		
	Zn ₁	112.7 ab			7.90 ab			21.82 ab		
	Zn ₂	114.5 ab			8.32 a			22.67 a		
	Zn ₃	116.2 a			8.39 a			22.99 a		
LSD		3.949**			0.537**			1.576**		

*(p < 0.05), **(p < 0.01), N.S. = Non-significant ; a,b = The differences among the groups with different letters in the same column and line are significant.

Zinc concentration of plants was mostly affected by adding zinc doses. The concentration rose 25 % after each zinc dose increase. Leaf application increased zinc concentration twice higher than seed and soil application. Zinc concentration increased by seed and soil application 1.6 and 6.1 %, respectively, while foliar application increased 106.6 %. Protein content was slightly increased by application methods and seed, soil and foliar application raised protein content of seeds 5.9, 2.5 and 1.2 %, respectively. The effects of zinc application methods and doses on phosphorus concentration of plant were also not significant (data not shown).

There were significant differences in between successive years in durum wheat plant parameters such as plant height, spike length, grain number per spike, grain weight per spike, thousand grain weight, zinc concentration and grain yield. The main reason of the differences in grain yield between two growing seasons can be attributed to heat and drought stress during germination and tillering period and to late heading time (data not shown) in the first year. The plant zinc concentration at the first year was lower than the second year. This difference in zinc concentration may be caused by unexpected rain in the first year after third application of ZnSO₄·7H₂O solution to plant.

Regression analysis showed that relationship between zinc doses and grain yield was significant for application methods. The curves simulated in prediction of grain yield from zinc doses were given in Fig. 1. According to the results of cubic equations, the highest grain yield can be obtained from the doses of 3821 g zinc ton⁻¹ seed⁻¹ for seed, 12.7 kg zinc ha⁻¹ soil and 401 g zinc ha⁻¹ for leaf application.

The results of plant height (Table-1) were correlated well with the findings of studies (Ozbek et al, 1998; Bayrakli et al, 1995) showing increases in the plant height from 57.6 to 63.3 cm and from 86 to 95 cm on the zinc application. One of the most common symptoms of the insufficient zinc level is the shortening of the plant height (Cakmak et al, 1998).

Table 2. Effects of fertilizers containing zinc on grain number per spike, grain weight per spike and thousand grain weight of durum wheat

Treatments		Grain number per spike			Grain weight per spike (g)			Thousand grain weight (g)		
		2001	2002	Means	2001	2002	Means	2001	2002	Means
Seed	Zn ₀	45.2	48.8	47.0	1.89	2.44	2.17	39.5	48.3	43.9
	Zn ₁	47.4	40.9	49.2	1.96	2.57	2.27	43.6	49.3	46.5
	Zn ₂	48.6	52.7	50.6	2.22	2.67	2.45	45.1	54.6	49.9
	Zn ₃	49.4	53.9	51.6	2.11	2.75	2.43	47.1	51.8	49.4
Soil	Zn ₀	42.7	46.7	44.7	1.79	2.33	2.06	41.8	49.9	45.9
	Zn ₁	46.5	48.6	47.5	1.93	2.50	2.22	44.6	50.5	47.6
	Zn ₂	48.4	51.0	49.7	2.05	2.76	2.40	46.6	53.0	49.8
	Zn ₃	46.1	52.3	49.2	1.97	2.79	2.38	45.7	54.0	49.9
Leaf	Zn ₀	45.9	47.6	46.7	1.76	2.29	2.03	40.2	49.7	45.0
	Zn ₁	46.8	49.3	48.1	1.97	2.48	2.23	42.2	50.6	46.4
	Zn ₂	48.8	51.8	50.3	2.08	2.70	2.39	46.7	53.1	49.9
	Zn ₃	50.0	52.5	51.3	2.13	2.63	2.40	48.3	51.9	50.1
Interaction (Application x Dose)										
LSD		N.S.			N.S.			N.S.		
Applications means	Seed	49.6			2.33			47.4		
	Soil	47.8			2.27			48.3		
	Leaf	49.1			2.26			47.8		
LSD		N.S.			N.S.			N.S.		
Doses Means	Zn ₀	46.2 b			2.09 b			44.9 b		
	Zn ₁	48.3 ab			2.24 ab			46.8 b		
	Zn ₂	50.2 a			2.42 a			49.9 a		
	Zn ₃	50.7 a			2.40 a			49.8 a		
LSD		3.857**			0.2107**			2.812**		

*(p < 0.05), ***(p < 0.01), N.S. = Non-significant ; a,b = The differences among the groups with different letters in the same column and line are significant.

Despite the spike length is controlled mainly by the genetic factors, it increased by adding zinc doses. This result was similar with the findings of Sayed *et al.* (1988) and Kenbaey and Sade (1998). Also increasing zinc application rates have increased spike length and grain number per spike.

The results showing the increase of the grain number per spike at the increasing rates of zinc application were in parallel with the findings of those of showing the increase of grain number per spike in wheat from 12.8 to 18.2 at the increased zinc application rates (Bayrakli *et al.*, 1995) and the increase in the grain number per spike in wheat varieties (Ozbek *et al.*, 1998) from 23.8 to 27.4. These increases might result from positive correlations among the spike properties of wheat (Keser and Altay, 1993). Several researchers (Taban *et al.*, 1998; Mishra *et al.*, 1989; Gezgin *et al.*, 2000) also reported that zinc application increased the grain weight of wheat.

Zinc level of wheat at heading time changes (Bergmann, 1988) between 20 and 70 mg kg⁻¹. Zinc application methods in this study and Zn₁, Zn₂ and Zn₃ doses increased the zinc level up to the optimum level. Leaf zinc application increased zinc concentration twice higher than seed and soil application (Table-3). This might result from the getting lower concentration (by growth) of the zinc level in the tissues of wheat applied by the soil and seed methods (Yilmaz *et al.*, 2000). The differences could also be attributed to the differences in the homogenization of zinc spray and uptake (diffusion) of zinc by leaves. The results showed that zinc concentrations of plants increased from 19.9 to 34.9 mg zinc kg⁻¹ by increasing doses in all applications. This supports the findings of those showing the increase of zinc concentrations in wheat (Cakmak *et al.*, 1996; Rengel and Graham, 1995) and in different cereals (Torun *et al.*, 1998).

Table 3. Effects of fertilizers containing zinc on grain yield, grain protein content and zinc concentrations of the plants of durum wheat

Treatments		Grain yield (kg ha ⁻¹)			Grain protein content (%)			Zinc concentrations of plants (mg kg ⁻¹)		
		2001	2002	Means	2001	2002	Means	2001	2002	Means
Seed	Zn ₀	4028	5140	4584	16.2	15.6	15.2	18.5	19.7	19.1 d
	Zn ₁	4534	5437	4985	15.8	15.9	15.5	20.9	20.8	20.9 d
	Zn ₂	4936	5333	5135	16.4	16.4	16.0	18.8	22.0	20.4 d
	Zn ₃	4653	5640	5147	16.0	16.0	15.7	18.3	22.8	20.5 d
Soil	Zn ₀	4140	5350	4745	15.2	14.9	14.7	17.2	20.4	18.8 d
	Zn ₁	4303	5990	5147	14.0	14.9	14.9	21.0	21.6	21.3 d
	Zn ₂	4896	6237	5566	14.8	15.1	15.3	20.5	23.5	21.9 d
	Zn ₃	5026	7023	6025	14.5	15.4	15.5	20.2	24.4	22.3 d
Leaf	Zn ₀	4177	5063	4620	13.3	14.3	14.3	21.6	21.8	21.7 d
	Zn ₁	4516	5303	4910	13.3	14.8	14.8	25.6	40.6	33.1 c
	Zn ₂	4844	5850	5347	13.7	15.9	15.6	30.8	64.2	47.5 b
	Zn ₃	4680	5720	5200	13.6	14.9	15.0	34.6	89.0	61.8 a
Interaction (Application x Dose)										
LSD		N.S.			N.S.			8.044**		
Applications means	Seed	4963 b			15.6 a			20.2 b		
	Soil	5371 a			15.1 ab			21.1 b		
	Leaf	5019 b			14.9 b			41.0 a		
LSD		300.2*			0.4805*			5.596**		
Doses Means	Zn ₀	4650 c			14.7 b			19.9 d		
	Zn ₁	5014 bc			15.1 ab			25.1 c		
	Zn ₂	5349 ab			15.6 a			29.9 b		
	Zn ₃	5457 a			15.4 ab			34.8 a		
LSD		416.3**			0.6992**			4.644**		

*(p < 0.05), **(p < 0.01), N.S. = Non-significant ; a,b = The differences among the groups with different letters in the same column and line are significant.

Zinc content of soil in control plots, 0.37 mg Zn kg⁻¹, produced 4649.7 kg ha⁻¹ grain yield, while yield increased up to 5457.0 kg ha⁻¹ by the application rate of 6.9 kg Zn ha⁻¹. These increases might result from the positive effect of zinc on the vegetative and generative growth and the efficient use of other nutrients (Bayraklı et al, 1995; Keser and Altay, 1993). Present findings support and showing that the yield increased at the rate of 17.2 % increasing from 2650 kg ha⁻¹ (Zn₀ = soil containing 0.37 mg kg⁻¹ Zn) to 3200 kg ha⁻¹ by the zinc application rate of 22 kg ZnSO₄·7H₂O ha⁻¹ in durum wheat (Bansal et al, 1990). Ozbek and Özgümüş(1998) reported that the highest grain yield in wheat varieties was obtained from soil application method and this was followed by the seed and foliar application methods. Yılmaz *et al.*(2000) found 76, 61 and 52 % increase in the soil, foliar and seed application methods, respectively.

The increased protein content of grain as a result of the increased application rates of zinc to wheat might result from the positive effects of consequent protein synthesis of zinc on the amino acid synthesis (Bayraklı et al, 1995; Aktas, 1995). In this study, the effects of the application rates and methods on protein content were significant and seed and soil applications were more effective than leaf applications. The positive effects of the increased zinc rates to the protein content might result from the increase of synthesis of endogenous plant growth hormone Auxin and of the efficient use of other plant nutrients (Bayraklı et al, 1995; Keser and Altay, 1993; Aktas, 1995).

Although all application methods and doses reached to the optimum level of zinc concentrations of the plants, the highest results was obtained from foliar application. The rate of 110 g zinc ha⁻¹ of ZnSO₄·7H₂O solution was applied three times to the plants and the zinc concentrations of the plants increased to the level of 34.8 ppm. Instead of three times applications, one time application of 550 g zinc ha⁻¹ of the solution to the plants on the stem elongation period may be a more economical way with the same result.

The most effective method (Martens and Westerman, 1991) for correcting zinc deficiency was soil application of zinc. Soil application alone resulted in higher increases in grain yield than from the seed or foliar applications (Table-3). Since the zinc fertilizers have an important residual effect on soils for a relative long time, it may not be necessary to apply zinc every year. For example, soil application of 28 kg zinc ha⁻¹ as ZnSO₄ was adequate to correct zinc deficiency in plants for 4 to 7 years (Takkar and Walker, 1993; Martens and Westerman, 1991). Therefore, the soil application method may be

more effective and more economical than seed or foliar application for correcting zinc deficiency in plants.

Considering the effects of amounts of 6.9 kg zinc ha⁻¹, 5400 g Zn ton⁻¹ seed⁻¹ and 550 g zinc ha⁻¹ of ZnSO₄·7H₂O on grain yield, yield components and zinc concentrations of durum wheat for soil, seed and leaf application, respectively. One of these applications might be recommended to obtain appropriate yield and zinc concentrations. Thus zinc-contained fertilizers should be taken into account for the soils where there is insignificant zinc content for an efficient and sustainable agriculture.

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Adaptation of Some Chickpea Genotypes for Yield and Quality Characteristics

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Abstract: In chickpea cultivars grown in winter, there are not exactly antracnose resistant varieties, but the producers can not make the chemical spraying with the diseases as they apply in other products to this plant. Antracnose which occurs in the winter or in the early spring (rainy periods), is a widespread reality that the disease can only be with resistant varieties. In the study, chickpea genotypes were investigated for yield, anthracnose disease, cold damage and seed quality traits under Diyarbakir conditions in winter growing seasons of 2015 and 2016. The trail achived as 4 replications in completely randomized block design. Each parcel is 5 m long and 6 rows and 40 cm row spaces. Total seventeen genotypes including 9 advanced lines, 1 local variety, 3 ICARDA accessions and 5 commercial varieties (Diyar 95, Gökçe, Çağatay, Azkan 95 and Arda), were used in the experiment. Grain yield ranged from 88.4 kg/da to 223.3 kg/da, Arda variety were higher yielding than other genotypes. It was determined Arda and Azkan varieties resistant to antracnose disease, when compared to hybrid lines and local variety sensitive to anthracnose. The values for fresh weight, dry weight, fresh volume, dry volume and 100 seed weight values were low in Arda variety, and high in D2-5 hybrid genotype. Cooking time ranged from 43 min. to 59 min., and local variety had high cooking time. In this study, the yield and quality characteristics of chickpea lines and varieties were investigated in Diyarbakir conditions in winter sowing; it was determined that the yield values of the examined lines were affected by anthracnose disease. Since lines with lower grain yield values give higher values in terms of grain quality characteristics, it was found that it would be appropriate to try early spring sowing instead of winter sowing.

Keywords: Chickpea, *Cicer arietinum* L. Yield, Seed quality, Anthracnose, Cold damage

1.INTRODUCTION

Chickpeas are the first plants in the cultivated food legumes. As gene center, also it found that Turkey's eastern Mediterranean region is shown. It is a edible grain legume plant which is used in the Middle East and South-Asia countries as dry grain in the world, cooked by boiling or consumed by making roasted chickpeas in sugarcane, and renewed as a phyla in milk era. Chickpeas containing very high levels of protein are an important food material, especially in underdeveloped and developing countries (Akcin, 1988).

Turkey chickpea cultivation area is 388 169 ha of plantation area with India (9.927 million hectares), Pakistan (949 513 ha), Iran (594 489 ha) and Australia (507 800 ha) comes after the fifth (Anonymous a, 2017). Our country chickpea production is 460 000 tons and grain yield is 1280 kg / ha (Anonymous b, 2017). The southeastern Anatolia region has a cultivation area of 32 494 ha, production of 44 609 ton and an average yield of 1460 kg / ha, followed by Central Anatolia (73 000 ha) and Aegean region (68 491 ha).

Chickpea farming is carried out in two different ways in the Southeastern Anatolia Region. The first is low-yielding farming, where the crops are still planted in the late spring season in order to avoid the disease, with crops planted as dry, stony and sloping land, and mostly used as village varieties. The second is farming in which the crops grown in the market for the last few years have been cultivated by research institutes with winter certified cultivated seeds, sowing machines and all kinds of cultural practices (such as fertilization and weed control). With the product support policy for legumes, especially in arid areas, the manufacturer's request has begun to concentrate on this product. Although the production area is low, this product, which is considered low in previous experience, encourages the producers of chickpea to grow in regions with high yield and tolerant varieties in winter sowing.

In chickpea cultivars grown in winter, there are not exactly antracnose resistant varieties, but the producers can not make the chemical struggle with the diseases they apply in other products to this plant. This disease, which occurs in the winter or in the early spring (rainy periods), is a widespread reality that the battles can only be with persistent varieties. Demand for winter varieties in the region is increasing and this demand is being met by agricultural institutions. Studies on chickpea anthracnose disease; it has been reported that it is important to use chemical methods such as seed dressing and green dressing with cultural methods such as field cleaning, sowing, clean seed use (Akdağ,2001). Dollar and Gurcan (1992), regarding the reduction of durability in resistant varieties; fungus 6 is a genus in which plants are resistant to all of them in plants, due to the interactions between fungi and varieties; they reported that the strength of plants diminished over time.

Yield, which is the most important feature in the cultivation studies of chickpea, is under the influence of many herbal properties. Since the yield of chickpea is a complex character, many investigators have reported that the selection for the yield of the yield should be based on properties such as 100 weight, number of beans per plant, and plant height, which are significantly related to the yield (Toker and Cancı, 2003; Kacar et al, 2005; Mart et al, 2005; Bakoglu and Aycicek, 2005). In this research, the yield and yield characteristics of the line and commercial chickpea varieties obtained from different lines were tried to be determined.

2.MATERIALS AND METHODS

In this study, 13 chickpea lines and 5 chickpea variety (Diyar 95, Gökçe, Çağatay, Azkan 95 and Arda) were used. The lines used in the experiment consisted of the advanced stage lines obtained and developed with diallel hybridization in 2001 (Konya × Balıkesir, Konya × ILC 3279, ILC 3279 × Balıkesir and Diyar 95 × ILC 482). Konya genotype; medium early, large creamy grained and tolerant to anthracnose disease. Konya and Balıkesir lines were obtained from the village varieties by single pure line method. ILC3279 genotype; tall, early, small-grained and tolerant to anthracnose disease and was selected from the ICARDA collection. Diyar 95 is developed for the conditions of Southeastern Anatolian region, it is suitable for early spring planting, it is a sensitive varieties in coarse-grained, creamy and anthracnose winter sowing. ILC 482 (Southern Yellow) variety is a small-grained anthracnose tolerance and highly efficient variety developed for Southeast Anatolian conditions. The lines D2-5, D2-8, D1-3 and D2-6 used in the experiment are from the Konya × Balıkesir hybrid, the lines D1-13 and D1-14 are from the Konya × ILC3279 hybrid, the line D1-28 is from the ILC3279 × Balıkesir hybrid, the lines R4 and R6 are Diyar 95 × ILC 482 hybrid. The N5-5 line has been developed by the single pure line method from Diyarbakir village type. FLIP98-206C, FLIP98-143C and FLIP99-34C were selected from the ICARDA collection.

2014, 2015 and 2016 of the province of Diyarbakır where the experiment is conducted and the climate data for many years are given in Table 1.

Table 1. Climate data for the years 2015 and 2016 of the province of Diyarbakır

	Minimum temperature (°C)		Average temperature (°C)		Total rainfall (mm)	
	2015	2016	2015	2016	2015	2016
November	2.8	1.4	9.5	8.0	10.4	56.0
December	-2.1	-1.4	3.8	2.2	31.6	138.2
January	-2.4	-2.9	2.2	1.1	64.6	70.4
February	0.7	2.5	5.4	7.9	55.2	69.6
March	2.1	3.1	8.3	9.7	127	55.8
April	5.3	6.7	12.4	15.7	48.6	29.0
May	10.9	11.2	18.7	19.9	48.2	41.4
June	15.7	16.7	26.0	26.8	7.4	18.4

Source: General Directorate of Meteorology, Ankara

When the climate data of the test site is examined, it is observed that the year 2016 is more rainy and hot than the year 2015, but when the minimum temperatures are examined; It was determined that February 2016 was hotter than the same month of the previous year.

The trial was established on November 27, 2014 and November 20, 2015 with four replications in a trial design of random blocks in the experimental field of Dicle University Agricultural Faculty. The trial area was selected from the separated area. The plots were arranged in 6 rows with a length of 5 m and the distance between rows was 40 cm. The planting density was 55 seed / m², the fertilizer amount was 3 kg / da N and 5 kg / da P₂O₅. The weed struggle was made by hand. Flowering and maturation observations were taken over all the plants in the plot, plant characteristics representing the plots in 10 plants and the harvest area in 8.0 m². Anthracnose observation according to scale value 1-9; It is taken before flowering in 2015, during flowering and pod binding periods, and only during flowering in 2016. During the seedling period when cold damage observation has been carried out, it is determined according to scale value 1-9; was taken every two years, but since the cold loss was detected in 2016, the results of this year were given. For anthracnose disease and cold observations, statistical analysis was not performed on the scale values repeatedly. In seed specimens of varieties and lines; wet weight (g), water uptake capacity (g / kg), water index (%), dry volume, wet volume (ml), swelling capacity (ml), swelling index (%) mean sieve (mm) analyzes were done at the Central Research Institute of Field Crops Laboratory. The data were grouped according to the LSD test and the differences between the mean values subjected to variance analysis according to the randomized blocks trial design were grouped and evaluated in the MSTATC statistical package program.

3.RESULTS AND DISCUSSION

Yield and Yield Items

In 2014-15 and 2015-16 years, the number of seedlings per plant, weight of 100 seeds, year by year, variety and year x kind of interactions were found important in Diyarbakir in winter.

The yield values for the year 2014/2015 ranged from 18.75 kg / da to 239.8 kg / da. FLIP98-206C, Arda and Azkan line and varieties high, Konya × Balıkesir, Konya × ILC3279 and ILC3279 × Balıkesir hybrids were found to be low productivity. Due to the precipitation values of March 2015, these lines were significantly affected by anthracnose disease. Despite the fact that the number of dead plants in the experimental parcels was higher than the number of dead plants, no parcel was harvested without disease or disease and the disease yield of the disease was determined. The yield values of the year 2015/2016 were found to be low in D1-13 lines with D2-6 and 150.8 kg / da with 150.7 kg / da and high in Arda with FLIP99-34C and 210.4 kg / da with 211.0 kg / da. In 2015/2016, anthracnose disease was detected in the lines coming from the hybrid combination, but the rejuvenation of the plants improved the yield. Lines and varieties were found to be low yield, standard varieties were highly productive from all hybrid combinations except R4 and R6 lines in both years. Among the standard varieties, yield losses due to disease in Gökçe and Diyar 95 varieties were determined. The N5-5 Diyarbakir local has had low fertility over the years, which is intense. ICARDA origin lines are close to standard varieties and show superior efficiency. Gül et al. (2006), reported that the crops yielded losses due to various winter durability and anthracnose susceptibility, while the number of plants harvested from the parcels was low due to anthracnose-dead plants.

Table 2. Average values of grain size and yield of winter chickpea in Diyarbakir.

Line/ Variety	Grain yield (kg/da)			Plant height (cm)		
	2014/15	2015/16	Avg.	2014/15	2015/16	Avg.
D2-5 (Konya x Balıkesir)	66.7 b	179.6 abc	123.2 def	49.7 a	50.0 d	49.8 a-e
D2-8 (K x B)	28.5 b	151.9 c	90.18 f	46.5 a-d	50.0 d	48.2 b-f
D1-3 (K x B)	29.7 b	190.9 abc	110.3 f	51.5 a	50.5 d	51.0 abc
D2-6 (K x B)	68.7 b	150.7 c	109.7 f	48.0 ab	50.5 d	49.2 a-f
D1-13 (Konya x ILC 3279)	42.0 b	150.8 c	96.42 f	37.5 cd	52.7 bcd	45.1 def
D1-14 (Konya x ILC 3279)	18.7 b	158.2 c	88.47 f	43.0 a-d	53.7 bcd	48.3 b-f
D1-8 (ILC3279 x B)	27.0 b	158.4 c	92.68 f	42.7 a-d	53.2 bcd	48.0 b-f
R4 (Diyar 95 x ILC 482)	165.0 a	165.0 bc	165.0 cde	50.2 a	54.5 bc	52.3 ab
R6(D.95 x ILC 482)	190.3 a	182.0 abc	186.1 abc	47.7 ab	55.7 b	51.7 abc
N5-5 (Diyarbakir yerel)	67.5 b	174.9 abc	121.2 ef	47.5 abc	52.7 bcd	50.1 a-d
FLIP98-206C	239.8 a	182.7 abc	211.2 abc	37.0 d	52.2 bcd	44.6 ef
FLIP98-143C	173.3 a	183.2 abc	178.2 abc	38.7 bcd	50.2 d	44.5 f
FLIP99-34C	167.3 a	211.0 a	189.1 abc	45.0 a-d	50.7 cd	47.8 b-f
Diyar 95	162.0 a	167.0 bc	164.5 cde	47.5 abc	60.0 a	53.7 a
Arda	234.3 a	210.4 a	222.3 a	48.2 ab	53.5 bcd	50.8 abc
Azkan	231.0 a	202.4 ab	216.7 ab	47.5 abc	60.7 a	54.1 a
Gökçe	182.0 a	156.8 c	169.4 bcd	43.5 a-d	50.5 d	47.0 c-f
Çağatay	182.0 a	189.4 abc	185.7 abc	45.2 a-d	55.0 b	50.1 a-d
Average	126.4 b	177.2 a		45.38 b	52.9 a	
LSD	Line 88.26	L:40.6**	L :47.6**	L :10.01	L :3.8**	L:5.2**
		İnt:67.4**			İnt:7.4**	

The difference between the averages shown with the same letters is not statistically significant.

Again, Düzdemir et al. (2007), reported that there were significant drops in the area of intense anthracnose productivity, there were no registered varieties showing complete resistance in all environments, and local varieties showed differences in endurance ratings from being more populations. Dogan et al., (2015), reported that the productivity of Mardin Kızıltepe in the years 2013 and 2014 was 159.18 kg / da and 124.83 kg / da with ILC-482, lowest 117.76 kg / da and 100.16 kg / da, respectively.

Plant height values of the year 2014-15 ranged from 37.0 cm to 51.5 cm. The highest plant height values were obtained from D1-3 and 50.2 cm with 51.5 cm and from the R4 lines with the lowest values 37.0 cm with FLIP98-206C and 37.5 cm with D1-13. The plant height values for the year 2015-16 ranged from 49.5 cm to 60.7 cm. The highest plant height values were obtained from Azkan and Diyar 95 varieties while the lowest values were obtained from D2-5, D2-8, D1-3, FLIP98-143C and D2-6 lines. When the average plant height values are examined; Azkan and Diyar 95 were high and FLIP98-143C was low. It was determined that plant height values of the year 2015/2016 were high between years. The rainy season of the raising season of 2015/2016 may have caused this situation. Our findings are similar to the findings

of Toker and Çancı (2003), in the chickpea genotypes that the values changed between 40-59 cm, higher than the findings of Bakoğlu and Ayçiçek (2005), reported in Bingöl as 22.2-32.8 cm, Mart et al., (2005), found that Cukurova reported 75.6-82.2 cm in winter sowing conditions.

The number of pods per plant in the year 2014/2015 ranged from 16.45 to 29.12. D1-13, D2-5, D1-28, D2-8 and N5-5 lines were low, while the Gökçe variety and R4 line had high number of pods. The number of pods pertaining to this year was based on plants taken from competitive lines not affected by anthracnose disease. The number of pods per plant in the year 2015/2016 ranged from 20.63 to 28.20. The number of plant pods D1-3, D1-13 and N5-5 was found to be low, Azkan, Diyar 95, FLIP98-206C and FLIP99-34C lines and varieties. According to the average of years; Azkan, Gökçe, FLIP98-206C and FLIP99-34C lines were high and D1-13 line was low (Table 3). Our findings are lower than the findings reported by Toker and Çancı (2003), which reported 26-67 pod number in the plant, was found to be between Bakoğlu and Ayçiçek (2005), in Bingöl 9.40-17.0 pod number in the plant and Bozoğlu and Özçelik (2005), 15.7-28.3 pod number in the plant.

The weight of 100 grains for 2014/2015 has changed from 39.9 g to 47.4 g. Except for D1-14 line and D1-28 line, the weight values of 100 grains of all hybrid lines were higher than the standard varieties. In the year 2015/2016, weights of 100 grains were obtained from 49.2 g with D2-6, 48.5 g with D1-3 and 47.5 g and the lines coming from Konya × Balıkesir, Konya × ILC 3279, ILC3279 × Balıkesir hybrid combinations. Arda variety was low with 38.6 g. As a result, 100 grain weight of D2-5 and D2-6 were high, and the lines of ICARDA origin were lower than the standard varieties (Table 3). Our findings were higher than the findings reported by Mart et al. (2005), 32.9-36.2 g, was found to be similar to the findings reported by Kaçar et al. (2005) between 41.07-47.3 g in winter sowing.

Table 3. Average values of number of pods and 100 grain weight in winter chickpeas in Diyarbakır.

Line/ Variety	Number of plant pods (pieces)			100 grain weight (g)		
	2014/15	2015/16	Avg.	2014/15	2015/16	Avg.
D2-5 (Konya × Balıkesir)	17.78 d	21.77 bcd	19.78 d-g	47.4 a	47.5 ab	47.4 a
D2-8 (K × B)	18.90 d	22.15 bcd	20.52 d-g	46.1 abc	47.5 ab	46.8 abc
D1-3 (K × B)	22.61 a-d	20.63 d	21.62 c-g	45.3 a-e	48.50 a	46.9 ab
D2-6 (K × B)	19.95 d	22.13 bcd	21.04 d-g	46.3 ab	49.2 a	47.8 a
D1-13 (Konya × ILC 3279)	16.45 d	20.88 d	18.66 g	44.8 a-e	47.5 ab	46.1 a-d
D1-14 (Konya × ILC 3279)	20.30 cd	22.33 bcd	21.31 c-g	39.9 g	47.7 ab	43.8 efg
D1-8 (ILC3279 × B)	17.15 d	21.05 cd	19.10 efg	40.5 fg	47.75 ab	44.1 defg
R4 (Diyar 95 × ILC 482)	28.70 a	22.48 bcd	25.59 abc	46.7 ab	43.7cd	45.2 b-e
R6 (D.95 × ILC 482)	23.10 a-d	24.42 a-d	23.76 a-d	45.7 a-d	43.7 cd	44.7 cde
N5-5 (Diyarbakır yerel)	17.08 d	20.70 d	18.89 fg	43.7b-f	45.7 bc	44.7 def
FLIP98-206C	27.86 abc	26.58 ab	27.22 ab	40.3 g	42.3 d	41.3 hı
FLIP98-143C	22.75 a-d	23.67 a-d	23.21 b-f	42.6 d-g	42.7 d	42.6 fgh
FLIP99-34C	28.28 ab	26.42 ab	27.35 ab	45.76 a-d	42.6 d	44.2 d-g
Diyar 95	20.72 bcd	26.02 ab	23.37 b-e	42.9 c-g	43.8 cd	43.39 e-h
Arda	22.51 a-d	25.90 abc	24.20 a-d	40.4 g	38.6 e	39.5 ı
Azkan	27.86 abc	28.20 a	28.03 a	42.0efg	42.8 d	42.39 gh
Gökçe	29.12 a	23.50 a-d	26.31 ab	40.90 fg	43.7 cd	42.3 gh
Çağatay	28.00 ab	23.27 bcd	25.64 abc	42.6 d-g	44.3 cd	43.4 efg
Average	22.73	23.68		43.5	44.9	
LSD	Line:7.63**	L: 4.90**	L:4.40**	3.26**	2.68**	L: 2.11**
		İnt:6.3**			İnt:2.9**	

The difference between the averages shown with the same letters is not statistically significant.

Anthracnose Disease

Anthracnose scale values for the year 2014-2015 chickpea line and varieties ranged from 1 to 9 (Table 4). The standard varieties Arda and Azkan varieties were resistant with 1 scale value, Çağatay, Gökçe and Diyar 95 varieties were determined as tolerant varieties. It has been determined that the lines R4 and R6, which are the experimental 95 × ILC 482 hybrid used in the trial, are also in the same group as the standard varieties with tolerance. It has been determined that the lines from Konya × Balıkesir, Konya × ILC 3279, ILC 3279 × Balıkesir hybrids in the experiment were sensitive to the local variety of Diyarbakır and even some plant deaths occurred in some parcels. When the climate data of Diyarbakır province were examined, it was observed that the plants were caught with this disease under high rainfall, temperature and humidity before and during flowering. It is reported that the disease is mostly caused by hot weather with closed, rainy, high relative humidity and rain is the most important factor in spreading the disease (Akdağ, 2001). Anthracnose disease observed during the 2015-2016 planting period was taken during the flowering period of the plants. No progress has been made in terms of this disease in plants during the later developmental periods. While some varieties have not been affected by this disease for many years, the damage has been damaged by this disease in both trial years. This sensitivity formed in the Gökçe variety overlaps with the finding that there is a genus that can be tolerated by the dollar and the Gurcan (1992), anthracnose 6 plants, and that the resistance of the plants decreases with time due to the interaction between the variety and fungus. It has been determined that some varieties in our experiment are not affected by anthracnose. It is known that these varieties are on the list of the Ministry of Food, Agriculture and Livestock which are resistant to anthracnose disease (Gökçe, Çağatay, İnci, Işık-05, Yaşa-05, Hisar, Azkan, Aksu, Hasanbey, Seçkin, Çakır).

Table 4. Winter chickpea anthracnose disease and cold loss values in Diyarbakır (1-9 scale values)

Replications	Before flowering (1-9) (2015)				During flowering (1-9) (2015)				Bonding Perot (1-9) (2015)				During flowering (1-9) (2016)				Cold Damage (2016) (1-9)			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
D2-5	5	5	5	5	7	7	7	7	9	9	9	9	3	3	3	3	1	3	1	1
D2-8	9	9	9	9	9	9	9	9	9	9	9	9	5	5	5	3	1	1	3	3
D1-3	9	9	9	9	9	9	9	9	9	9	9	9	3	3	3	3	3	5	1	3
D2-6	3	3	3	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3	5	5
D1-13	5	7	7	7	7	7	7	7	9	9	9	9	5	3	3	3	7	5	5	5
D1-14	9	9	9	9	9	9	9	9	9	9	9	9	3	5	5	3	3	5	3	3
D1-28	7	7	9	9	7	9	9	9	9	9	9	9	1	1	3	1	3	5	3	3
R4	5	3	3	5	5	3	5	3	5	3	3	5	1	5	3	1	3	5	3	3
R6	3	3	3	3	3	3	3	3	5	5	3	5	1	3	3	3	3	1	1	3
N5-5	3	5	7	7	9	9	9	7	7	9	9	9	5	5	5	5	1	5	5	5
FLIP98-206C	1	1	3	5	3	3	3	5	3	3	3	3	5	3	3	3	5	5	5	5
FLIP98-143C	3	3	3	5	5	5	5	5	5	5	5	5	3	3	3	5	5	5	3	5
FLIP99-34C	1	3	3	5	3	3	3	5	3	5	3	5	5	3	3	3	5	3	3	3
Diyar 95	3	3	3	5	5	5	5	5	5	3	3	3	5	5	3	3	3	3	3	3
Arda	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	1	3
Azkan	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	1
Gökçe	3	3	3	5	3	5	5	5	3	3	5	5	5	5	5	3	3	5	3	3
Çağatay	3	3	3	3	3	3	5	3	3	5	3	5	1	3	3	3	5	3	3	5

Cold Damage

On March 19-22, 2016 in Diyarbakır, cold weather was determined due to low night temperature and plant development cycle. The plant development cycle was determined as flowering period in some genotypes in these dates and in some genotypes in the period immediately before flowering. The cold damage rating ranged from 1 to 7. D1-13 (Konya × ILC 3279) was the most affected line by taking line values from 5 to 7. N5-5, FLIP97-254C and FLIP98-143C lines were found to be resistant (Table 4). The warmth of the air and the effect of the cold damage on the plant have risen from the middle. As a matter of fact, chickpea is a plant with the ability to withstand short-term colds down to -12 ° C during the seedling period (Akçin, 1988). However, our lines have been damaged without reaching this temperature and have taken 1 scale value and 7 scale value. One of the most important reasons for this is the hot past of February 2016 and the unprecedented arrest of the vegetable coming in March. The plants can only react to hot and cold without being affected by the transitions. Rapid and sudden temperature increases and falls cause plants to shock. Gül et al., (2006) reported that the percentage of wintering tolerance on the chickpea lines varied between 55.42% and 78.75%, that the Cevdetbey variety was very sensitive to its own lines but that there was no statistical difference between the lines. that durability is a direct effect on yield and yield items, and that it is desirable to be particularly high in winter varieties.

Grain Quality

The grain quality analysis results of eight lines and two chickpeas used in the experiment are given in Table 5. Statistical analysis was not applied to the data.

Among the chickpea lines and varieties, Arda variety had the lowest (173 ml) and dry volume (79.5 ml), wet weight (81.4 g) and water intake capacity (0.43 g / grain). The D2-5 line had the highest wet (195 ml) and dry volume (89.5 ml), wet weight (106.8 g) and water uptake capacity (0.56 g / grain). It was determined that FLIP99-34C line had the highest water intake capacity (0.57 ml / grain), water index (2.50%), cooking time (55 min) and protein ratio (25.64%) (Table 5).

The water uptake capacity was between 0.43 g / g and 0.56 g / g. The water uptake capacity was 0.42-0.45 g / g (Anonymous d, 2017) in the Çağatay range, 0.54-0.55 g / g in the Aslanbey range (Anonymous e, 2017) and 0.49 in the Zuhale gauge g / piece (Anonymous f, 2017).

Table 5. Seed quality analysis results for winter chickpea cultivars

Line/ Variety	Dry (ml)	Volume	Wet (ml)	Volume	Wet (g)	Weight	Water Intake Capacity (g/grain)	Water (%)	index
D2-5	89		195		106.9		0.56	1.10	
D2-6	86		186		91.9		0.49	1.10	
D1-14	86		185		94.2		0.49	1.09	
R6	88		193		104.6		0.55	1.10	
R4	86		189		99.83		0.52	1.10	
N5-5	89		190		100.96		0.53	1.06	
FLIP98-206C	87		191		101.11		0.53	1.10	
FLIP99-34C	88		195		105.84		0.56	1.14	
Gökçe	82		178		87.18		0.46	1.11	
Arda	79		173		81.45		0.43	1.14	
Line/ Variety	Inflation (ml/grain)	capacity	Inflation (%)	Index	Cooking Time (dak.)	Protein (%)	Ratio	100 grain weight (g)	
D2-5	0.56		2.41		50	24.20		50.38	
D2-6	0.49		2.38		52	23.16		46.33	
D1-14	0.49		2.36		46	23.62		44.88	
R6	0.55		2.42		43	24.27		49.43	
R4	0.53		2.44		58	25.13		47.73	
N5-5	0.51		2.31		59	23.45		48.16	
FLIP98-206C	0.54		2.43		51	22.98		48.51	
FLIP99-34C	0.57		2.50		55	25.64		49.88	
Gökçe	0.46		2.44		46	24.91		41.28	
Arda	0.44		2.47		48	24.48		38.31	

Cooking time 43 min. with 59 min. low cooking time value was determined in the Gökçe and Arda varieties, coarse-grained lines showed late cooking characteristics. Singh et al., (1988) reported that the cooking time of chickpeas varied between 35 and 103 minutes, that varied according to grain size, and small grains were swollen in a shorter time than large grains. Again in this study Çağatay in the study of 70-87 min. (Anonymous d, 2017) and in the Zuhale range 50-70 min. (Anonymous f, 2017) In the Aslanbey variety 41-52 min. (Anonymous e, 2017), 37 min in the TAEK Sure mutant line (Sagel et al., 2009).

Protein ratio ranged from 22.98% to 25.64%. Singh et al. (1990), reported that the intake of chickpea protein varied from 14.3% to 27.0%.

In this study, the yield and quality characteristics of chickpea lines and varieties were investigated in Diyarbakir conditions in winter sowing; it was determined that the yield values of the examined lines were affected by anthracnose disease. Since lines with lower grain yield values give higher values in terms of grain quality characteristics, it was found that it would be appropriate to try early spring sowing instead of winter sowing.

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Evaluation of Some Durum Wheat Genotypes for Yield and Yield Components at Different Environment

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Abstract: Improvement of high yielded and stable durum wheat genotypes is of great importance in South Anatolian environments where drought and heat stress interact each other. Therefore, this study was conducted to investigate heat and drought stress tolerance of advanced durum wheat genotypes under rainfed and irrigated conditions of Dicle University in Diyarbakir and rainfed condition of Çukurova University in Adana. Two commercial durum wheat variety (Firat 93 and Balcalı 2000), one landrace (Sorgül) and twelve advanced lines improved by mutation and classical breeding methods were used as material. Experimental design was completely randomized block design with three replications. Grain yield was changed between 76.1-723.5 kg da-1, 239.5-406.8 kg da-1 and 290.5-519.0 kg da-1 at Adana, Diyarbakir rainfed and irrigated conditions, respectively. Very low grain yield was obtained from land race and five advanced lines at Adana conditions. Drought susceptibility index and heat susceptibility index were used to determine heat and drought stress potential of the lines. Drought and heat susceptibility index were changed between 0.00-1.43 and 0.00-2.30, respectively. According to index values, the lines of 7-286 at drought stress and the lines of 8-68, 8-317 and 12-421 at heat stress conditions had high grain yield potential. The line 7-289 was found successful for favorable environments.

Keywords: Adaptation, Drought and heat stress, Durum wheat, Yield, Stress susceptibility index

1.INTRODUCTION

Improving heat and drought tolerant wheat genotypes is the main objective of the breeding program for many achievements in this regard have been limited level (Bruckner ve Froberg 1987). In many breeding programs, grain yield is maintained as an element of basic selection in the development of adaptation to a stressful environment. The concept of tolerance to hot stress was evaluated as relative reduction in grain yield in stressed environments compared to normal surroundings in fully drained conditions (Fischer ve Maurer, 1978, Clarke ve ark. 1984). This approach has been determined in durum wheat (Chinnusamy and Khanna-Chopra 2003), spring wheat (Bruckner and Froberg 1987), durum wheat (Özkan et al., 1998) and triticale (Özkan et al., 1999). The aim of this study is to evaluate advanced durum wheat lines for tolerance to hot and dry stress.

2.MATERIALS AND METHODS

In the study, two controls, one local variety and twelve advanced durum wheat lines were used as materials. Balcalı 2000 for Çukurova region and Firat 93 for Diyarbakir region was accepted as the standard. Trial were carried out during 2002-2003 wheat growing season in Dicle and Çukurova University Agricultural Faculty Field Crops research fields. For each region, its own agricultural techniques were applied and the sowing in both regions was carried out in November. In Adana location was planted with 550 seeds per square meter and 8 kg P and 16 kg N. Nitrogen fertilization is divided into three equal parts, one with sowing, one with tillering and other part in heading time. In Diyarbakir, 450 seeds per square meter were planted and 6 kg P and 12 kg N were given in pure form. Nitrogen fertilization is divided into two equal parts, one with sowing and one with tillering.

After ripening was completed, the plots were harvested separately with Hege-125 type C parcel harvesting. The average monthly temperature in Adana (November-May) during the growing season was 16.4, 8.8, 11.1, 8.2, 11.5, 17.1, 24.5 ° C and monthly total rainfall was 25.7, 77.9, 84.5, 111.7, 92.3, 61.1 mm; average monthly temperature in Diyarbakir was 10.2, 0.0, 4.0, 2.5, 6.5, 13.4, 20.4 ° C and monthly total precipitation was 36.6, 74.1, 64.8, 151.8, 80.7, 80.6 and 5.4 mm respectively.

Evaluations can be made using the MSTAT-C package program; randomized blocks with single factor years or locations were constructed according to the trial design standard method; P probability values were determined using the F test to see the effective differences; comparisons between mean values were made according to the EGF test. The genotype x environmental interaction important for grain yield was assessed as a further step using the hot and aridity index (HSI and DSI). Simple relationships between the characters studied are determined by the SAS package program.

HSI and DSI values for each genotype were calculated according to the formula $S = (1 - YD / YP) / D$ given by Fischer and Maurer (1978). Where YD = average yield in a stressed environment of a genotype, YP = mean yield in a stress-free environment of a genotype, D = stress coefficient = $(1 - XD / XP)$, where XD = mean YD of all genotypes; XP = the mean

FC value of all genotypes. HSI and DSI values represent the relative stress tolerance of all genotypes. A genotype has $S \leq 0.5$ stress tolerance at high level; If $S > 0.5 \leq 1.0$, it means that there is stress tolerance in the middle level and $S > 1.0$, which is stress sensitive. The stress coefficient is calculated over the most stressful environment. The water conditions of Diyarbakır for HSI are stressful, the dry conditions of Adana are stress-free; for DSI, dry conditions in Diyarbakır are regarded as stressful, watery conditions as stress free environment.

3.RESULTS AND DISCUSSION

In addition to significant differences between genotypes in terms of grain yield, the occurrence of significant genotype environmental interactions suggests that genotypes can be evaluated for stability (Table 1). The fact that the average number of squares for the environment is important indicates that the environments are different.

Table 1. Variance analysis results of 15 durum wheat genotypes grown in Adana and Diyarbakır

Sources	D.F.	Mean Square	F Value
Locations	2	57864	10.17*
Error	6	5687	
Genotypes	14	149107	64.90***
Gen. x Loc.	28	36919	16.07***
Error	84	2297	
CV (%)	12.66		

*, ***= Significant at $p < 0.05$ and $p < 0.01$ level, respectively.

The highest grain yield was obtained from Diyarbakır dry conditions while the lowest yield was obtained from Diyarbakır dry conditions. The yield in Adana exceeded the watery conditions of Diyarbakır (Table 2) when 6 genotypes lying in the lysozyme of Adana were not taken into account. When the genotypes were evaluated over all locations, the highest yield was obtained from Fırat 93 and the lowest yield was obtained from 5-244 lines.

Genotypes with low index values are considered to be resistant to stress conditions. Because these genotypes show less reduction in grain yield than stress-free conditions in stress conditions compared to all genotype averages. For 15 genotypes, the index values were calculated for the stress coefficient (D) significant (data not shown). The calculated index values for each genotype ranged between 0-2.30 and 0-1.46 for HSI and DSI, respectively (Table 2). In this study, 8 genotypes were found to be susceptible to constipation with 1 large KS value and 4 genotypes were found to be tolerant at medium level with $DSI > 0.5 < 1$ and DSI value of 3 genotypes lower than 0.5. The heat sensitivity index was calculated from 9 genotypes due to lying in 6 genotypes. Three genotypes of HSI were found to be highly tolerant and one genotype was tolerant to moderate level. According to the index values, drought stress of line 7-286 and lines 8-68, 8-317 and 12-421 were determined to have high efficiency potency for hot stress conditions. 7-289 line has been found to be successful in stress-free environments. Fırat 93 variety emerged as a sensitive genotype in warm conditions while being fully tolerant to arid conditions. This varieties also have a high efficiency potential for stress-free environments. The genotype 8-68 has emerged as a genotype that is tolerant to both warm and dry conditions and has yielded a general average high yield in all circles.

Table 2. Grain yield and dry and hot sensitivity index values of 15 durum wheat genotypes grown in dry conditions Adana and dry and irrigated conditions Diyarbakır in 2002-2003 season.

Genotypes	Grain Yield (kg/da)			Avg.	INDEX	
	Adana (Rainfed)	Diyarbakır (Rainfed)	Diyarbakır (Irrigated)		DSI	HSI
4-24	584.9	326.4	413.9	441.7 c	1.31	1.54
8-68	474.0	406.6	474.4	451.7 c	0.89	0.00
10-211	571.2	412.8	519.0	501.0 ab	1.27	0.48
7-286	615.6	406.7	430.8	484.3 abc	0.35	1.58
7-299	667.8	381.0	473.8	507.5 ab	1.22	1.53
8-317	509.2	388.9	492.7	463.6 bc	1.31	0.17
12-421	533.6	384.5	503.1	473.7 abc	1.46	0.30
Fırat 93	723.5	406.8	406.7	512.3 a	0.00	2.30
Sorgül	92.2	248.1	322.2	220.8 de	1.43	*
5-244	97.4	239.5	298.2	211.7 e	1.22	*
5-411	112.7	251.1	290.5	218.1 de	0.84	*
15-417	160.8	283.8	334.1	259.6 d	0.94	*
20-435	76.1	275.8	322.7	224.9 de	0.90	*
5-586	108.4	259.0	338.4	235.3 de	1.46	*
Balcılı 2000	618.0	388.7	410.9	472.5 abc	0.33	1.76
Avg.	396.4 a*	337.3 b	402.1 a			
LSD %5	94.8	55.2	85.1			

* No calculations due to sleeping.

Since the lines used in this study were obtained from different hybrids, HSI and DSI values showed a wide variation. Similarly, Özkan et al. (1999) obtained wide variation in stress tolerance index in triticale lines in Çukurova conditions. A wide variation in grain size and starch content for diploid, hexaploid and tetraploid wheat varieties has been reported in terms of tolerance to temperature (Khanna-Chopra and Viswanathan, 1999, Chinnusamy and Khanna-Chopra, 2003). In genotypes determined as strain-tolerant based on index, the index value is not expected to have a high efficiency potential (Clarke et al., 1984; Brucner and Frohberg, 1987) as it is based on minimizing the loss of efficiency compared with stress-free environments in stressed environments. Generally, in dry conditions, high stability in grain yield has been associated with low or medium yield potential (Ehdaie et al., 1988). Contrary to this declaration, Fırat 93 reached a high efficiency potential in dry conditions, 12-421 in warm conditions, while being tolerant to stress, from average yield. The change limits obtained for the index values (Table 2) were obtained from Özkan et al. (1998) higher than the change bounds reported by Brucner and Frohberg (1987) on bread wheat (0.86-1.14) and in durum wheat. A large variation similar to our study has been reported in studies using different populations of wild and cultured wheat (0.13 to 2.08).

When the genotypes are evaluated on an environmental basis, it is seen that the index values can be used safely in the selection of high tolerance genotypes. High-yield durum wheat lines are considered for new varieties and one of the DSI and HSI values is closer to zero ($S < 0.5$) than the other one ($S > 1$), allowing both stratum durability and high yield to coexist. In addition, lines with an index value near zero can be used as a source of endurance in rehabilitation.

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The Reactions of Bread Wheat Lines Against Stem (Black) Rust (*Puccinia graminis* F. Sp. *tritici*) Population

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Abstract: Quality parameter is very important selection for bread wheat improve programme. Yield trials were evaluated in terms of some physical characteristics, the amount of protein, its quality and some gluten rheological parameters. Stem rust (*Puccinia graminis* f. sp. *tritici*, (*Pgt*) can occur at higher altitudes and coastal areas in Turkey. On the other hand, stem rust is unfavorable for wheat quality to susceptible cultivars. 26 bread wheat genotypes (mixographe class; 3-6, (Bezostaja-1; 5) in yield trials were developed by the Central Research Institute for Field Crops (CRIFC) Department of Quality Assessment and Food. The aim of this study was to determine the reactions of 26 winter bread wheat lines to stem rust disease in adult plant stage. The test materials were sown in a one-meter row with 2 replications in Seydiler, Kastamonu Province. The test materials were screened under natural epidemic condition with *Pgt* (virulent on: *Sr5*, 6, 7b, 8a, 8b, 9b, 9g, 10, 30, *Tmp* and *Mcn* resistance genes). Stem rust developments on each entry were scored using the modified Cobb scale (Susceptible control cv. Little Club 80-100S) in June-August 2015. Coefficients of infections were calculated, and the values below 20 were considered as resistant to disease. Five (14%) genotypes were resistant to *Pgt*. These resistance genotypes can be used in both quality and stem rust resistance breeding programs to stem rust reactions.

Keywords: Bread wheat, stem rust (*Puccinia graminis* f. sp. *tritici*), reaction test, quality

1. INTRODUCTION

Wheat (*Triticum* sp.) is among the strategic crops for the both world and Turkey. Because of the important area of growing, even a slight increase yield for per unit can cause significant increases in total production. On the other hand, the yield and quality of wheat can affect everybody economically from producer to consumer. For this reason, solving the problems of wheat from production to consumption is very important in terms of influencing the country's economy and producer-consumer income levels due to the fact that a certain amount of wheat is being produced, the reactions that have shown against the quality and stress factors of the wheat have started to become an important improvement criterion.

Selection of early generation material with different and reliable methods in breeding programs ensures that the breeder reaches its purpose in a short time and more surely. If the wheat breeding studies are thought to last about 16 years, the earlier the material that is not suitable is removed in the early generations, the more material and detailed work can be done with the other material and the less time, money and labor can be achieved. The quality criteria used in this part of the study; Hectorite weight, zeleny sedimentation and mixograph.

In addition to efforts to improve quality attributes, at every stage, it is desirable in all respects to completely eliminate or partially reduce the production factors and stress that may affect quality. Fungal diseases play an important role in the biotic stress factors that predominate in wheat growing areas. It is reported that the losses that can occur as a result of epidemic of rust disease from rust diseases can reach up to 90% (Aktaş, 2001). Although different methods of struggle for the control of stem rust disease are proposed, the preferences of producers are usually in favor of chemical warfare. Some important disadvantages can be encountered as a result of chemical treatment applications. One of the cheapest and most practical control methods that can be used by producers, is protection of natural environment, genetic resistance (Çetin et al., 2007).

26 bread wheat genotypes (mixographe class; 3-6, (Bezostaja-1; 5) which were developed by the Central Research Institute for Field Crops (CRIFC) Department of Quality Assessment and Food were used in this study. The aim of this study was to determine the reactions of 26 winter bread wheat lines to stem rust disease in adult plant stage.

2. MATERIALS AND METHODS

Quality Studies

Hectoliter weight test: Refers to the weight of 100 liter of wheat in kg. It is a criterion used in the classification of wheat and it is directly related to flour yield. Grain size, density, shape and homogeneity affect the hectoliter weight.

Zeleny sedimentation test: Zeleny sedimentation test was carried out according to Anonymous (1972). The principle of the zeleny sedimentation test is to swell the flour particles in the suspension prepared with the flour and lactic acid solution according to the gluten quality and measure the amount of these particles at a certain time. In wheat flour, which is high

in gluten content and high in quality, the particles are more densely packed and less precipitated in the solution. For this reason, zeleny sedimentation values of high quality wheat flours are higher (Atlı and Koçak, 2004).

Mixographe test: 25 gr flour is mixed with the amount of water calculated according to the moisture contained in the mixer kneader until the maximum dough consistency is obtained. Taking into consideration the peak height and general curve characteristics, a numerical classification is made by comparing with eight reference mixograms. It shows the stronger curve type as the number grows (Anonymous, 2018).

Stem Rust Disease Studies

Reactions test: The test materials were sown in a one-meter row with 2 replications in Seydiler, Kastamonu province in October 2014. The test materials were screened under natural epidemic condition to stem rust (*Puccinia graminis* f. sp. *tritici*). Susceptible control (cv. Little Club) and stem rust differential set, sown in the same method and same date.

Disease Assessment: Disease scoring was performed using the Modified Cobb scale. The rust severity and infection type were recorded. Disease evaluations were conducted at least 2 times. The highest score was taken into calculate in the evaluations. The coefficient of infection (CI) was found by multiplying the coefficients determined for rust intensity and type of infection.

3.RESULTS AND DISCUSSION

The genotypes used in this study were selected from different early stage materials used in the different breeding program being run in 2013 growing season. The main selection criterion is; zeleny sedimentation value 54, which is widely used by industrialists and researchers in the final product estimate, and lines with values above were selected.

When the results of the hectoliter and mixograph analyzes of the selected lines are evaluated collectively, Hectoliter values ranged from 76.5 to 80.4 and mostly showed good hectoliter values. If the mixer classes are examined, they variation between 4 and 6. (Table 1).

The test materials were screened under natural epidemic condition with stem rust (virulent on: *Sr5*, *6*, *7b*, *8a*, *8b*, *9b*, *9g*, *10*, *30*, *Tmp* and *Mcn* resistance genes). Stem rust developments on each entry were scored using the modified Cobb scale (Susceptible control cv. Little Club 80-100S) in June-August 2015. Coefficients of infections were calculated, and the values below 20 were considered as resistant to disease. Five (14%) genotypes were resistant to stem rust (Table 1).

Table 1. Hectoliter, zeleny sedimentation and mixograph characteristics of the materials and stem rust reactions

Origin	No	Hectoliter Weight (kg/hl)	Zeleny Sed. (ml)	Mixogram	Stem Rust (Reactions)
Line	1	78,5	63	6	50 S
Line	2	76,7	62	5	70 MS
Line	3	75,4	63	5	40 MS
Line	4	76,7	59	6	70 S
Line	5	78,8	62	6	10 MS
Line	6	76,8	61	4	10 MS
Line	7	77,7	62	4	70 MS
Line	8	77,6	59	4	60 MS-S
Line	9	77,6	61	4	T MS
Line	10	78,6	63	4	60 MS
Line	11	76,1	61	4	50 MS
Line	12	77,7	62	4	60 MS
Line	13	80,2	59	4	70 S
Line	14	78,4	61	5	60 MS
Line	15	78,4	61	4	80 S
Line	16	77,5	59	6	10 MS
Line	17	77,3	63	4	60 MS
Line	18	76,9	62	3	T-10 MS
Line	19	76,9	62	3	90 S
Line	20	79,6	63	4	60 MS
Line	21	76,7	60	4	80 S
Line	22	78,5	60	6	40 MS
Line	23	78,1	61	5	40 S
Line	24	76,7	62	4	60 MS
Line	25	77,6	61	4	60 MS
Line	26	79,2	61	5	60 MS
Standard Cultivars					
Bayraktar 2000	Std 1	77, 8	45	5	60 MS
Bezostaja 1	Std 2	78,1	56	5	70 MS
Demir 2000	Std 3	77,9	46	5	90 S
Konya-2002	Std 4	79,6	47	4	50 MS
Tosunbey	Std 5	78,8	53	6	40 MS

The study facilitated identification of stem rust resistant germplasm and their exchange among the quality-diseases resistance breeding programmes. They seem that there are good sources of quality resistance among the bread wheat germplasms of the research programme. Materials seem to be utilized efficiently in bread wheat breeding programmes in winter or facultative wheat growing areas. These resistance genotypes can be used in both quality and stem rust resistance breeding programs to stem rust reactions.

Acknowledgements

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The Reactions of Some Quality Wheat Lines Against Yellow Rust And Stem Rust Reactions

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Abstract: Yield potential, abiotic and biotic stress resistances and quality parameters are very important selection criterion for crop improve programme. Breeders use different tests to evaluate wheat good quality. These tests (test weight, mixograph, Zeleny sedimentation gluten rheological parameters) are based on the end-use quality objective of the breeding programmes. On the other hand rust (*Puccinia* spp.) disease resistances are important selection criterion improve programme. 5 bread wheat genotypes (Zeleny sedimentation (57-65 ml), (Bezostaja-1; 56) in yield trials were developed by the Central Research Institute for Field Crops (CRIFC) Department of Quality Assessment and Food. The aim of this study was to determine the reactions of 5 winter bread wheat lines to yellow rust (YR) and stem rust (SR) disease in adult plant stage. The test materials were sown in a one meter row with 2 replications in İkizce, Ankara (for, YR) and Seydiler, Kastamonu (for SR) locations. The test materials were screened for yellow rust artificial epidemic condition with YR (virulent on Yr2, 6, 7, 8, 9, 25, 27, *Sd*, *Su* and *Avs* resistance genes in Europe/World differential set) and under natural epidemic condition with SR (virulent on: *Sr5*, 6, 7b, 8a, 8b, 9b, 9g, 10, 30, *Tmp* and *Mc*n resistance genes). Yellow rust and stem rust developments on each entry were scored using the modified Cobb scale (Susceptible control cv. Little Club 80-100S) in July-August 2015. Coefficients of infections were calculated, and the values below 20 were considered as resistant to disease. One material was resistant to YR and SR in adult plant stage. These resistance genotypes can be used in both quality and yellow rust and stem rust resistance breeding programs to stem rust reactions.

Keywords: Bread wheat, rust (*Puccinia* spp.) diseases, reaction test, quality

1. INTRODUCTION

Wheat (*Triticum* sp.) is the most important cereal crop of Turkey where many of its ancestors originated. Although majority of the 20-22 million tonnes of production takes place in the Turkey, it is grown under diverse climatic conditions.

In Turkey, wheat is usually consumed in the form of bread, pasta, noodles, biscuits, bulgur, semolina, flour and bakery products. It is necessary to use different kinds of flour in making different products. For this reason, the quality requirements of different industrial groups are different. In this study, some genotypes that have emerged as part of a quality winter bread wheat development program have been studied.

The selection of early generation material with different and reliable methods in breeding programs enables the breeder to reach its purpose in a short time and more surely. If the wheat breeding studies are thought to last about 16 years, the material that is not suitable is removed in the early generations fast, the more material and detailed work can be done with the other material and the less time, money and labor can be achieved. The quality criteria used in this part of the study; Hectoliter Weight, Zeleny Sedimentation and Mixogram of the important diseases yellow rust (caused by *Puccinia striiformis* f.sp. *tritici*) is the most significant disease that can occur in wet and cool springs growing areas. Other of the important diseases stem rust (caused by *Puccinia graminis* f. sp. *tritici*) is the most significant disease that can occur at higher altitudes and coastal growing areas.

In recent years, some important of yellow and stem rusts epidemics have been experienced in the Turkey, causing significant losses in yield and quality of wheat (Aktaş, 2001). Development of cultivars with resistance to yellow rust and stem rust are among the objectives of these programmes but natural disease development is not always adequate for evaluation of the materials for resistance against the yellow rust and stem rust. Genetic resistance is one of the cheapest and most practical control methods that can protect the natural environment and be used by producers in the control of rust disease (Çetin et al., 2007).

5 bread wheat genotypes (Zeleny sedimentation (57-65 ml), (Bezostaja-1; 56) in yield trials were developed by the Central Research Institute for Field Crops (CRIFC) Department of Quality Assessment and Food. The aim of this study was to determine the reactions of 5 winter bread wheat lines to yellow rust and stem rust disease in adult plant stage.

2. MATERIALS AND METHODS

Quality Studies

Hectoliter weight test: Refers to the weight of 100 liter of wheat in kg. It is a criterion used in the classification of wheat and it is directly related to flour yield. Grain size, density, shape and homogeneity affect the hectoliter weight.

Zeleny sedimentation test: Zeleny sedimentation test was carried out according to Anonymous (1972). The principle of the zeleny sedimentation test is to swell the flour particles in the suspension prepared with the flour and lactic acid solution according to the gluten quality and measure the amount of these particles at a certain time. In wheat flour, which is high in gluten content and high in quality, the particles are more densely packed and less precipitated in the solution. For this reason, zeleny sedimentation values of high quality wheat flours are higher (Atlı and Koçak, 2004).

Mixograph test: 25 gr flour is mixed with the amount of water calculated according to the moisture contained in the mixer kneader until the maximum dough consistency is obtained. Taking into consideration the peak height and general curve characteristics, a numerical classification is made by comparing with eight reference mixograms. It shows the stronger curve type as the number grows (Anonymous 2018).

Rust Disease Studies

Reactions test: The test materials were sown in a one meter row with 2 replications in İkizce, Ankara (for, yellow rust) and Seydiler, Kastamonu (for stem rust) locations. The test materials were screened for yellow rust artificial epidemic condition with yellow rust and under natural epidemic condition to stem rust in October 2014. Susceptible control (cv. Little Club) and stem rust differential set, sown in the same method and same date.

Disease Assessment: Disease scoring was performed using the Modified Cobb scale. The rust severity and infection type were recorded. Disease evaluations were conducted at least 2 times. The highest score was taken into calculate in the evaluations. The coefficient of infection (CI) was found by multiplying the coefficients determined for rust intensity and type of infection.

3. RESULTS AND DISCUSSION

The test materials used in this study were selected from different early stage materials used in the different breeding program in 2013 growing season. The main criterion for selection is; class; value 5-6, which is widely used by industrialists and researchers in the final product estimate and lines with values above were selected. When the results of the hectoliter, zeleny sedimentation and mixograph analyze of the selected test materials and standards cultivars are evaluated collectively, Hectoliter values range from 76.6 to 78.8 kg/hl. Zeleny sedimentations values range from 57-65 ml. The material often has suitable hectoliter test values. The mixograph classes are to be examined; They variations between 5 and 6. (Table 1).

The test materials were screened for yellow rust artificial epidemic condition with yellow rust (virulent on *Yr2*, 6, 7, 8, 9, 25, 27, *Sd*, *Su* and *Avs* resistance genes in Europe/World differential set) and under natural epidemic condition with stem rust (virulent on: *Sr5*, 6, 7b, 8a, 8b, 9b, 9g, 10, 30, *Tmp* and *Mcn* resistance genes). Yellow rust and stem rust developments on each entry were scored using the modified Cobb scale (Susceptible control cv. Little Club 80-100S) in July-August 2015. Coefficients of infections were calculated, and the values below 20 were considered as resistant to disease. One genotypes was resistant to yellow rust and stem rust (Table 1).

Table 1. Hectoliter, zeleny sedimentation and mixograph characteristics of the materials and stem rust reactions

Origin	No	Hectoliter (kg/hl)	Weight Zeleny Sed. (ml)	Mixogram	Yellow (Reactions)	Rust Stem (Reactions)	Rust
Line	1	78,8	63	6	40 MS	40 S	
Line	2	77,7	62	5	50 MS	70 MS	
Line	3	77,4	65	5	40 MS	10 MS	
Line	4	76,6	57	6	20 MS	60 S	
Line	5	77,5	62	6	60 S	40 MS	
Standard Cultivars							
Bayraktar 2000	Std 1	76,7	45	5	20 MS	60 MS	
Bezostaja 1	Std 2	77,0	56	5	60 MS	70 MS	
Demir 2000	Std 3	76,8	46	5	40 MS	90 S	
Konya-2002	Std 4	78,5	47	4	70 MS	50 MS	
Tosunbey	Std 5	77,5	53	6	40 MS	40 MS	

Bread wheat will be effectively improved in quality by improving the hectoliter weight, zeleny sedimentation and mixograph tests and resistance to yellow rust and stem rust and implement these materials to the selection in the early generations of breeding.

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Bifidogenic Effect of Salep Powder

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Abstract: The aim of this research was to study the bifidogenic effect of salep powder on some *Bifidobacterium* species, namely *B. lactis*, *B. infantis*, *B. longum* and *B. bifidum*. The growth of the *Bifidobacterium* species was investigated by measuring the pH and optical density (OD) during 48 h-fermentation. In order to evaluate the efficiency of the fermentation of salep powder by the *Bifidobacterium* spp. lactic, acetic, butyric and propionic acid values in the growth media were quantified by HPLC. It was determined that the growth of all strains on media containing salep powder was similar to the growth on glucose and the highest OD values were found for *B. lactis* in media containing glucose and for *B. infantis* in media containing salep powder. All the tested strains observed the ability to produce higher amounts of lactic and acetic acids than amounts of propionic and butyric acids. Consequently, it was determined that all four *Bifidobacterium* species were able to ferment salep powder. Moreover, because salep powder enhanced the growth and activity of Bifidobacteria and it might be conferred as a bifidogenic effect.

Keywords: *Bifidobacterium*, Bifidogenic effect, Salep powder

1.INTRODUCTION

There is growing interest in functional foods having beneficial effects on the human health. Probiotics, prebiotics and synbiotics have gained an important to modulate the gut microbiota with the aim of improving host health. Probiotics have been defined by WHO and (FAO) as “viable non-pathogenic microorganisms which, when administered in adequate amounts, demonstrate beneficial effect on the human health”. The beneficial effects of the probiotics are inhibition the growth of the intestinal pathogens, improved lactose digestion, enhancing the immune system, lowering the risk of cancer, treatment and prevention of obesity, diabete, cardiovascular diseases and some allergic reactions. Although there are hundreds of probiotic species such as *Bifidobacterium*, *Lactobacillus*, *Lactococcus*, *Saccharomyces*, and *Enterococcus*, *Bifidobacterium* and *Lactobacillus* species are most commonly probiotic species used in food products (Bernardeau et al., 2008; Pan et al., 2009; Kerry et al., 2018; Shokryazdan et al., 2017; Zoumpoulou et al., 2018).

Bifidobacterium species are gram-positive, high G+C, catalase negative, rod-shaped, non-immobile, non-sporulate, obligate anaerobes with the exceptions of a few species, highly sensitive to pH above 8.0 or below 4.5 with optimum growth between 37 to 41°C. *B. breve*, *B. bifidum*, *B. adolescentis*, *B. animalis*, *B. infantis*, *B. lactis* and *B. longum* are the most recognized species of Bifidobacteria used as probiotics. *Bifidobacterium* species consumed at adequate levels have demonstrated beneficial effects on treatment and/or prevention of some diseases namely concerning immune system, gastro-intestinal infections, hypertension, cholesterol and cancer. Bifidobacteria constitute 95% of the total intestinal microbiota in the colons of breast-fed infants and decline with age and changes in eating habits (Champagne et al., 2005). Many attempts have been made to stimulate the growth of bifidobacteria and to increase their populations in the intestines of humans and/or animals and a food by supplying biologically active components called as “bifidogenic factor” or “bifidus factor” (Wang et al., 2010; González-Rodríguez et al., 2013). Bifidogenic factor was described by Modler (1994) and Gomes and Malcata (1999) as a carbohydrate that survive direct metabolism by the host and reach the colon where they are preferentially metabolised by Bifidobacteria as source of energy. Recently, this factor is called as a prebiotic. Prebiotics are non-digested, not-hydrolyzed and non-absorbed food ingredients in stomach and small intestine. They have been fermented by the gut microbiota that causes specific changes, both in the composition and/or activity in the gastrointestinal microbiota. As a result of fermentation, i) potentially health promoting metabolites such as lactic acid, short chain fatty acids, bacteriocins and B vitamins have occurred, ii) the colonic flora by exerting bifidogenic effect (the proliferation of bifidobacteria) have been modulated and iii) the growth of undesirable bacteria have been inhibited. Thus, prebiotics have demonstrated health benefits including detoxification of toxic substances, reduction of blood ammonia levels and cholesterol, stimulation of mineral uptake and the treatment/prevention of cancer and infectious diseases (Bindels et al., 2015; Shigwedha et al., 2016; Carlson et al., 2018).

Cereals, legume crops, vegetables (chicory, onions, leek, artichoke etc.), fruits (dragon fruit, jack fruit etc.) and milk components (oligosaccharides) are natural sources for prebiotics. However, inulin, fructooligosaccharides, oligofructose, (trans-) galactooligosaccharides (TOS or GOS) or lactulose derived through biochemical and/or enzymatic techniques from these foods are the most used prebiotics at production of industrial products (Gibson and Rastall, 2006; Wang et al., 2010; Rios-Covian et al., 2013; Sousa et al., 2015; Underwood et al., 2015).

Synbiotic has been called as combining probiotic bacteria with prebiotics. In a synbiotic composition, prebiotics should be fermented selectively by the probiotic strain. Fermentation of the prebiotic results in i) increasing of beneficial microbiota (e.g., bifidobacteria and lactobacilli), ii) decreasing the populations of potentially pathogenic microbiota (e.g., *Clostridium perfringens* and *E. coli*), iii) lowering of the pH and iv) production of short-chain fatty acids (SCFAs), mainly acetic, propionic and butyric acids. SCFAs might serve health promoting properties such as promoting the absorption of water and minerals including calcium, magnesium and iron, inhibiting cholesterol synthesis and the prevention/treatment of the metabolic syndrome, bowel disorders and certain types of cancer (Markowiak and Śliżewska, 2017; McNabney and Henagan, 2017; Morrison and Preston, 2016).

Orchids are mostly cultivated for beautiful flowers which have immense economic importance and medicinal value. The “salep” powder is obtained from grinding dried tubers of *Orchis mascula*, *Orchis militaris* and related species of orchids growing naturally in Turkey. Salep is used as very nutritive ingredient in a delicious hot drink known by the same name, traditional Kahramanmaraş-type of ice cream, soft drinks and confectionary industries. In traditional medicine, salep is used as an aphrodisiac in sexual activity and erectile dysfunction, as a blood sugar manager to relieve pancreas stress, in the prevention of chronic disorders, in treatment of bowel disorders, tuberculosis, diarrhea, Parkinson’s, cancer, fever and weight management (Jagdale et al., 2009; Altundag et al., 2012; Pourahmad, 2015; Jahromi et al., 2018). Although the components of salep vary according to the season of collection and orchid species, generally it contains mucilage (48%), moisture (12%), sugar (1%), starch (3%), nitrogenous substance (5%), ash (2%) and glucomannan (16%–60%). Glucomannan is a natural neutral water-soluble fiber which are important in normalizing blood sugar, relieving stress on the pancreas, and preventing blood sugar abnormalities, such as hypoglycemia (Staiano et al., 2000; Keithley and Swanson, 2005; Onakpoya et al., 2014; Tester and Al-Ghazzewi, 2017.).

Recently, researchers have studied to find innovative or alternative sources which are relatively low in cost in comparison to commercially available prebiotics. In this context, prebiotic properties of glucomannan have been reported by many researches (Connolly et al., 2010; Harmayani et al., 2014; Muller et al., 2012). Salep powder may be metabolized by bifidobacteria and demonstrate bifidogenic as well prebiotic effect, probably due to its glucomannan content.

In order to develop candidate prebiotic substrates, firstly the bacterial fermentation properties of a substrate can be initially determined using in vitro models and its prebiotic activity can later be confirmed by controlled human clinical trials. The objective of this research was to study was to measure the ability of salep powder to promote the growth of four bifidobacteria species. Glucose, a non-prebiotic simple carbon source, is able to metabolized by probiotic fastly and reach maximum growth more quickly, thus it was chosen as a positive contro. The comparison was made in both basal media with salep powder and glucose as well as glucose. The growth of bifidobacteria species was tested by determining the optical density (OD) and pH values. In order to examine the biochemical activities of the species, high performance liquid chromatography (HPLC) analysis of lactic acid and short chain fatty acids (acetic, propionic and butyric acids) concentrations were also carried out.

2.MATERIALS AND METHODS

Bacterial Strains

The bacteria used in this study were *Bifidobacterium longum* subsp. *infantis*, *Bifidobacterium animalis* subsp. *lactis* *Bifidobacterium longum* subsp. *longum* and *Bifidobacterium bifidum*. These strains were obtained from DSMZ (Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH, Braunschweig, Germany). These strains were activated according to the method suggested by DSMZ and incubated at 37°C using an anaerobic atmosphere generation system (Anaerocult A, Merck, Darmstadt, Germany).

Salep Sample

Salep from orchids grown different parts of Turkey region was provided by Kadem Sahlepçilik (Istanbul, Turkey). Stock solutions of salep were prepared in distilled water and filter-sterilized using Millipore-Stericup-GP 0.45 µm (Kaplan and Hutkins, 2000; Mumcu and Temiz, 2014).

Growth Conditions

Tryptone Peptone Yeast Extract (TPY) was used as the basal medium containing peptone (5.00 g L⁻¹), yeast extract (2.50 g L⁻¹), glucose (5.00 g L⁻¹), tween 80 (1.00 g L⁻¹), K₂HPO₄·3H₂O (2.00 g L⁻¹), MgCl₂ (0.50 g L⁻¹), ZnSO₄·7H₂O (0.20 g L⁻¹), CaCl₂ (0.15 g L⁻¹), FeCl₃·6H₂O (0.003 g L⁻¹) and L-cysteine HCl (0.50 g L⁻¹). The medium was sterilised at 121°C for 15 min. Sterile salep solutions were added into the basal TPY medium to obtain final concentrations of 0.5% (w/v.) As positive control TPY with 0.5 % (w/v) glucose was used. The assay was performed by adding 2%(w/v) of an overnight culture of *Bifidobacterium* spp.

pH Measurement

The pH of each sample was determined during fermentation using a pH-meter (pH 315i / SET; WTW, Germany).

Growth Measurement

The optical density as cell density of bacteria was determined at 600 nm (OD₆₀₀) with a spectrophotometer (Shimadzu UV 1800, Kyoto, Japan) during fermentation. The corresponding sterile TPY solutions without bacteria were used as blanks for the absorbance measurements.

Lactic Acid and SCFA Analyses

To evaluate the efficiency of the fermentation of salep by the *Bifidobacterium* spp., HPLC was performed. Lactic, Acetic, Butyric and propionic acids can be detected in the growth medium and quantified by HPLC (Shimadzu marka LC-20 AD, Japan, [17]. The HPLC equipment consisted of Transgenomics ORH-801 column and Refractive Index Detectors (RID) (Shimadzu, Kyoto, Japan) connected to a recorder. Samples was filtered through a 0.45 µm syringe filter prior to injection into the HPLC column. The injection volume was 20µl. 0.0025 N H₂SO₄ was used as the mobile phase, under a flow rate of 0.6 mL min⁻¹ at 65 °C (Anonymous, 2012).

Statistical Analysis

All results are expressed as mean ± SD. Data were analyzed by two-way analysis of variance (ANOVA). Duncan's Multiple Range Test was applied to determine the significant difference between the fermentation times and substrates used as carbohydrate source at $P \leq 0.01$.

3.RESULTS AND DISCUSSION

In order to determine the carbohydrate preferences of *Bifidobacterium* species, the optical density (OD) and pH was determined. Table 1 shows OD and pH values after the five fermentation times (0, 12, 24, 36 and 48 hours) in anaerobic culture following supplementation with glucose as a positive control and salep powder (test substrate).

The results are presented as the mean value of each fermentation time (FT), regardless of the *Bifidobacterium* species (BS), and the mean value of each strain, regardless of the fermentation time. For all parameters, the interaction among both factors (BSxFT) could be determined, and for all parameters and every time, a significant interaction was detected ($P < 0.01$). Regarding the fermentation time, the highest value of optical density was recorded for media with glucose, while it showed pH value. In glucose samples, the pH decreased significantly ($P < 0.01$) during 48 h of fermentation. It was found that pH value for salep powder samples showed temporal increase and decrease between 36 h and 48 h. *B. infantis* has the lowest pH values in both media with glucose (4.52) and salep powder (5.25).

As shown in Table 1, *Bifidobacterium* species used salep powder as a source of carbon and energy. All strains grew well on glucose, the highest OD values were found for the strains *B. lactis* in media containing glucose (1.114) and *B. infantis* in media containing salep powder (0.952). Optical density value when salep powder for *B. infantis* was used as a single carbon source was able to generate similar growth as that promoted by glucose (the traditional carbon source). Wang et al. (2010) reported that *B. adolescentis* displayed the highest growth on xylooligosaccharides with the maximum OD of 1.68 and the lowest pH value of 5.1, followed by *B. longum* and *B. bifidum*, however, *B. breve* did not show any growth on XOS. García-Cayuela et al. (2014) determined that the OD values after 48 h growth of *B. lactis* BB-12, *B. breve* 26M2 and *B. bifidum* HDD541 with the six carbohydrates (glucose, lactulose, lactosucrose, Kojibiose, Lactulosucrose and 40-Galactosyl-kojibiose) used as carbon sources ranged from 0 to 1.21. On the other hand, the maximum OD for glucose values were obtained at 48 h of fermentation, while at 36 h of fermentation for salep powder. Voragen (1998) reported that chemical structure, degrees of polymerization (DP), composition of monomer units and water solubility of substrate affect their utilisation by probiotic microorganisms.

Table 1. The mean values of OD and pH values obtained by four *Bifidobacterium* species grown on glucose and salep powder for 48 h

<i>Bifidobacterium</i> strains	N	OD		pH	
		GLUCOSE	SALEP POWDER	GLUCOSE	SALEP POWDER
<i>B. bifidum</i>	10	0.901 ^{BCa}	0.682 ^{Bb}	4.70 ^{Cb}	5.52 ^{Ba}
<i>B. infantis</i>	10	0.951 ^{ABa}	0.952 ^{Aa}	4.52 ^{Db}	5.25 ^{Ca}
<i>B. lactis</i>	10	1.114 ^{Aa}	0.645 ^{Bb}	4.89 ^{Bb}	5.55 ^{Ba}
<i>B. longum</i>	10	0.703 ^{Ca}	0.619 ^{Bb}	5.39 ^{bA}	5.90 ^{Aa}
Fermentation time (hours)					
0	8	0.077 ^{Ca}	0.113 ^{Da}	6.43 ^{Aa}	6.32 ^{Aa}
12	8	0.831 ^{Ba}	0.608 ^{Ca}	5.12 ^{Ba}	5.69 ^{Ba}
24	8	1.152 ^{Aa}	0.874 ^{Bb}	4.46 ^{Cb}	5.35 ^{Ca}
36	8	1.194 ^{Aa}	1.092 ^{Aa}	4.20 ^{Db}	5.17 ^{Da}
48	8	1.334 ^{Aa}	0.935 ^{Ba}	4.16 ^{Db}	5.25 ^{CDa}
ANOVA					
<i>Bifidobacterium</i> strains (BS)		**	**	**	**
Fermentation time (FT)		**	**	**	**
BSXFT		**	**	**	**

^{A-D}Different uppercase supercripts in the same column depict the significant difference between means for fermentation time and *Bifidobacterium* strains ($P < 0.01$)

^{a-d}Different lowercase supercripts in the same row depict the significant difference between glucose and salep powder ($P < 0.01$)

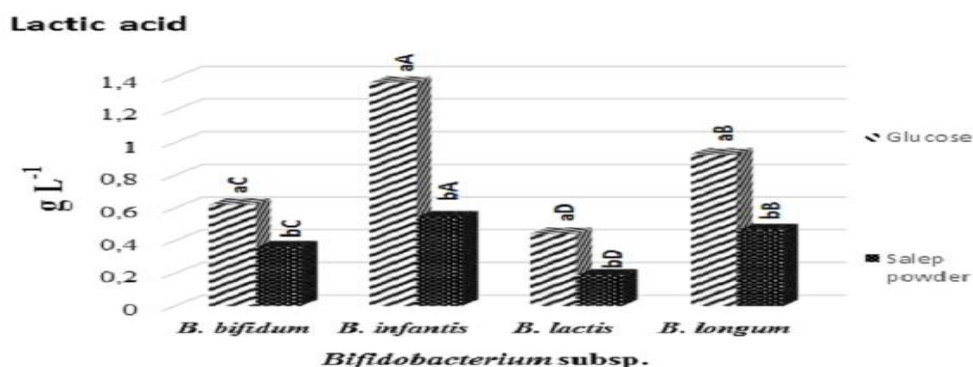


Figure 1. Changes of lactic acid values of samples after the 48 h-fermentation

^{a-d}Different lowercase supercripts depict the significant difference among samples ($P < 0.01$);

^{A-D}Different uppercase supercripts depict the significant difference between *Bifidobacterium* subsp. ($P < 0.01$)

Lactic acid is the main end-product of the glycolytic fermentation produced by lactic acid bacteria. For all the tested strains, lactic acid was the most abundant produced metabolite, this finding is in agreement with LAB metabolism. Figure 1 shows the lactic acid concentrations of *Bifidobacterium* species in media including glucose and salep powder. The concentration of lactic acid ranged from 0.19 g L⁻¹ of *B. lactis* in media with salep powder to the 1.37 g L⁻¹ of *B. infantis* in media with glucose, depending on the strain and type of substrate. More lactic acid was produced from glucose than salep powder. *B. infantis* produced the higher lactic acid in media with salep powder than other species. Barczynska et al. (2012) reported that lactic acid content determined 109.3 mg 100 mL⁻¹ for *B. bifidum* Bb12 108.8 mg/100 mL for *B. animalis* DN-173 010 in the broth containing the tartaric acid-dextrin as the only one source of carbon after 24-h incubation.

Short Chain Fatty Acids

Short-chain fatty acids (SCFAs) such as acetic, propionic and butyric acids are produced as the end products of the microbial fermentation of dietary carbohydrates via *Bifidobacteri* and *Lactobacilli*. The type number and enzymatic capabilities of microorganisms and substrate sources have affected amount and type of these metabolites in vitro media (Wong et al., 2006). Also, in human body endogenous colonic microbiota like probiotic bacteria and gut transit time have affected production (Barczyńska et al., 2015; Pessione et al., 2015).

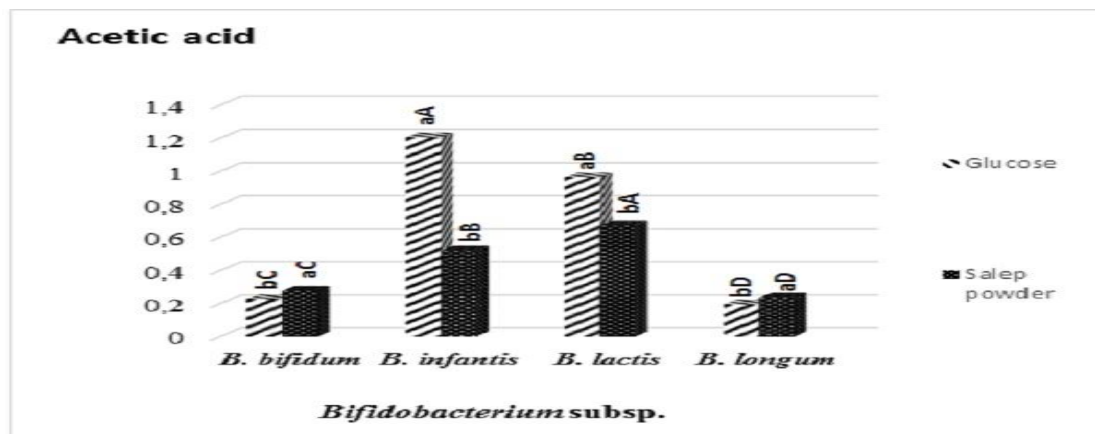


Figure 2. Changes of acetic acid values of samples after the 48 h-fermentation

^{a-d}Different lowercase supercripts depict the significant difference among samples ($P<0.01$);

^{A-D}Different uppercase supercripts depict the significant difference between *Bifidobacterium* subsp. ($P<0.01$)

Acetic acid, the most abundant SCFA produced by the human colonic microbiota, can be used as energetic substrate in muscle tissue, controlling inflammation and counteracting pathogen invasion (Fukuda et al., 2011). The acetic acid concentrations of *Bifidobacterium* species are shown in Figure 2. Its concentration depended on the strain and substrate type. Acetic acid, it ranges from 0.19 g L⁻¹ of *B. longum* to 1.20 g L⁻¹ of *B. infantis* in media with glucose. The higher acetic acid values were observed for *B. bifidum* and *B. longum* in media with salep powder than glucose. Generally, during the whole fermentation progress, samples including salep powder exhibited a lower acetic acid value than glucose. It was found that acetic acid content determined 19.1 mg 100 mL⁻¹ for *B. bifidum* Bb12 16.9 mg 100 mL⁻¹ for *B. animalis* DN-173 010 in the broth containing the tartaric acid-dextrin as the only one source of carbon after 24-h incubation (Barczynska et al., 2012).

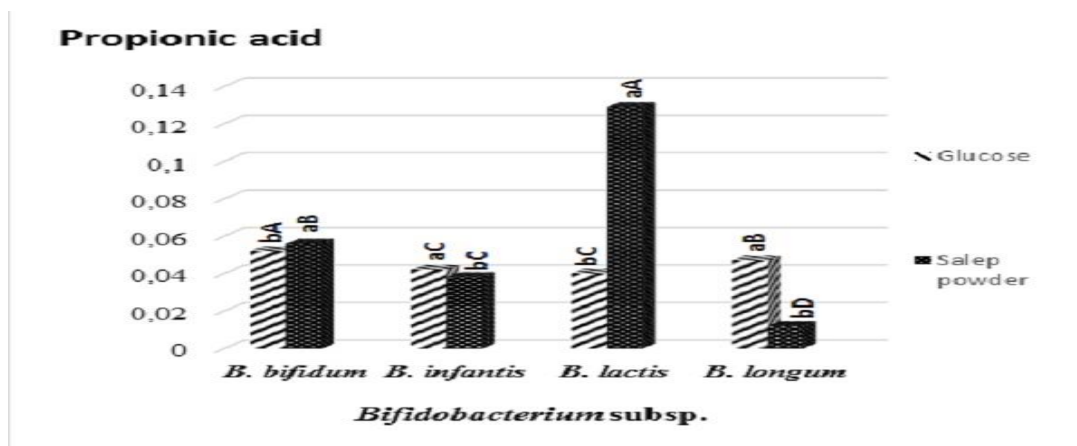


Figure 3. Changes of propionic acid values of samples after the 48 h-fermentation

^{a-d}Different lowercase supercripts depict the significant difference among samples ($P<0.01$);

^{A-D}Different uppercase supercripts depict the significant difference between *Bifidobacterium* subsp. ($P<0.01$)

Propionic acid produced by certain colon bacteria can be transported to many parts of the body and utilized in liver cells (Hongpattarakere et al., 2012). It can be observed (Figure 3) that the fermentation time might influence the propionic acid values of *Bifidobacterium* species fermented in media including glucose and salep powder. Propionic acid contents range from 0.13 g L⁻¹ of *B. lactis* to 0.01 g L⁻¹ of *B. longum* in media with salep powder. For *Bifidobacterium* species, the maximum propionic acid value of *B. lactis* fermented in media with salep powder was observed. Barczynska et al. (2012) reported that propionic acid content determined 4.5 mg 100 mL⁻¹ for *B. bifidum* Bb12 4.6 mg 100 mL⁻¹ for *B. animalis* DN-173 010 in the broth containing the tartaric acid-dextrin as the only one source of carbon after 24-h incubation.

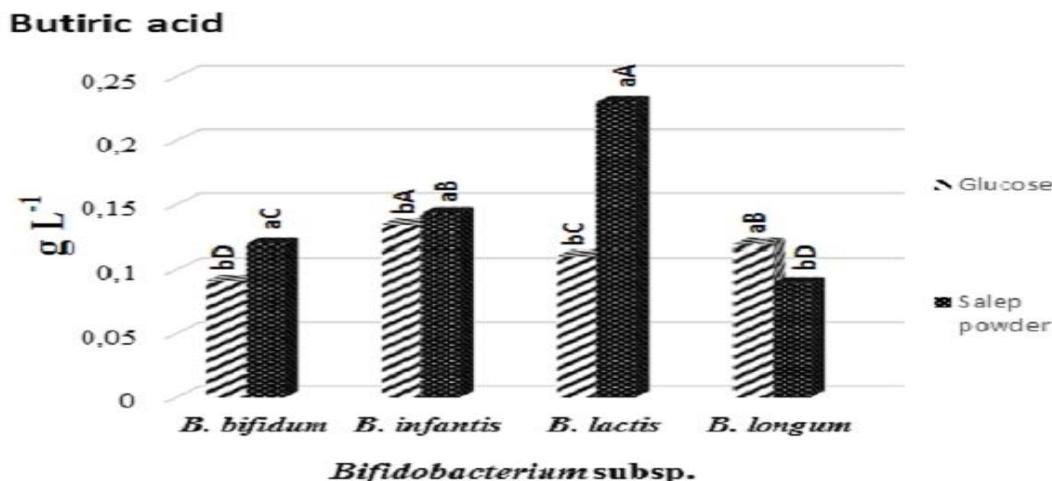


Figure 4. Changes of butyric acid values of samples after the 48 h-fermentation

^{a-d}Different lowercase supercripts depict the significant difference among samples ($P < 0.01$);

^{A-D}Different upppercase supercripts depict the significant difference between *Bifidobacterium* subsp. ($P < 0.01$)

Butyric acid among SCFAs displays beneficial health effects such as the prevention and treatment of colonic diseases (Fung et al., 2012; Pessione et al., 2015). The *Bifidobacterium* species and type of substrate affected the butyric acid values. Generally, higher butyric acid values were present in media with salep powder. A maximum butyric acid value of *B. lactis* fermented in media with salep powder was observed, while *B. bifidum* and *B. lactis* fermented in media with glucose has a lower butyric acid values. Interestingly the trends of production of propionic and butyric acids are similar for the tested strains, the highest producers of the both SCFAs are for *B. lactis* in media with salep powder, while and the lowest producers are *B. longum* in media with salep powder. These results agree with Pessione et al. (2015) who studied characterization of potentially probiotic lactic acid bacteria isolated from olives and evaluation of short chain fatty acids production.

In this study, for the evaluation of bifidogenic effect by growth and metabolic activity achievements, growth curves were monitored by optical density assessment, and bacterial metabolism was assessed by pH measurement and as well as determination of short chain fatty acids production. Based on the results reported herein, salep powder may stimulate the growth of *Bifidobacterium* species. Enhancement of *Bifidobacterium* species growth and metabolism by the increase of lactic acid and short chain fatty acids production that it may be stated that salep powder has potential as “bifidus factor”.

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The Lactation Performances of Different Heifer Raising Programs

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Abstract: In dairy cattle husbandry, the successful heifer rearing program has great importance in terms of return of investment. Heifers for breeding purpose are to ensure that profitability has given birth to her first calving age of 22-24 months. However, for this purpose controlled conditions and some special requirements must be provided. Many literature reported that the different growth pattern for optimal heifer raising performances. But it must be quite technical critical threshold value for the get optimum performances in the future. The ideal value of the first calving of Holstein heifer is to 22-24 months of age. But in the practical result did not show these ideal. Many study results showed big variation from 18 months to 36 months of age. This high first calving age affected the animal future performances. Dairy farms must be considering the critical threshold value for the optimum heifer raising program. For this purpose 118 head heifer which 2010-2013 born were monitored and recorded during the 3 year study and status from birth to first lactation were evaluated depending on the growth performances. In this study the results of 118 heifer lactations and reproductive performances were determined. Many studies on the effect of weight and age at first calving on subsequent milk yields have been carried out. There is a wide variation between the results of the researchers. The first lactation milk yield of these study is higher but variations is also higher. First lactation milk yield of low performance group was determined as 7191.95 ± 270.09 kg while high performance group values were 6430.45 ± 151.26 kg. The differences between the groups is to determined statistically significant ($P < 0.01$).

Keywords: Lactation, performances, heifer, raising, dairy herd

1. INTRODUCTION

Heifers are the key basic factor of any dairy enterprise for future performance. Improvement of a herd is possible when culled cows are replaced by well fed, healthy, genetically superior, and properly managed to 2-year-old heifers. Holstein replacement heifers should calve and enter the milking herd at 22 to 24 month of age (Heinrichs and Hargrove, 1987; Crowley et al., 1991). Healthy, productive heifers are the result of good management that starts before the cows are conceived and continues until they enter the milking herd. Monitoring growth and adjusting diets accordingly for their planning performances is the single most important part of a sound dairy heifer program. The general rule is to heifer's growth targets should be 55% of mature weight at breeding and 85 to 90% of mature weight at first calving. Many research studies have shown the positive relationship between body weight at calving and first lactation milk production. Not only are undersized heifers smaller and less productive, but they also are prone to more problems at calving. On the other hand, accelerating the growth of heifers in a manner that causes them to become fat also reduces their lifetime milk production and longevity. Published research studies show that excessive energy intake (140 percent of the recommended amount) before breeding can decrease development of the secretory tissue in the cow's mammary gland and thereby reduce first lactation milk yield (Clark, and Touchberry 1962). It is recommended to grow heifers at 1.8 lbs. /day to achieve optimal milk yields. Feeding below or above this rate has been shown to reduce first lactation milk production. Feeding to achieve accelerated growth rates after breeding does not appear to hinder mammary development. Therefore, we recommend that growth rates after puberty can be 1.5 to 2.5 lbs. /day, based solely on the age and body weight at breeding and the desired body weight at calving. Optimal growth and development are related to energy intake and also can be aided by ensuring that heifers receive an adequate level of protein. Dairy farms must be considering the critical threshold value for the optimum heifer raising program. For this purpose 2010-2013 year are born between 118 head heifer were monitored and recorded during the 3 year study and status from birth to first lactation were evaluated depending on the growth performances.

2. MATERIALS AND METHODS

In this study, data obtained from reproductive records of 118 heifer birth from 2010 to 2013 to which were raised at the Cukurova University Dairy Research Farm were investigated. A total of 118 heads of heifer fertility and milk yield records were evaluated during 2011-2013. After birth all females weighing and monitored for the performances. During pre-weaning period all calves were kept together with their mothers for the first 3 days after calving and then were housed in individual pens in fiberglass calf hutches. All hutches had soil floors with a straw bedded which is commonly used in intensive dairy farm for calf comfort. Calves were fed colostrums as soon as possible, after birth during the 3-day period. Between day 4 and 56, calves were fed with whole milk from a pail twice a day, such that each calf received 212 L whole milk (4 kg per day) over the whole experiment. After weaning, the calves were kept in the calf hutches for a further 8 weeks period of the experiment. During the post-weaning period (8-16 weeks), calves were fed a total mixed ration ad-libitum containing 40% of calf grower and 60% of alfalfa hay grounded to 1-2 cm lengths. After weaning calves were

allocated the experimental groups which were fed live weight gained high (>700 g/day +) as first group and low (<700 g/day) as second group. Low performance group calves were fed 0.5-1 kg calf grower and with corn silage for freely and the high performance group calves were fed free corn silage and 1.5-2 kg calf grower.

Table 1. Chemical compositions of calf starter, calf grower and alfalfa hay

Chemical composition (%, as fed basis)	Calf starter	Calf grower	Alfalfa hay
Dry matter	93.76	92.33	93.14
Crude protein	15.98	16.85	11.4
Ether extract	4.12	4.55	0.8
Crude fiber	9.60	9.53	34.43
ADF	11.51	10.25	39.23
NDF	22.23	23.94	45.32
Ash	7.67	73.80	7.23

Animals are taken to the dairy farm normal heifer rearing management till 250 kg live weight and all the experimental groups were fed the same feed feeding programs of the farms. During the all this period weight gain of the heifer were taken monthly interval. These feeding system continued until the end of pregnancy and during the last one month has TMR were changed to the concentrate. In the last month of pregnancy, 10 kg of corn silage or triticale + vetch silage, 1 kg alfalfa hay and 1 kg wheat straw and 5-6 kg of concentrate were used as feed source. During the lactation corresponding to 2.5 kg of milk yield for shareholders is given 1 kg of concentrate feed. During the studies heifers were kept in shelters which is ground floor area. Artificial insemination is used for all heifer during all season.

3.RESULTS AND DISCUSSION

Results

110 heifers calved, and 8 heifers were died prior to parturition because of disease problem (heifers fed on low performance= 3; heifers fed on high performance = 5). All the rest of heifers reproductive and milk performance parameters were summarized Table 2. As expected that the groups average daily weight gain differences between the experimental groups during pre-puberty period is determined statistically different ($P<0.01$). During this period, body condition score values differences between the groups is also determined statistically different ($P<0.01$).

Table 2. The reproductive and milk performance parameters of low and high performance of experimental groups.

	Low performance			High performance			P<
	Average	Min.	Max.	Average	Min.	Max.	
Prepuberty Performance							
Birth weight (kg)	36.00±0.65	29.00	43.00	37.23±.75	33.00	43.00	0.22
weaning weight (kg)	73.50±1.28	64.00	88.00	75.65±2.14	62.00	98.00	0.37
Daily weight gain (kg/day)	0.51±0.01	0.27	0.62	0.74±0.01	0.63	0.87	0.00
Body Condition Score	3.20±.049	2.75	3.50	3.53±.038	3.25	3.75	0.01
Reproduction parameters							
First oestrus age (Month)	11.82±0.28	11.02	14.03	9.70±0.38	7.11	13.44	0.00
First Insemination Age (Month)	24.54±.58	19.41	39.38	20.27±0.56	16.62	41.18	.000
First Insemination weight (kg)	365.67± 13.11	345.00	390.00	375.61±4.40	350.00	405.00	0.49
Insemination per pregnancy (times/pregnancy)	2.17±.15	1.00	5.00	2.38±.14	1.00	6.00	.321
First Calving Age (Month)	32.83±0.34	30.62	39.93	28.10±0.18	25.70	30.49	.000
Milk performance							
First Lactation Milk Yield (kg)	7191.95±270.09	2925	9924	6430.45±151.26	3392	9119	.010
Lactation period (day)	317.41±16.77	143	652	339.13±9.44	235	532	.233

First estrus of the calves were observed around 11.82 ± 0.28 months of age of low performance group while high performances group first estrus age is to determined as 9.70 ± 0.38 months of age. The differences between the groups is also determined statistically different ($P < 0.01$).

First lactation milk yield of low performance group was determined as 7191.95 ± 270.09 kg of age (min. 2925.00 kg and max. 9924.00 kg) while high performance group values were 6430.45 ± 151.26 kg (min. 3392.00 kg and max. 9119.00 kg). The differences between the groups is to determined statistically significant ($P < 0.01$). Milk yield of the heifers were higher than the similar with 5600 kg, 5087,5 kg and 4583,776 kg findings of researchers (Akman et al, 2008; Duru and Tuncel, 2004; Soylu, 1994) and other 5209 kg, and 4966,1 kg values of researchers (Kumuk, 1989 and Özçelik 1994). The lactation period of low performance group was determined as 317.41 ± 16.77 day (min. 143.00 day and max. 652.00 day) while high performance group values were 339.13 ± 9.44 day (min. 235.00 day and max. 532.00 day). The differences between the lactation period of the groups is not determined statistically significant ($P > 0.05$).

Discussion

In this study, the results obtained were higher than the values reported by Shearer et al. Age at puberty depends on genetics and weight. This age is important for heifer calf production and lactation performance. Lifetime profit of dairy replacement heifers is maximized when heifers calve between 23 and 25 months of age (Head, 1992). Puberty is defined as the time when the heifer has her first ovulation. Following the first ovulation, the heifer should begin to have heat periods on a continual basis, typically every 21 days. Delays in reaching puberty will in turn delay age at first breeding and delay age at which the heifer calves. Optimally, the Holstein heifer should reach puberty at 9 to 10 months of age, begin cycling on a typical basis, and have her first insemination at 14 to 15 months of age to calve at 23 to 24 months (Heinrichs and Hargrove, 1987). High performance groups showed acceptable first estrus age (9.70 ± 0.38) while low performance group first estrus age (11.82 ± 0.28) is higher than the acceptable level (9 to 10 months of age). The first calving age of low performance group was determined as 32.83 ± 0.34 months of age (min. 30.62 months and max. 39.93 month) while high performance group values were 28.10 ± 0.18 months of age (min. 25.70 months and max. 30.9 month). These results were similar with 887.07, 900.5 and 933.20 day findings of researchers (Bakır et al, 1994; Kumlu et al., 1991) and other 861.10, 865.9 and 880 day values of researchers (Mangurkar et al., 1987; Shrinivas and Govindalah, 1997). Sejrsen and Purup (1997) reported that the negative effect of high average daily gain on milk production at first lactation while other in which no effect was found (Pirlo et al. 1997; Waldo et al. 1998). Also Van Amburgh et al. 1998 reported that the nutrition effect was observed with average daily gain over 1.0 kg. Abeni et al. (2000) reported that the late calving heifers had higher milk production and a lower fat milk percentage than early calving heifers. Gardner et al. (1977) groups of heifers have been applied to an accelerated growth study gaining 2.4 pounds per day after puberty and freshening at 19.7 months of age. Compared to heifers calving at 26.9 months of age, the milk yields were significantly lower in the accelerated group, but there were no differences in the second lactation milk yield. Choi et al. (1997) carried out a study which is heifer fed according to a schedule of 3, 2, 4, 2, 5 and 2 mo. in which feed intake was alternately 20% below or 25% above requirements. And results showed that the first estrus, first conception, gestation period, services per conception, and calving difficulties were not affected by stair-step growth. These results indicate that compensatory growth can contribute to the improvement of growth efficiency and lactation performance. In the bovine, postnatal mammary growth occurs at an allometric rate prior to puberty and returns to an isometric rate after puberty (Sinha and Tucker, 1969). It is well documented that elevated nutrient intake during this allometric growth phase results in reduced parenchymal (PAR) mass and DNA (Sejrsen et al., 1978; 1982; Petitclerc et al., 1999; Capuco et al., 1995). Several hypotheses have been proposed to explain this mechanism.

According to the results of this study first lactation milk yield of low performance group was determined as 7191.95 ± 270.09 kg while high performance group values were 6430.45 ± 151.26 kg. The differences between the groups is to determined statistically significant ($P < 0.01$). Healthy, productive heifers are the result of good management that starts before the cows are conceived and continues until they enter the milking herd.

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The Colostrum Quality of Primiparous and Multiparous Holstein Cow

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Abstract: Colostrum management is one of the most important managemental factors in protecting calf health for the first weeks of life. After birth the first secretion from the mammary glands is called colostrum. Colostrum is varied in terms of colour and the composition varies from that of normal milk. Between the second and eighth milkings, the structure of the milk gradually turns normal, and the secretion between these periods is called transit milk. Colostrum quality is also essential for the health of new-born calf health and performances. Colostrum quality depends primarily on the amount of the antibody (IgG) it contains. High quality colostrum is defined as having an IgG concentration of greater than 50mg/ml. Colostrum plays a vital role in providing passive immunisation, thereby contributing to the development of the gastrointestinal tract, affecting the endocrine and metabolic systems and providing a source of energy for young animals to obtain heat generation to protect themselves from hypothermia. In this study, differences between uniparous and multiparous 100 heads Holstein dairy cow colostrum qualities are studied. Colostrum quality are dependent on factors such as density, the amount of milk produced after birth, cow diseases history, cow's age, season, feeding, breed, difficult birth, the live weight after given birth dry period. For this purpose, colostrum quality were determined by using colostrometer and chemical composition were determined by using MilkoScan FT120 (Foss).

Keywords: Dairy, colostrum, quality, primapour, holstein, cows

1. INTRODUCTION

In the mammals, the immune system is divided into humoral and cellular (cellular). They are separated again, both specific and non-specific (Doğan et al., 2010). Immun system protects calf from the external factors, some substances biologically active substances, such as IgG, somatotropin, prolactin, insulin which are not nutritional in the colostrum come directly from mother's milk. Because of its role in developing immunity with the colostrum, calf colostrum feeding is very important. The results of the study show that placenta of ruminants is not permeable to macromolecules such as immunoglobulin (Ig) from the mother (Medvezki, 1989).

Colostrum management is one of the most important managemental factors in protecting calf health for the first weeks of life. After birth the first secretion from the mammary glands is called colostrum. Colostrum is varied in terms of colour and the composition varies from that of normal milk. Between the second and eighth milkings, the structure of the milk gradually turns normal, and the secretion between these periods is called transit milk. Colostrum quality is also essential for the health of new-born calf health and performances. Colostrum quality depends primarily on the amount of the antibody (IgG) it contains. High quality colostrum is defined as having an IgG concentration of greater than 50mg/ml. Colostrum plays a vital role in providing passive immunization, thereby contributing to the development of the gastrointestinal tract, affecting the endocrine and metabolic systems and providing a source of energy for young animals to obtain heat generation to protect themselves from hypothermia. Colostrum has been reported to have very little Ig in the blood serum with bactericidal and lysozyme activity (Gerov et al., 1987) and that there is little or no alternative support system before colostrum consumption. Although the colostrum delay the development of the calf active immune response, it has great effect on neonatal disease protection (Blecha 1988; Blood and Radostites 1989). However, studies reported that calves differ in immunoglobulin levels and Ig levels in 41% of the calves are below 1000 mg / dl (Sellers, 2001). Factors such as malnutrition of the cow especially during the dry period, disruption of the immune system and decrease colostrum antibody content (Flesh, 1982). On addition to this many factors affect the colostrum quality such as age, disease, prenatal nutritional, dry period, difficult birth, body size and many behavioral factors (Arthington, 1999, Earley and Morin et al., 2001, Logan and Penhale, 1971).

In this study, differences between uniparous and multiparous 100 heads Holstein dairy cow colostrum qualities were evaluated.

2. MATERIALS AND METHODS

The animal material of this study was 100 head Holstein Cows and heifer. The cows were taken to the calving unit 1 week before calving and were kept together with calves in these unit 3 days period after birth. During this time, the calves drink their own mother's and the calves consume colostrum up to 6% of their live weight within 1 hour after birth and 10% of their live weight within 24 hours. The first three days of the calves kept in front of the mother's maternity pen and after the third day they are taken to individual calf hutches to the end of weaning period.

The colostrum quality was determined by using the relationship between colostrum gamma globulin content and colostrum density. The colostrometer is based on the relationship between the amount of Ig in the colostrum and the specific gravity. The colostrum obtained from each cow after birth was cooled to 20 ° C within the first 24 hours, then filled into its own measuring vessel and its specific weight was determined with a colostrometer. The classification of colostrum was based on the specific classification given in Table 1 (Kaygısız ve Köse, 2007).

Table 1. Classification of colostrum

Colostrum specific weight	Percent (%)
> 1.045 g / ml	Good quality
1.035-1.045 g / ml	Medium quality
<1.035 g / ml	Low quality

Colostrum samples were taken from the first milking. During the colostrum sampling cows milked manually and careful attention was given to the hygiene by the researchers. A 250 ml colostrum sample was taken from each cow. These samples were stored in deep freeze until analysis. It was thawed in a water bath at 38 ° C before analysis was performed and then prepared for analysis. The colostrum samples diluted with 25 ml of distilled water to determine the contents of KM, fat, protein, lactase, urea, casein, with MilkoScan FT120 (Foss) device. The colostrum quality variance analysis according to the lactation number, randomized experimental design was used and Duncan test was applied for the comparison of the averages.

3.RESULTS AND DISCUSSION

Results

The distribution of colostrum quality groups of colostrum samples is given in Table 2. The colostrum quality of heifer and cow is 1064±1,49 (1040-1075). It is understood that there is no sample poor quality colostrum sample class, grading 1035 g / mL or less. The number of samples in the medium colostrum quality (between 1035-1045 g / ml) constituted 12% of the total cows. The number of samples in the good colostrum quality (between 1055+ g / ml) constituted 88% of the total cows.

Table 2. The Distribution of Colostrum Densities, Frequency and Percent of the Groups

Colostrum specific weight	Percent (%)	Frequency
Good (> 1.045 g / ml)	88	60
Medium (1.035-1.045 g/ml)	12	40
Low quality (<1.035 g/ml)	0	0

The distribution of colostrum densities of heifer and cow groups is given in Table 2. Age of cows is an important factor affecting colostrum quality (Deung-Pocius and Larson, 1983). As older cows are exposed to more diseases and develop more antibodies to these diseases, the colostrum obtained from these cows contains more immunoglobulin (Morin et al. 2001). However, it should not be overlooked that the immune system may carry as much immune matter as the diseases it is exposed to from the structure of a cow. Cows may be a factor, but if not exposed to many diseases, the level of immunity may be low even for the elderly (Arthington, 1999, Earley and Fallon, 1999, Logan and Penhale, 1971).

Table 3. The Distribution of Colostrum Densities, Frequency and Ratio of the Groups

Colostrum specific weight	Heifer	Cow
Groups	1059,29±3,51	1066,11±1,47
Max	1075,00	1075,00
Min.	1040,00	1045,00
Median	1060,00	1065,00

In general, colostrum quality studies are done with colostrometer. However, colostrum contains more dry matter, fat and nonfat dry matter, protein and most importantly more immunoglobulin (Ig) than other milk (Selk, 2003; Waterman, 1998; Gulliksen, et al., 2008).

Discussion

In this study, the results obtained were higher than the values reported by Shearer et al. (1992) and lower than the results of Vaz et al. (2004). Shearer et al. (1992) reported that out of 79.8% of 2045 total colostrum samples were low quality, 13.5% were moderate quality and first lactation cows had a lower quality colostrum than the second lactation cows. Vaz et al. (2004) reported that 79.7% of colostrum samples were good quality, 14.9% had moderate quality, and 5.4% had low quality. Tyler et al. (1999) reported that the concentrations of cows in the third and more lactation were the highest at 97

mg / mL IgG, while the concentrations of colostrum in the first and second lactation cows were lower at 66 and 75 mg / mL, respectively. Rook and Campling (1965) reported that colostrum IgG concentrations of the first and second lactation cows were lower than those of the advanced lactation cows, using the first 4 milk colostrum samples of 87 cows. Gulliksen et al., (2008) reported that the colostrum quality of 1017 Norwegian red cows with fourth or further lactation has better colostrum quality results (Pritchett et al., 1991). Pritchett et al., (1991) report that the average IgG1 concentration of 919 Colostrum samples were 48.2 mg / ml but varies between 20 and 100 mg / ml.

According to the results of this study Holstein cows colostrum quality according to the order of lactation were found to be statistically significant in terms of colostrum quality. it is understood that using the quality of colostrum obtained in the establishment and using it in keeping the excess of high quality colostrum and especially feeding the pups of the first born or young animals will be an important advantage.

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Harmfull Diptera (Insecta) Species and Their Control Possibility on *Allium sativum* L. and *Allium cepa* Growing Areas In Turkey

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Abstract: Onion and garlic are the most common species of the *Allium* spp. and are produced at very high rate all over the world. The using of garlic in the world although varies from country to country generally garlic is used in various forms as spices, mashed potatoes, canned, dried garlic powder, garlic oil and garlic tablets. Onion is used as food material besides and is used in the field of health as healing. Onion has the chemical constituents which a positive impact on within cancer, cholesterol lowering agents and antioxidant properties such as Quercetin. The large using area of garlic and onion and the revealing the positive impact on human health by the results of research studies were caused increasing of their importance. Garlic and onion production occupies an important place between agricultural products of Turkey. Kastamonu is the most important city in term of garlic production with % 25,2 share. Almost all of the garlic produced in Kastamonu (85-90%) are grown in Taşköprü district. The yield loss caused by pests is the most important problem in production of *Allium sativum* and *Allium cepa*. In the absence of control measures, yield loss would be around 35% on average. The yield loss sometimes depending on the pest species and population density can reach about 100%. Insects are one of the most important pests of them. Insects cause largely the product and yield loss. These pests that cause damage to *A. sativum* and *A. cepa* shows a wide range of taxonomic categories. Diptera species are one of these harmful insects. In this study important species that their level of damage and economic importance are high were given information about their morphology, life cycle and damage types by examined studies conducted about the harmful Diptera species in garlic and onion cultivation areas in Turkey. So the harmful Diptera fauna of onion and garlic plants in Turkey was determined. In this study important species that their level of damage and economic importance are high were given information about their morphology, life cycle and damage types by examined studies conducted about the harmful Diptera species in garlic and onion cultivation areas in Turkey. So the harmful Diptera fauna of onion and garlic plants in Turkey was determined. When the studies that were realized in Turkey and the world, 22 mite species that belong to *Eumerus*, *Phytomyza*, *Merodon*, *Syricta* and *Suillia* genus were reported. *Delia antiqua* (Meigen), *Liriomyza trifolii* (Burgess), *Liriomyza sativae* (Blanchard), *Eumerus amoenus* (Loew), *Eumerus strigatus* (Fallén), *Eumerus tuberculatus* (Rond.), *Phytomyza gymnostoma* (Loew), *Merodon equestris* (Fabricius) and *Suillia lurida* (Meigen) are the important harmful species of these.

Keywords: *Allium sativum* L., *Allium cepa*, Acari, Garlic, Onion, Diptera, Turkey

1.INTRODUCTION

Onion and garlic are the most common species of the *Allium* spp. and are produced at very high rate all over the world. The using of garlic in the world although varies from country to country generally garlic is used in various forms as spices, mashed potatoes, canned, dried garlic powder, garlic oil and garlic tablets. Onion is used as food material besides and is used in the field of health as healing. Onion has the chemical constituents which a positive impact on within cancer, cholesterol lowering agents and antioxidant properties such as Quercetin. The large using area of garlic and onion and the revealing the positive impact on human health by the results of research studies were caused increasing of their importance. Garlic and onion production occupies an important place between agricultural products of Turkey. Kastamonu is the most important city in term of garlic production with % 25,2 share. Almost all of the garlic produced in Kastamonu (85-90%) are grown in Taşköprü district. *Allium cepa* L. is the most commonly produced and consumed plant species among, *Allium* species. Onion is used as a foodstuff and is used by itself because of its healing effect in the field of health. *Allium cepa* L. is produced China, America, Argentina, Russia, France, Turkey, Australia, Kazakhstan, Iran, Pakistan, India, Brazil, Peru, Mexico, Algeria, Libya and Egypt in the world (Kılıç *et al.* 2012).

In Turkey among agricultural productions garlic (*Allium sativum* L., Liliaceae) production takes an important place. In our country the most important city in terms of garlic production (% 25,2) is Kastamonu. Almost the total of the garlic produced in Kastamonu (%85-90) is raised in Taşköprü province. According to 2012 data in Taşköprü region garlic cultivation is made in total 18.500 ha area and total production is 16.650 tons and approximate yield is 900 kg/ha. ³/₄ part of Taşköprü province which has 3.500 families and 40.000 population is employed in garlic production. In Kastamonu city mainly Taşköprü garlic, T216 kinds of local garlic and even a little China garlic are grown (Koçak 2001).

Garlic, even it shows spread in almost every region of the world, being in the first place Mediterranean countries, develops very well in lands a little humid, slightly sandy in regions having temperate climate, besides grows in loamy and

argilliferous soils. The most important feature of this plant is it yields the best quality in soils rich in germanium and selenium. Consequently the most quality garlics in the world grow in Taşköprü plain. % 85 of the soil in Taşköprü region has a middle weight, permeable, loamy-argillifereous structure that garlic needs. Garlic favors transition regions whose spring passes tepid and humid. When considered from this point Kastamonu climate has optimum conditions for garlic agriculture. Rainfalls at the beginnings of february and march when the implementation of the garlic herb is made is enough for this herb's germination. In these precipitation conditions without the additional irrigation in Kastamonu garlic agriculture can be made. In this study especially Taşköprü garlic which is at the top of the most important and rich garlic varieties in our country and the World and the only territory this agricultural product is raised in has been chosen as the area of work (Kılıç and Yoldaş 2012).

In garlic and onion production diseases and pests play an important role, depending on these factors, yield penalties from %10 up to %50 may happen. In many studies made in the world and our country it is reported that mites cause important problems espeacially in onion, garlic and bulbous ornamental plants (Chen and Lo 1989, Madanlar and Önder 1996, Diaz *et al.* 2000, Straub 2004, Bayram and Çobanoğlu 2006, Göven *et al.* 2009, Kılıç 2010, Denizhan 2012, Kılıç *et al.* 2012).

The yield loss caused by pests is the most important problem in production of *Allium sativum* and *Allium cepa*. In the absence of control measures, yield loss would be around 35% on average. The yield loss sometimes depending on the pest species and population density can reach about 100%. Insects are one of the most important pests of them. Incests cause largely the product and yield loss. These pests that cause damage to *A. sativum* and *A. cepa* shows a wide range of taxonomic categories. Diptera species are one of these harmful insects. In this study important species that their level of damage and economic importance are high were given information about their morphology, life cycle and damage types by examined studies conducted about the harmful Diptera species in garlic and onion cultivation areas in Turkey. So the harmful Diptera fauna of onion and garlic plants in Turkey was determined.

2.MATERIALS AND METHODS

In this study important species that their level of damage and economic importance are high were given information about their morphology, life cycle and damage types by examined studies conducted about the harmful Diptera species in garlic and onion cultivation areas in Turkey. So the harmful Diptera fauna of onion and garlic plants in Turkey was determined.

3RESULTS AND DISCUSSION

In our country onion and garlic planting areas in the field of plant protection angle studies are few, especially the number of studies on garlic pests are not enough to be tried. Studies on insect species that cause damage in onion cultivation areas in our country are Bora ve Karaca (1970), Klimaszewski ve Lodos (1979), Lodos (1982), Tunç (1985), Tunç (1990), Tunç, (1998), Yıldırım ve Hoy (2003), Atakan (2008), Anlaş (2009), Kılıç (2010) ve Kılıç vd. (2012).

The living organisms that are damaged in *A. sativum* and *A. cepa* plants show a very wide taxonomic distribution. When the studies that were realized in Turkey and the world, 22 Diptera species that belong to *Eumerus*, *Phytomyza*, *Merodon*, *Syrirta* and *Suillia* genus were reported. *Delia antiqua* (Meigen), *Liriomyza trifolii* (Burgess), *Liriomyza sativae* (Blanchard), *Eumerus amoenus* (Loew), *Eumerus strigatus* (Fallén), *Eumerus tuberculatus* (Rond.), *Phytomyza gymnostoma* (Loew), *Merodon equestris* (Fabricius) and *Suillia lurida* (Meigen) are the important harmful species of these.

In our country plant protection studies in onion and garlic planting areas are few. *Delia antiqua* (Meigen), one of the most important pests of onion cultivation areas, has been reported in Adana and Kahramanmaraş by Yabaş (1984) for the first time in our country.

In this part of the study, detailed information was given about morphology, life cycles and fighting with harmful forms of the important species with high levels of damage and economic importance. The names of the species that are not important to damage are listed (Table 1.)

Table 1. The list of harmful species that were damaged on garlic and onion

Common Species on Onion and Garlic
<i>Delia antiqua</i> Meigen, 1826 (Diptera: Anthomyiidae)
<i>Eumerus</i> spp. (Diptera: Syrphidae)
<i>Merodon equestris</i> Fabricius, 1794 (Diptera: Syrphidae)
<i>Liriomyza</i> spp. (Diptera: Agromyzidae)
<i>Phytomyza gymnostoma</i> Loew, 1858 (Diptera: Agromyzidae)
<i>Suillia lurida</i> Meigen, 1830 (Diptera: Heleomyzidae)
<i>Syrpita pipiens</i> Linnaeus, 1758 (Diptera: Syrphidae)
Harmfull Species on <i>Allium cepa</i> L.
<i>Ceroxys latiusculus</i> Oliver, 1873 (Diptera: Ulidiidae)
<i>Chromatomyia horticola</i> Goureau, 1851 (Diptera: Agromyzidae)
<i>Lonchaea chorea</i> Fabricius, 1781 (Diptera: Lonchaeidae)
<i>Euxesta anna</i> Harriot, 1942 (Diptera: Ulidiidae)
<i>Euxesta notata</i> Wiedemann, 1830 (Diptera: Ulidiidae)
<i>Phytomyza horticola</i> Goureau, 1851 (Diptera: Agromyzidae)
<i>Tritoxa flexa</i> Wiedemann, 1830 (Diptera: Ulidiidae)

***Delia antiqua* (Meigen), 1826 (Diptera: Anthomyiidae)**

Their bodies are 6-7 mm long. The body color is ash, and it looks like a home fly in appearance, but it is smaller than it. The legs are black, the wings are transparent, and the adjacent eyes are brown in color. The larva is white in color and in worm form (Harris and Miller 1988) (Fig. 1).



Figure 1. Adult and larvae of *D. antiqua*

It's hosts are onion, garlic and leek (Fig 2).

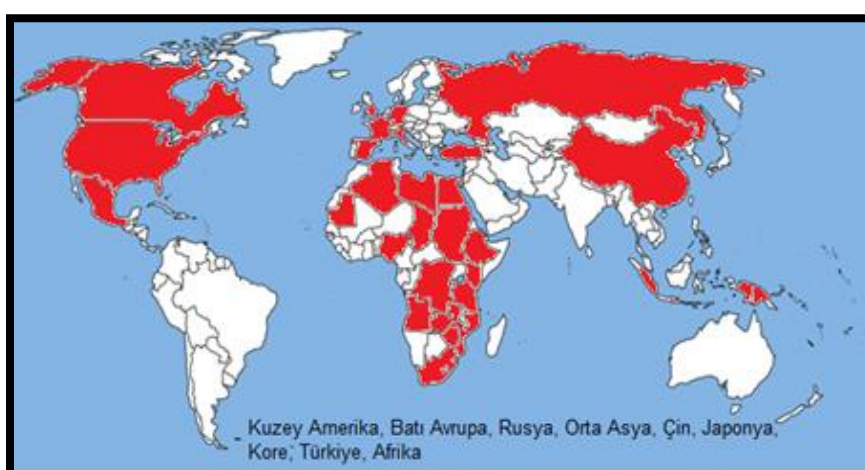


Figure 2. Geographical Distribution and of *D. antiqua* (<http://www.onions-potatoes.com/>, 2017)

The larval stage is 15-20 days. Maturing larvae become pupa in soil near onion. The duration of the pupa is 10 - 15 days. Adult flights take place between August and October. Necrosis and curling on the leaves. Causes blackness and decay on the head (Eckenrode ve Nyrop, 1995) (Fig 3).



Figure 3. Damage of *D. antiqua* on onion (<http://ipmworld.umn.edu/>, 2017)

***Eumerus* spp. (Diptera:Syrphidae)**

It looks like a bee. Body length is 4-6 mm. Head, thorax and abdomen are blackish yellow color, larva is white color (Fig 4).



Figure 4. Adult of *Eumerus* spp. (<http://www.udec.ru/vrediteli/zhurchalka.php>, 2017)

It makes 4 generations per year. Life cycle is about 39 days. These genus-related species are secondary harmful. The damage to plants that are infected by root nematodes, such as root fungi or *Ditylenchus dipsaci* (Kühn) is more harmful. On the head of the onion, deterioration, softening and decay are seen. Product loss in global onion planting areas is 10-15% (Nestel *et al.* 1994) (Fig 5). Zümreoğlu and Erakay (1978) reported the damage of *Eumerus* spp. species.



Figure 5.

of *Eumerus* spp. on onion (<http://www.donsgarden.co.uk/pests/>, 2017)

The damage

The most important species of *Eumerus* spp. that causing damage in onion and garlic planting areas are *Eumerus amoenus* (Loew), *Eumerus strigatus* (Fallén) and *Eumerus tuberculatus* (Rond.) (Fig 6).

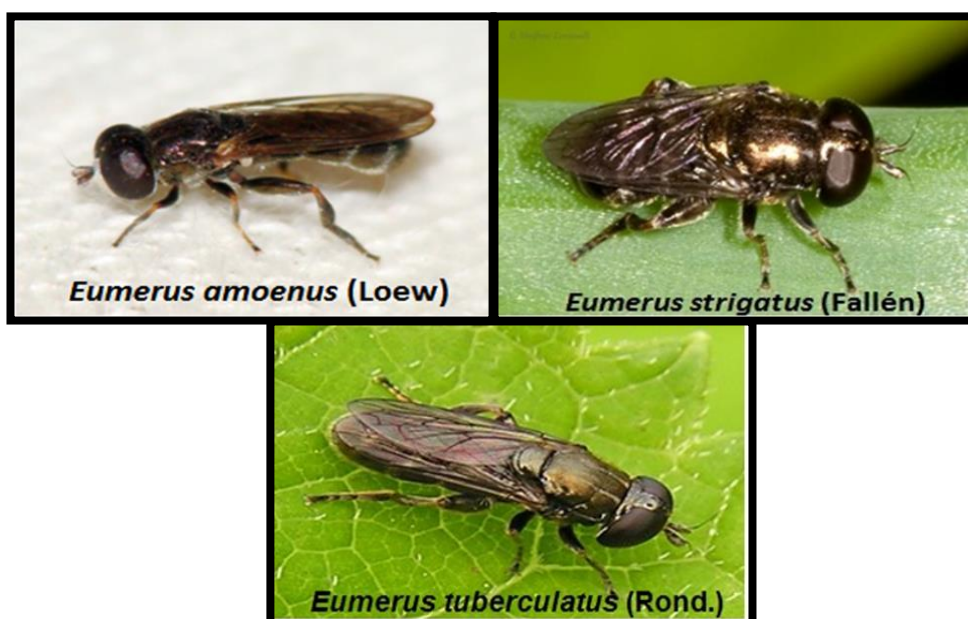


Figure 6. Adults of *Eumerus amoenus* (Loew), *Eumerus strigatus* (Fallén) and *Eumerus tuberculatus* (Rond.) (http://diptera.info/forum/viewthread.php?thread_id=38569, 2017)

***Liriomyza* spp. (Diptera: Agromyzidae)**

The body is black-yellow. Eyes large. Wing length 1,3-1,7 mm. Larva is greenish and transparent (Yabaş *et al.* 1995) (Fig 7).



Figure 7. Adult and larvae of *Liriomyza* spp. (<http://cals.arizona.edu/>, 2017)

Yabas *et al.* (1995) determined *Liriomyza* spp. species in onion and garlic pests for the first time in Mersin. *Liriomyza* spp. is a cosmopolitan genus (Fig 8).



Fig 8. Distribution of *Liriomyza* spp. (<http://keys.lucidcentral.org/>, 2016)

They are polyphagous. An adult female can lay 700 eggs. Life cycle also completes 15-21 days. Formation of white-yellow spots on leaves, deformation in leaves and hairs (Fig 9) (Rauf *et al.* 2000).

Fighting with Harmfull Diptera Species

Yellow sticky traps against onion gal flies. For the *Delia antiqua*, the soil is planted before sowing, plant spraying against seeds and adults during sowing.



Figure 9. The damage of *Liriomyza* spp. on garlic and onion (<http://sjefgardentips.wordpress.com/>, 2018)

Onion and garlic are important agricultural products that provide high economic input for the country farming. The most important problem in the production of *Allium sativum* L. and *Allium cepa* L. are the losses that occur due to the harmful. The product loss is around 35% on average if no necessary struggle is done with them. This lost culture can sometimes reach 100% depending on the type and intensity of the harmful plant.

Nematodes, mites and various insect species are harmful in garlic and onion cultivation areas. Approximately 200 major pests were determined in both plants. On the other hand, the number of studies made in this area in our country is very small.

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Characterization of Naturally Grown *Festuca* Species for Forage Purposes

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Abstract: This study aimed at examining forage quality and yield of 130 *Festuca arundinacea* Schreber, 217 *Festuca ovina* L., 46 *Festuca pratensis* Huds and 77 *Festuca rubra* L. collected from Turkey. The materials were collected as whole plant or seed from 18 locations in 2014. Each material was planted at 50 x 50 cm (as seedling or clone) to application field of Agriculture Faculty of Selçuk University in 2015. The plants were observed in forage yield visually as 1-9 scale at the pre-flowering stage and then harvested. The harvested plants were investigated in ADF, NDF, Ca, Mg, K and P ratio using NIRS. Forage yield was averaged as 3.25 in *F. arundinacea*, 2.37 in *F. pratensis*, 2.35 in *F. ovina* and 2.13 in *F. rubra*. Crude protein content of the species was follows; *F. rubra* (15.83 %), *F. ovina* (15.38 %), *F. arundinacea* (15.04 %) and *F. pratensis* (14.57 %). While the average ADF content was ranked as *F. rubra* (32.29 %), *F. ovina* (33.43 %), *F. arundinacea* (33.45 %) and *F. pratensis* (34.16 %) with very close variation. Average NDF content was ranked as *F. rubra* (63.17 %), *F. arundinacea* (64.59 %), *F. ovina* (65.80 %) and *F. pratensis* (66.31 %) among the species. In terms of nutritional content, intra-species variation was higher than inter-species variation. This indicates that yield can be effective feature for material selection especially inter-species level. As a result, each species has promising genotypes that can be improved as forage with, high forage yield, high protein and nutrient content.

Keywords: ADF, *Festuca*, forage, NDF, protein.

1. INTRODUCTION

Festuca L. which have the use as forage production, silage and pastures crops is a natural resource commonly found in Turkey. Furthermore, Fescue which can grow in every continent except Antarctica, is a cosmopolitan plant. Fescues grazing lovely by animals are high its forage yield, quality and delicious. *Festuca* L. can easily compete with other plants and can be used frequently in erosion control programs. *Festuca* has over 300 species. Especially, *F. arundinacea* Schreb. has been use in land reclamation work since 1930. Although *F. arundinacea* Schreb. has medium the forage quality, it is one of the highest yielding forage crops when grown in suitable conditions. One of the *Festuca* species which is *F. pratensis* Huds. is a good pasture plant with a high forage quality as well as use the turfgrass. *F. rubra* L. used in green areas in airports, playgrounds, and the installation of green areas in sloping places rather than the pasture and turfgrass. In addition to all these features in their, *Festuca* is one of the important plant groups in terms of sustainable agriculture. In Turkey, 52 species and sub-species of *Festuca* are grown in naturally (Güner, 2012). So that Turkey natural flora is rich in the variety of *Festuca* species in order to develop varieties and has a great genetic potential in terms of breeding forage crops. The selection of domestic genotypes will be improved both for animal feeding purposes and for the development of varieties resistant to diseases and pests with high yield and quality. This development will prolong the degradation process of pastures and increase the production of quality and delicious feed. In addition, developing new varieties will provide added value to our country by decreasing the cost of seeds as well as reducing the amount of foreign currency spent abroad.

Fescue breeding studies are carried out with two aims as forage type and turf type. In forage type breeding studies, plants with high forage yield and protein, low ADF and NDF content are preferred (Frame, 1994; Hannaway et. al., 1999; Van Huylensbroeck, 1999; Connolly, 2001; Arslan ve Çakmakçı, 2004; Orr et. al., 2004; Morris, 2005; Simit ve et. al., 2005a; Simit ve et. al., 2005b). The crude protein, ADF, NDF and forage yield of *Festuca arundinacea* has determined by Macadam et al., (1997), Costa ve ark. (2003) and Karakoç ve Avcioğlu (1997) 13.9 -17.8%, 29.0-33.0%, 43-53.9% and 1266.5 – 1642.4 kg da⁻¹ respectively. Kratovalieva ve et. al., (2012) have reported that the crude protein content of *F. pratensis* is 8.63-14.60%. Koukoura et al. (2003) said that *F. ovina* had Ca content of 2.2 mg g⁻¹, K content of 2.6 mg g⁻¹ and P content of 0.6 mg g⁻¹. Moreover, the forage yield determined that *F. rubra* is between 241.9 - 656.7 kg da⁻¹ (Zorer Çelebi et al., 2011), and *F. ovina* is between 106.05 - 671.73 g m⁻² (Gül, 2015). The American Forage and Grassland Council (2009) classified the forages as 31% - 35% very good, 36% - 40% good, 41% - 42% medium, and 43 - 45% bad according to ADF content. According to NDF content, forages are classified as 41 – 46% very good, 47 – 53% good, 54 – 60% medium and 61 – 65% bad.

In this study was conducted in order to determination of the use as forage crops of *F. arundinacea*, *F. ovina*, *F. pratensis* ve *F. rubra* genotypes collected from the natural flora of Turkey. As a result of the evaluation of the obtained data, superior genotypes have been determined and these genotypes will make significant contributions to future breeding studies.

2.MATERIALS AND METHODS

In this study was used 130 *Festuca arundinacea* Schreber, 217 *Festuca ovina* L., 46 *Festuca pratensis* Huds and 77 *Festuca rubra* L. genotypes which were collected with TÜBİTAK 113O919 project in 2014 (Table 1).

Table 1. Collection, Collection Area and Number of *Festuca* L. genotypes ait toplanmış materyallerin toplama yeri, enlem boylam yükselti içerikleri ve adetleri

Name	Collection	Collection Area	Number
<i>F.arundinacea</i>	Plant	Bolu-Kartaltepe	10
<i>F.arundinacea</i>	Seed	Konya- Urban forest	25
<i>F.arundinacea</i>	Plant	Antalya-Korkuteli/Çobanisa	6
<i>F.arundinacea</i>	Seed	Eskişehir-Mihalıççık	6
<i>F.arundinacea</i>	Plant	Bursa-Uludağ 20km	7
<i>F.arundinacea</i>	Seed	Kocaeli-Derbente 4km	7
<i>F.arundinacea</i>	Seed	Kastamonu- Ilgaz 3km	8
<i>F.arundinacea</i>	Plant	Adana-Aladağ	2
<i>F.arundinacea</i>	Plant	Mersin-Tarsus, Çamalan Çamlıyayla	2
<i>F.arundinacea</i>	Plant	Konya-Akşehir, Eber Gölü	6
<i>F.arundinacea</i>	Seed	Yozgat	2
<i>F.arundinacea</i>	Plant	Osmaniye-Kadirli/Karatepe	2
<i>F.arundinacea</i>	Plant	Antalya-Korkuteli/Çobanisa	4
<i>F.arundinacea</i>	Plant	Konya-Akşehir, Eber	12
<i>F.arundinacea</i>	Plant	Eskişehir-Alpu'dan Mihalıççık 25km	1
<i>F.arundinacea</i>	Plant	Eskişehir-Mihalıççık	5
<i>F.arundinacea</i>	Seed	Ankara-Kızılcahamam 50km	6
<i>F.arundinacea</i>	Plant	Adana-Aladağ ilçesi	2
<i>F.arundinacea</i>	Plant	Bolu-Kartaltepe	4
<i>F.arundinacea</i>	Plant	Adana-Pozantı, Gülek	3
<i>F.arundinacea</i>	Plant	Adana-Pozantı Akçatekir	3
<i>F.arundinacea</i>	Plant	Antalya-İbradı 10km	2
<i>F.arundinacea</i>	Plant	Antalya-Korkuteli (30km)	1
<i>F.arundinacea</i>	Plant	Antalya-Akseki / Aksekiye 10 km	4
Total			130
<i>F.ovina</i>	Plant	Osmaniye-Kadirli	1
<i>F.ovina</i>	Plant	Alanya-Çukuryurt	11
<i>F.ovina</i>	Seed	Yozgat	2
<i>F.ovina</i>	Seed	Ankara-ızılcahamam 50km	5
<i>F.ovina</i>	Seed	Kayseri- Erciyes'e 10km	13
<i>F.ovina</i>	Seed	Konya-Kızılören Sefaköy	1
<i>F.ovina</i>	Plant	Antalya-Akseki / aksekiye 10 km	18
<i>F.ovina</i>	Seed	Ankara-Kızılcahamam-Gerede 20km	4
<i>F.ovina</i>	Seed	Kayseri-Erciyes'e 10km	7
<i>F.ovina</i>	Seed	Konya-Başarakavak	3
<i>F.ovina</i>	Plant	Adana-Kadirli/Karatepe	1
<i>F.ovina</i>	Plant	Osmaniye	1
<i>F.ovina</i>	Plant	Adana-Karaisalıdan Çatalan 10km	2
<i>F.ovina</i>	Plant	Antalya-Akseki / Aksekiye 10 km	1
<i>F.ovina</i>	Plant	Antalya-Korkuteli 30km	1
<i>F.ovina</i>	Plant	Antalya-Korkuteli/Çobanisa	6
<i>F.ovina</i>	Plant	Antalya-Korkuteli 10km	4
<i>F.ovina</i>	Plant	Konya-Seydişehir, Tınaztepe	5
<i>F.ovina</i>	Plant	Konya-Kent Ormanı	14
<i>F.ovina</i>	Plant	Konya-Kızılören	19
<i>F.ovina</i>	Seed	Eskişehir-Mihalıççık	1
<i>F.ovina</i>	Plant	Yozgat	8
<i>F.ovina</i>	Seed	Ankara-Kızılcahamam, Gerede 20km	8
<i>F.ovina</i>	Seed	Konya-Kızılören, Sefaköy	3
<i>F.ovina</i>	Seed	Kocaeli-Derbente 4km	11
<i>F.ovina</i>	Seed	Konya-Başarakavak	4

<i>F.ovina</i>	Seed	Konya-Meram Dere	4
<i>F.ovina</i>	Seed	Kastamonu- Ilgaz'a	4
<i>F.ovina</i>	Plant	Bursa-Uludağ	10
<i>F.ovina</i>	Plant	Antalya-Akseki	1
<i>F.ovina</i>	Plant	Alanya- 99km	29
<i>F.ovina</i>	Seed	Yozgat	2
<i>F.ovina</i>	Seed	Yozgat- Çamlık	1
<i>F.ovina</i>	Seed	Konya-Meram Dere	3
<i>F.ovina</i>	Seed	Kastamonu-Ilgaz 3km	4
<i>F.ovina</i>	Seed	Yozgat	4
<i>F.ovina</i>	Plant	Adana-Kadirli Karatepe/Aslantaş	1
Total			217
<i>F.pratensis</i>	Plant	Sivas 10km	3
<i>F.pratensis</i>	Plant	Gümüşhane-Maçka 30-40 km	9
<i>F.pratensis</i>	Plant	Erzincan-Refahiye 10km	3
<i>F.pratensis</i>	Seed	Yozgat	6
<i>F.pratensis</i>	Plant	Bursa-Uludağ	1
<i>F.pratensis</i>	Seed	Yozgat-Çamlık	2
<i>F.pratensis</i>	Seed	Yozgat-Çulhalı 5km	11
<i>F.pratensis</i>	Plant	Bolu-Kartaltepe zirvesi	1
<i>F.pratensis</i>	Seed	Konya- Cevizli	10
Total			46
<i>F.rubra</i>	Seed	Kastamonu-Ilgaz 3km	8
<i>F.rubra</i>	Plant	Bursa-Uludağ 20km	6
<i>F.rubra</i>	Plant	Bursa-Uludağ	11
<i>F.rubra</i>	Plant	Alanya 75km	1
<i>F.rubra</i>	Plant	Sivas 10km	9
<i>F.rubra</i>	Seed	Konya-Beyşehir yolu	1
<i>F.rubra</i>	Seed	Kocaeli-Derbente 4km	8
<i>F.rubra</i>	Seed	Konya-Taşkent	7
<i>F.rubra</i>	Seed	Karabük-Kastamonu	2
<i>F.rubra</i>	Seed	Konya-Seydişehir-Tınaztepe	1
<i>F.rubra</i>	Seed	Yozgat	10
<i>F.rubra</i>	Plant	Konya-Akşehir Eber Gölü	8
<i>F.rubra</i>	Seed	Yozgat-Çamlık	5
Total			77
Overall Total			470

The collected materials were grown in Field Crops Applied Greenhouse, Faculty of Agriculture, SÜ. Genotypes with enough growth have been established by experimenting with 50 x 50 cm intervals in July-August 2015 as seedlings. Genotypes with enough growth have been planted as seedlings with 50 x 50 cm intervals in July-August 2015. During the cultivation period, normal maintenance techniques such as weed control, irrigation and fertilization were applied. In 2016, when the plants came to the beginning of flowering period, the fresh hay yield was determined for each genotype by using the 1 - 9 scale (1 = lowest, 5 = moderate, 9 = highest (forage type)). Samples from each genotype were taken and plant samples were dried 65 °C until constant weight. Her genotipten yeşil örnek alınarak 60 °C'de sabit ağırlığa gelene kadar kurutma dolabında (etüv) kurutulmuştur. After the dried samples were ground, Crude Protein (CP), Acid Detergent Fiber (ADF), Neutral Detergent Fiber (NDF), Ca, K, Mg and P content of hay were determined by using Near Reflectance Spectroscopy (NIRS, 'Foss 6500') with software package program 'IC-0904FE' (Mut, 2003). The results of all these observations and measurements were evaluated by creating tables which include average, minimum, maximum, standard deviation and coefficients of variation in each species.

3.RESULTS AND DISCUSSIONS

Festuca arundinacea Schreber

In 2015-2016, table 2 shows the means, minimum, maksimum, standard deviation (SD) ve coefficient of variation (CV) of some features in *Festuca arundinacea* SCHREBER genotypes collected from nature.

Table 2. Means, minimum, maksimum, standard deviation (SD) ve coefficient of variation (CV) of some features in *Festuca arundinacea* SCHREBER genotypes

Features	N	Means	Min.	Max.	SD	CV (%)
Fresh hay yield (1-9 scale)	130	3.25	1.00	9.00	2.06	63.38
Crude protein (%)	80	15.04	9.99	21.13	3.06	20.32
ADF (%)	80	33.45	25.36	40.96	4.11	12.28
NDF (%)	80	64.59	46.43	76.44	6.78	10.50
Ca (%)	80	0.48	0.29	0.77	0.11	23.00
K (%)	80	3.84	2.94	3.99	0.42	11.01
Mg (%)	80	0.15	0.02	0.26	0.07	50.30
P (%)	80	0.38	0.29	0.48	0.07	17.49

Tall fescue genotypes had the highest average (3.25) among other species according to the yield of green grass. In terms of crude protein ratio, 80 tall fescue genotype changes between 9.99 - 21.13% and average value is 15.04%. The ADF and NDF content which analyzed to determine the degree of digestibility of the species have been determined to changes between 25.36 – 40.90%, 46.43 – 76.44% and have average 33.45% ve 64.59% respectively (Table 2).

Ca, K, Mg and P contents of 80 tall fescue were investigated in terms of nutrient contents. The mean values of calcium and potassium were 0.48% and 3.84%, and the range of variation was 0.29 - 0.77% and 2.94 - 3.99%, respectively. The mean values of magnesium and phosphorus contents were 0.15% and 0.38%, and the range of variation was 0.02% - 0.26% and 0.29 - 0.48%, respectively (Table 2).

***Festuca ovina* L.**

In 2015-2016, table 3 shows the means, minimum, maksimum, standard deviation (SD) ve coefficient of variation (CV) of some features in *Festuca ovina* L. genotypes collected from nature.

Table 3. Means, minimum, maksimum, standard deviation (SD) ve coefficient of variation (CV) of some features in *Festuca ovina* Lam. genotypes

Features	N	Means	Min.	Max.	SD	CV (%)
Fresh hay yield (1-9 scale)	217	2.35	1.00	6.00	2.10	89.43
Crude protein (%)	163	15.38	9.98	19.94	2.14	13.91
ADF (%)	163	33.43	25.32	44.72	3.95	11.81
NDF (%)	163	65.80	52.14	81.32	6.01	9.14
Ca (%)	163	0.51	0.30	0.80	0.11	21.87
K (%)	163	3.73	2.85	4.34	0.44	11.70
Mg (%)	163	0.13	0.02	0.28	0.05	39.64
P (%)	163	0.39	0.29	0.48	0.04	10.44

Fresh hay yield of the sheep fescue were observed in 217 plants but crude protein, ADF, NDF and nutrient contents were measured in 163 genotypes which have adequate sample for analysis. Fresh hay yield of sheep fescue has been low with 2.35. The sheep fescue had the smallest 9.98% and the largest 19.94% protein and had an average crude protein of 15.38%. (Table 3). ADF and NDF content of their also ranged from 25.32% to 44.72% and 52.14% to 81.32%, and the average was 33.43% and 65.80%, respectively. The mean values of the Ca, K, Mg and P contents of the species in terms of nutrient contents were 0.51%, 3.73%, % 0.13% and 0.39%, respectively.

***Festuca pratensis* Huds**

In 2015-2016, table 4 shows the means, minimum, maksimum, standard deviation (SD) ve coefficient of variation (CV) of some features in *Festuca pratensis* Huds genotypes collected from nature.

Table 4. Means, minimum, maksimum, standard deviation (SD) ve coefficient of variation (CV) of some features in *Festuca pratensis* Huds genotypes

Features	N	Means	Min.	Max.	SD	CV (%)
Fresh hay yield (1-9 scale)	46	2.37	1.00	8.00	2.02	85.04
Crude protein (%)	29	14.57	11.50	18.54	1.88	12.93
ADF (%)	29	34.16	26.40	41.34	3.34	9.77
NDF (%)	29	66.31	53.64	78.26	5.41	8.15
Ca (%)	29	0.46	0.30	0.70	0.09	19.05
K (%)	29	3.72	2.88	4.63	0.44	11.86
Mg (%)	29	0.13	0.02	0.21	0.05	36.62
P (%)	29	0.39	0.31	0.49	0.04	10.43

Fresh hay yield of 46 meadow fescue has been visually 2.37 (1-9 scale). The average crude protein, ADF and NDF value of the species were respectively 14.57%, 34.16% and 66.31%.

The mean values of calcium and potassium in meadow fescue genotypes were 0.46% and 3.72%, and the range of change was 0.30 - 0.70% and 2.88 - 4.63%, respectively. The mean values of magnesium and phosphorus contents were 0.13% and 0.39%, respectively, and the range of changes was 0.02 - 0.21% and 0.31 - 0.49%, respectively (Table 4).

***Festuca rubra* L. pseudorivularis Mark. Dan**

In 2015-2016, table 5 shows the means, minimum, maksimum, standard deviation (SD) ve coefficient of variation (CV) of some features in *Festuca rubra* L. pseudorivularis Mark. Dan genotypes collected from nature.

Table 5. Means, minimum, maksimum, standard deviation (SD) ve coefficient of variation (CV) of some features in *Festuca rubra* L. pseudorivularis Mark. Dan genotypes

Features	N	Means	Min.	Max.	SD	CV (%)
Fresh hay yield (1-9 scale)	77	2.13	1.00	7.00	1.99	93.39
Crude protein (%)	61	15.83	9.98	21.58	2.88	18.20
ADF (%)	61	32.29	25.60	46.45	4.68	14.51
NDF (%)	61	63.17	49.69	81.32	7.14	11.30
Ca (%)	61	0.50	0.30	0.90	0.12	24.29
K (%)	61	3.90	2.58	4.61	0.52	13.27
Mg (%)	61	0.15	0.02	0.31	0.06	40.90
P (%)	61	0.41	0.29	0.47	0.04	9.78

Although red fescue has a change range of 1.00 - 7.00 in terms of fresh hay yield, it was observed as the lowest average (2.13) compared to other species. As a result of the analysis, the crude protein of the red fescue genotypes was 15.83% and was changed 9.98 - 21.58%. Intra-species average ADF content was determined to be the most easily digested species among other species with 32.29%. When the NDF contents of the genotypes were examined, it was found that the mean values was 63.17% and the range of variation was 49.69 - 81.32%. As indicated in Table 5, the mean value Ca, K, Mg and P content of the species were 0.50%, 3.90%, 0.15% and 0.41%.

The high coefficient of variation in all types of green grass yield will allow for the diversity of genotypes and the easier selection of the desired plant during selection. *F. rubra*, which has the lowest ADF and NDF ratio and the highest protein ratio, has a great advantage in the use of fodder plant and has the disadvantage that it is the lowest species. According to AFGC, (2009), all species in the classification of ADF content in good quality roughage (% 31 - 35) class is included in the best, while in the NDF classification of *F. arundinacea* and *F. rubra* species were bad (61 - 65%) class, *F. ovina* and *F. pratensis* were very bad (> 65%). Studies of some researchers (Macadam et al., 1997; Costa et al., 2003; Karakoç and Avcioğlu, 1997; Kratovalieva et al., 2012; Koukoura et al., 2003; Zorer Çelebi et al., 2011 and Gül, 2015) on *Festuca* genus with the result in the research are similar and there are minor differences. These differences are due to natural resources, and the aquaculture and environmental conditions of materials used in the study.

Some researchers emphasized that it should be at least 0.3% Ca, 0.1% Mg, 0.20 - 11.0% K and 0.05% - 0.43% P in quality roughage (Kidambi et al. 1989 and Kaçar 1972). As a result of the study, the nutritional contents are mostly included in the quality roughage values specified by the researchers. However, some species are excluded from these values and this is thought to be caused by genetic and environmental factors.

As a result, each species has genotypes that can produce high quality forage with high digestibility, fresh hay yield, protein and nutrient content. Based on these characteristics, 49 genotypes of the genus *Festuca* L. were selected for use as material in future breeding studies. It is thought that the results obtained from this study will provide significant contribution to future characterization, selection and breeding studies. Bu çalışmadan elde edilen verilerin ileride yapılacak karakterizasyon, seleksiyon ve ıslah çalışmalarına önemli katkılar sağlayacağı düşünülmektedir.

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Effect on Hay Quality of Seed Ratios in Different Forage Crops Mixes

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Abstract: Common vetch (*Vicia sativa* L.) and forage pea (*Pisum sativum* spp. *arvense* L.) which are lodged legume species are generally intercropped with cereals under different seed ratio to increase yield and quality of hay. This research was conducted to determine forage quality of the different legume (common vetch “*Vicia sativa* L.”, fodder pea “*Pisum sativum* spp. *arvense* L.”) – cereal (barley “*Hordeum vulgare* L.”, oat “*Avena sativa* L.”) binary mixtures with different seed ratio under Çekerek ecological conditions (Yozgat - Turkey) during the 2012 and 2013 growing seasons. Fodder pea (Taskent), common vetch (Segmen), oat (Checota) and barley (Karatay-94) were used as a plant material. The experiment was arranged in randomized block design with three replications. The mixtures were harvested base on the cereals when they were at milk dough stage. Then each treatment separated as legume and cereal and, samples were dried at 70 °C to constant weight. After samples were milled chemical analyses were performed by NIRS. The significant differences were determined among cropping treatments in terms of crude protein ratio, Calcium, Potassium, Phosphorus and Magnesium contents. According to two years results crude protein ratio, Calcium, Potassium, Phosphorus and Magnesium content were 17.57 %, 1.13 %, 2.09 %, 0.33 % and 0.27 % respectively. Consequently, considering crude protein ratio, calcium, potassium, phosphorus and magnesium content 20 % oat:80 % fodder pea and 30 % barley:70 % fodder pea mixtures exhibited higher results, in our conditions. Furthermore, it has been identified by suitable for similar ecologies and Yozgat of these mixture and seeding ratio.

Keywords: Common vetch, crude protein ratio, intercropping, fodder pea, oat.

1.INTRODUCTION

Although Turkey has a great potential of animal wealth and productions, majority of people cannot reach animal product due to low productivity and high price. The main reason of this situation is high prices and insufficiency of inputs in the animal production sector. Forages are the most important input of animal production and effects quality and quantity of animal products (Karaca, 2001). Feeding cost constitutes 70% of animal production cost, therefore, procurement of forages is a crucial factors for profitable production in animal farms (Sabancı et al., 2010). (Alçiçek, 1995; Bilgen et al., 1996). Forages can be cultivated or naturally grow in meadow and pasture. Forage crops are very prominent due to being a cheap source, containing necessary nutritions for animal gastro microflora, having minerals and vitamins, leading increase in animal fecundity and providing high quality animal production.

Forage crops can be grown as intercrop and used for green herbage, hay, also pasture and silage (Doğan, 2010). In intercropping systems, seed ratio is crucial factor for yield and quality. Same times intercropping increase hay yield but its decreases crude protein (Uzun ve Asık, 2009). Eğritas and Onal asçı (2015) found that Ca, Mg, K and P contents in common vetch+cereal mixtures were 0.37-4.45, 0.14- 0.51, 0.38-1.44 and 0.29-0.61%, respectively, Kaya (2012) stated that the highest protein ratio of cereal-legume intercropping was found in 75% forage pea +25% barley. Kocer (2011) reported that high quality hay should contain 65% pea and %35 oat and barley and, Dogan (2010) stated that crude protein content of forage pea x barley intercropping was 6.56 – 14.5%.

In the present study, legume X grass intercrops with different seed ratio were investigated for hay quality.

2.MATERIALS AND METHODS

In the study, Taşkent (forage pea), Seğmen (common vetch), Checota (oat) and Karatay-94 (barley) varieties were used. In 2012 and 2013, the study was conducted in Çekerek, Yozgat. According to the soil analysis results of the experiment field, the soil was loamy structure, mild alkaline, mild calcareous, phosphorus content was low in first year and less in second year, potassium content was high and organic matter was low. During vegetation period of plants in 2012, rainfall in March, April, May and June was respectively 60.7, 38.3, 106.5 and 25.3 mm, and was totally 230.8 mm. In second year of the experiment, rainfall was 54.2, 35.9, 22.0 and 35.6 mm, respectively and totally 144.7 mm. Rainfall of the both season was lower than the previous seasons. Mean temperature of experiment season was -0.2, 11.4, 13.8, 18.5 °C and 5.3, 9.9, 16.3, 18.2 °C, respectively. In 2012, below 0 °C in March caused delayed in germination. However, the temperatures of other months was higher than previous seasons and that situation leaded positive effects on plant growth. Mean temperatures of both experiment seasons (10.9 and 12.4 °C) were higher than previous seasons (10.4°C). Relative humilities in March, April, May and June were 71.9, 50.1, 62.1 ve 53.0%, respectively in 2012 and 63.8, 61.3, 47.8 ve 46.1, respectively in 2013.

The experiment was conducted with following a randomized plot design involving three replications. Every plot was 5 m length and sowing took place in 6 space rows with 20 cm spacing. Plot area was 6 m², spacing between plots and blocks was 1 m, 1 block area was 215 m² and total experiment area was 731 m². Seeds were sown at a seeding density of 12 kg/da for forage pea and common vetch, 20 kg/da for oat and 25 kg/da for barley. 20 experiment designs were performed in the study as shown in Table 1.

Table 1. Experimental designs

1	Barley (B)	11	O (%30) + CV (%70)
2	Oat (O)	12	O (%30) + FP (%70)
3	Common vetch (CV)	13	B (%40) + CV (%60)
4	Forage pea (FP)	14	B (%40) + FP (%60)
5	B (%20) + CV (%80)	15	O (%40) + CV (%60)
6	B (%20) + FP (%80)	16	O (%40) + FP (%60)
7	O (%20) + CV (%80)	17	B (%50) + CV (%50)
8	O (%20) + FP (%80)	18	B (%50) + FP (%50)
9	B (%30) + CV (%70)	19	O (%50) + CV (%50)
10	B (%30) + FP (%70)	20	O (%50) + FP (%50)

Seeds were sown by hand with one row cereal and one row legume on 9 March 2012 and 15 March 2013. According to soil analysis, 4 kg N and 6 kg P fertilizer were applied during sowing. Legumes were harvested by hand at 50% bloom, on 8 June 2012 and 14 June 2013. For analysis of crude protein and nutrition values, samples were dried at 60 °C, weighed and ground with a miller. Crude protein, Ca, Mg, P and K ratios (%) were determined with Near Infrared Reflectance Spectroscopy (NIRS) (Foss 6500) with IC – 0904FE calibration program (Mut, 2003).

The statistical analyses were performed with the statistical software package SPSS, version 11.0 (SPSS, 2002). Data were separated by the Duncan's test (Açıkgöz, 1993; Gülümser et al., 2006).

3.RESULTS AND DISCUSSION

Crude Protein Ratio

Crude protein ratio was significantly affected ($p < 0.01$) in both years (Table 2).

Table 2. Mean crude protein ratios (%) of sole and intercropping grown

Experimental Designs		2012**		2013**		Average**	
1	Barley (B)	14.53	j	13.21	h	13.87	k
2	Oat (O)	15.06	j	14.09	h	14.58	k
3	Common vetch (CV)	19.53	bcd	19.22	ab	19.38	bc
4	Forage pea (FP)	21.00	a	19.92	a	20.46	a
5	B (%20) + CV (%80)	18.51	c-g	17.09	def	17.80	d-h
6	B (%20) + FP (%80)	18.62	c-f	18.18	bcd	18.40	de
7	O (%20) + CV (%80)	19.66	bc	16.37	efg	18.02	d-g
8	O (%20) + FP (%80)	20.32	ab	19.01	ab	19.67	b
9	B (%30) + CV (%70)	18.72	c-f	16.38	efg	17.55	e-h
10	B (%30) + FP (%70)	18.67	c-f	18.60	bc	18.64	cd
11	O (%30) + CV (%70)	19.25	b-e	17.10	def	18.18	def
12	O (%30) + FP (%70)	17.79	f-1	17.48	cde	17.64	e-h
13	B (%40) + CV (%60)	17.86	f-1	15.32	g	16.59	ij
14	B (%40) + FP (%60)	18.94	c-f	17.48	cde	18.21	def
15	O (%40) + CV (%60)	17.17	h1	16.65	ef	16.91	hij
16	O (%40) + FP (%60)	17.33	gh1	17.09	def	17.21	g-j
17	B (%50) + CV (%50)	18.03	e-1	16.77	ef	17.40	f-1
18	B (%50) + FP (%50)	18.31	d-h	16.61	efg	17.46	f-1
19	O (%50) + CV (%50)	16.93	1	15.94	fg	16.44	j
20	O (%50) + FP (%50)	17.34	gh1	16.77	ef	17.06	hij
Mean**		18.18 A		16.96 B		17.57	

There is no differences between same letter in the same column ($p < 0.05$)

In the study, crude protein ratio ranged from 14.53% to 21.00% in 2012 and from 13.21% to 19.92% in 2013. In both years, the highest crude protein ratios were determined in sole forage pea and 20% oat + 80% forage pea (21.00% and 19.01%, respectively). Moreover, 3. experimental design which is sole common vetch was in the same group with 4. and 8. experimental design. The highest crude protein ratio was in sole forage pea (20.46%). The crude protein ratio was higher in 2012 (18.18%) compared to 2013 values (16.96%) (Table 2). In general, protein ratio was higher in intercrops compared to sole cereals and increase depend on legume ratio. Similar results were reported in previous studies (Aasen et al., 2004; Ross et al., 2004; Aşık, 2006). The crude protein ratios of our study are similar with other studies (Yücel 2004; Koçer, 2001; Arslan, 2012; Doğan, 2013; Temel et al., 2015).

Calcium Ratio

Calcium ratio of sole crops and intercropping were shown in Table 3. The values were significantly affected ($p < 0.01$) in both years.

Table 3. Mean calcium ratios (%) of sole and intercropping grown

Experimental Designs		2012**		2013**		Mean**	
1	Barley (B)	0.510	h	0.500	l	0.505	j
2	Oat (O)	0.520	h	0.640	k	0.580	i
3	Common vetch (CV)	1.390	ab	1.480	b	1.435	b
4	Forage pea (FP)	1.480	a	1.690	a	1.585	a
5	B (%20) + CV (%80)	1.100	cde	1.200	e-h	1.150	de
6	B (%20) + FP (%80)	1.130	cd	1.430	bc	1.280	c
7	O (%20) + CV (%80)	1.160	c	1.260	de	1.210	cd
8	O (%20) + FP (%80)	1.110	cde	1.370	c	1.240	c
9	B (%30) + CV (%70)	1.120	cde	1.140	hi	1.130	ef
10	B (%30) + FP (%70)	1.080	cde	1.420	bc	1.250	c
11	O (%30) + CV (%70)	1.030	c-g	1.180	gh	1.105	e-h
12	O (%30) + FP (%70)	1.010	d-g	1.200	d-h	1.105	e-h
13	B (%40) + CV (%60)	1.040	c-f	1.100	ij	1.070	fgh
14	B (%40) + FP (%60)	0.990	efg	1.270	d	1.130	efg
15	O (%40) + CV (%60)	0.920	fg	1.190	fgh	1.055	gh
16	O (%40) + FP (%60)	1.060	cde	1.450	b	1.255	c
17	B (%50) + CV (%50)	1.020	d-g	1.050	j	1.035	h
18	B (%50) + FP (%50)	1.010	d-g	1.170	gh	1.090	e-h
19	O (%50) + CV (%50)	1.320	b	1.260	def	1.290	c
20	O (%50) + FP (%50)	0.900	g	1.230	d-g	1.065	fgh
Mean**		1.045 B		1.212 A		1.13	

There is no differences between same letter in the same column ($p < 0.05$)

Calcium ratio range from 0.510% to 1.480% in first year and from 0.500% to 1.690% in second year. The highest Ca ratio was obtained in sole forage pea in years (1.480, 1.690 and 1.585%, respectively). Ca ratio of sole common vetch (1.39%) was in the same group with forage pea. Mean Ca ratio was 1.045% in 2012 and 1.212% in 2013 (Table 3).

In our study, the highest Ca ratio value was found in common vetch after the value of forage pea. Tan and Serin, (1996) reported that Ca ratio was higher in common vetch than cereals and, the nutrients increased with common vetch ratio in intercropping.

Potassium Ratio

Potassium ratio of sole cropping and intercropping were shown in Table 4. The values were significantly affected in 2012 ($p < 0.05$) and 2013 ($p < 0.01$) (Table 4).

Table 4. Mean potassium ratios (%) of sole and intercropping grown

Experimental Designs	2012*		2013**		Mean**	
1 Barley (B)	2.530	bc	2.310	a	2.420	a
2 Oat (O)	2.570	b	2.080	b	2.325	ab
3 Common vetch (CV)	2.350	c	1.530	efg	1.940	gh ₁
4 Forage pea (FP)	2.470	bc	1.490	fg	1.980	fgh
5 B (%20) + CV (%80)	2.390	bc	1.600	efg	1.995	fgh
6 B (%20) + FP (%80)	2.520	bc	1.240	h	1.880	h ₁
7 O (%20) + CV (%80)	2.440	bc	1.870	c	2.155	de
8 O (%20) + FP (%80)	2.460	bc	1.610	ef	2.035	efg
9 B (%30) + CV (%70)	2.420	bc	1.590	efg	2.005	fg
10 B (%30) + FP (%70)	2.540	bc	1.430	g	1.985	fgh
11 O (%30) + CV (%70)	2.550	b	2.200	ab	2.375	ab
12 O (%30) + FP (%70)	2.440	bc	1.670	de	2.055	efg
13 B (%40) + CV (%60)	2.450	bc	1.600	efg	2.025	fg
14 B (%40) + FP (%60)	2.490	bc	1.180	h	1.835	i
15 O (%40) + CV (%60)	2.470	bc	1.680	de	2.075	def
16 O (%40) + FP (%60)	2.450	bc	1.920	c	2.185	cd
17 B (%50) + CV (%50)	2.760	a *	1.800	cd	2.280	bc
18 B (%50) + FP (%50)	2.520	bc	1.150	h	1.835	i
19 O (%50) + CV (%50)	2.560	b	2.180	ab	2.370	ab
20 O (%50) + FP (%50)	2.450	bc	1.600	efg	2.025	fg
Mean**	2.492 A		1.687 B		2.09	

There is no differences between same letter in the same column ($p < 0.05$)

K ratios range from 2.350% to 2.760% in 2012 and from 1.150% to 2.310% in 2013. The highest K ratio was obtained in 50% barley+50% common vetch (2.760%) in 2012 and it was in sole barley (2.310%) and oat x common vetch intercrops with 50%:50% and 30%:70% seed ratio in 2013. Mean K ratio was 2.492% in 2012 and 1.687% in 2013.

Previously, in the common vetch+cereal intercropping, it was stated that common vetch had more K content, however it decreased depend on the cereal ratio in intercropping (Tan ve Serin, 1996). Karaca (2001) reported that N and P fertilizer applications increases K content in common vetch+barley intercropping.

Phosphorus Ratio

Phosphorus ratio of sole cropping and intercropping were shown in Table 5. The values were significantly affected in 2012 ($p < 0.05$) and 2013 ($p < 0.01$) (Table 5).

Table 5. Mean phosphorus ratios (%) of sole and intercropping grown

Experimental Designs	2012	2013**		Mean**	
1 Barley (B)	0.393	0.257	f	0.325	c-f
2 Oat (O)	0.400	0.340	ab	0.370	a
3 Common vetch (CV)	0.330	0.277	def	0.303	f
4 Forage pea (FP)	0.350	0.290	c-f	0.320	c-f
5 B (%20) + CV (%80)	0.363	0.273	def	0.318	c-f
6 B (%20) + FP (%80)	0.363	0.283	c-f	0.323	c-f
7 O (%20) + CV (%80)	0.360	0.290	c-f	0.325	c-f
8 O (%20) + FP (%80)	0.353	0.333	ab	0.343	bc
9 B (%30) + CV (%70)	0.360	0.277	def	0.318	c-f
10 B (%30) + FP (%70)	0.367	0.293	cde	0.330	c-f
11 O (%30) + CV (%70)	0.377	0.297	cde	0.337	b-e
12 O (%30) + FP (%70)	0.343	0.333	ab	0.338	bcd
13 B (%40) + CV (%60)	0.353	0.263	ef	0.308	ef
14 B (%40) + FP (%60)	0.353	0.293	cde	0.323	c-f
15 O (%40) + CV (%60)	0.353	0.300	cd	0.327	c-f
16 O (%40) + FP (%60)	0.330	0.317	bc	0.323	c-f
17 B (%50) + CV (%50)	0.377	0.283	c-f	0.330	c-f
18 B (%50) + FP (%50)	0.367	0.270	def	0.318	c-f
19 O (%50) + CV (%50)	0.363	0.353	a	0.358	ab
20 O (%50) + FP (%50)	0.340	0.283	c-f	0.312	def
Mean**	0.360 A	0.295 B		0.33	

There is no differences between same letter in the same column ($p < 0.05$)

Phosphorus ratios range from 0.330% to 0.400% in 2012 and from 0.257% to 0.353% in 2013. The highest P ratios were obtained in sole oat (0.400%) in 2012, 50% oat+50% common vetch in 2013 that was in the same statistical group with sole oat, 20% oat+80% forage pea and 30% oat+70% forage pea (0.353, 0.340, 0.333, 0.333%, respectively). Averaged P content was 0.360% in 2012 and 0.295% in 2013. According to combined years, the highest P ratio was in sole oat and 50% oat+50% common vetch (0.370 and 0.358%, respectively) (Table 5).

Carr et al. (2004) reported that the highest P content was found in sole barley cropping in different legume x cereal intercrops. Moreover, Çomaklı and Tas (1996) found that P content was determined by 0.27% through P fertilizer application.

Magnesium Ratio

Magnesium ratio of sole cropping and intercropping were shown in Table 6. The values were significantly affected ($p<0.01$) in both years (Table 6).

Table 6. Mean magnesium ratios (%) of sole and intercropping grown

Experimental Designs		2012**		2013**		Mean**	
1	Barley (B)	0.080	g	0.207	e	0.143	h
2	Oat (O)	0.087	g	0.220	e	0.153	h
3	Common vetch (CV)	0.343	a	0.387	a	0.365	a
4	Forage pea (FP)	0.320	a	0.343	bcd	0.332	b
5	B (%20) + CV (%80)	0.267	b	0.330	bcd	0.298	c
6	B (%20) + FP (%80)	0.270	b	0.317	cd	0.293	cde
7	O (%20) + CV (%80)	0.243	bcd	0.353	abc	0.298	c
8	O (%20) + FP (%80)	0.260	b	0.333	bcd	0.297	cd
9	B (%30) + CV (%70)	0.250	bc	0.330	bcd	0.290	c-f
10	B (%30) + FP (%70)	0.253	bc	0.340	bcd	0.297	cd
11	O (%30) + CV (%70)	0.203	def	0.317	cd	0.260	g
12	O (%30) + FP (%70)	0.203	def	0.343	bcd	0.273	c-g
13	B (%40) + CV (%60)	0.233	b-e	0.300	d	0.267	efg
14	B (%40) + FP (%60)	0.203	def	0.307	d	0.255	g
15	O (%40) + CV (%60)	0.203	def	0.323	cd	0.263	fg
16	O (%40) + FP (%60)	0.220	c-f	0.367	ab	0.293	cde
17	B (%50) + CV (%50)	0.183	f	0.320	cd	0.252	g
18	B (%50) + FP (%50)	0.220	c-f	0.323	cd	0.272	c-g
19	O (%50) + CV (%50)	0.207	def	0.330	bcd	0.268	d-g
20	O (%50) + FP (%50)	0.200	ef	0.303	d	0.252	g
Mean**		0.222 B		0.320 A		0.27	

There is no differences between same letter in the same column ($p<0.05$)

Mg ratio range from 0.080% to 0.343% in 2012 and from 0.207% to 0.387% in 2013. The highest value was obtained in sole common vetch by 0.343% and sole forage pea by 0.320% in 2012 and sole common vetch by 0.387% in 2013. Mean values of Mg ratio were 0.222% in 2012 and 0.320% in 2013.

Egritas and Onal Ascı (2015) reported that Mg ratio ranged from 0.14% to 0.51% in a study on common vetch+cereal intercropping.

According to the results, quality traits of hay (crude protein, Ca, K, P and Mg) were higher in the intercropping than sole sowing and, 20% oat+80% forage pea and 30% barley+70% forage pea intercropping give the best results, therefore, its can be preferred in similar ecologies.

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Health Promoting Oils; Fish and Olive Oils

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Abstract: Fish and olive oil are two healthy oils which are known as noble oils for a healthy life. There are many dietetic association recommends fish at least two times a week and two table spoon olive oil in daily intake routine in order to get and stay health. Because fish and olive oil commonly provide omega 3 [EPA (eicosapentaenoic acid, C20:5n3) and DHA (docosahexaenoic acid, C22:6n3)] and omega 9 [Oleic acid (C18:1n9)], respectively. While fish oil rich in polyunsaturated fatty acid which is easy to oxidize, olive oil has a source of monounsaturated fatty acids, especially oleic acid (60–80%) which is less susceptible to oxidation, having an important role in terms of contributing to the high stability and long shelf life. The content of phenolic compounds is an important parameter considering the evaluation of the quality of virgin olive oil since phenols are mainly responsible for oil flavour and aroma. Nowadays, the phenolic compounds in olive oil and omega 3 content of fish have raised attention due to positive health effects along the last years. They are rich in antioxidant and also have got some fat soluble vitamins such as; vitamin A, D, E, K. These issues let many scientific studies and numerous publications and some guidelines recognizing the health benefits of omega 3 from fish and omega 9 from olive oil sources. According to the previously published studies, these two different kind of oils have been found to be effective against different kinds of cancer, aging, hypertension. They also help losing weight, lowering blood pressure and improving digestion system. This paper got closer attention the health benefits of these two oils and will discuss in detail. The results provide valuable information for preparing our diet tables in a healthy way. These health promoting oils can improve our health and our lives.

Keywords: fish oil, olive oil, health, omega 3, phenolic compounds

1.INTRODUCTION

Fish and olive are two great food items for heart health and has a special place in our tables for centuries. Throughout history they have been important as a source of food which has excellent nutritional value. A numerous scientific research agreed these fact. They even contribute a minimum intake value in order to get benefits by obtaining their results on these issues. Fish should be consumed at least two times a week and olive oil ought to be taken two table spoon in a day. The aim of this current review study get a closer attention of these two healthy oils in order to understand why they are healthy.

2.MATERIALS AND METHODS

Previously published research about biochemical compounds of the fish and olive oil were investigated and health benefit compounds were selected.

3.RESULTS AND DISCUSSION

Fish has rich unsaturated fatty acids, fat soluble vitamins, protein while olive oil has got oleic acid (unsaturated fatty acids), sterol content, fenolik compounds, and also vitamins. These features are seem to improve our health. Therefore, the next section give information both some of the fish and olive oil' bioactive compounds.

EPA (eicosapentaenoic acid, C20:5n3) and DHA (docosahexaenoic acid, C22:6n3) are two fatty acids commonly found in seafood. Some studies on these issue were investigated from different previously published studies were reviewed from different parts of Turkey. Seafood caught from Mediterranean Sea, Black Sea of Turkey's coastal line, and freshwater species collected from various lakes in Anatolia were reviewed. These studies brought out some scientific facts.

First of all, previously reported studies which are 12 journal articles, 3 proceeding papers, and 1 master thesis were examined in a review study to figure out the total DHA and EPA contents of seafood caught from Mediterranean Sea and the minimum-maximum DHA+EPA levels of the seafood in that research were observed to be in the range of 8.7-51,05%, respectively (Özyılmaz 2017a).

Secondly, different seafood species, gastropods, cephalopods, cartilaginous, and mostly bony fish, caught along the Black Sea of Turkey with 111 sampling data were investigated from published data and the mean levels of saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), and polyunsaturated fatty acids (PUFA) were found to be 30.97 %, 29.43%, and, 28.28%, respectively. The levels of DHA and EPA in PUFA were found to be 14.11% and 48.30% at most in bony fish, caught along the Black Sea of Turkey (Özyılmaz 2017b).

Moreover, in a review, DHA and EPA levels of freshwater species collected from various lakes with 114 sampling data were investigated. The average EPA and DHA levels of the data were calculated to be 5.46% and 12.22%, respectively (Özyılmaz 2017c).

According to many scientist many fatty acids can be synthesized in the body. But the human body does not have the enzymes to produce essential fatty acids, acids must be taken via the food (Lunn and Theobald, 2006). According to the American Heart Association [American Heart Association (AHA)], people should consume fish (especially the fatty fish) twice a week (two servings). One of the most important features of fish oil is a very rich unsaturated fatty acid composition which has many health benefits.

Some these benefits are: reducing the low risk of pregnancy and in reducing the risk of premature birth and in the lactation period (Olsen and Secher, 2002; Jensen, 2006), to protect dental health and reduce tooth loss (Hamazaki et al., 2006), brain development and functioning of organs (Connor, 1992), development prevention of some diseases that can be seen in children (Richardson, 2006), protection of heart health and reducing the mortality due to cardiovascular problems (Calder, 2004 and Anderson et al., 2009) prevented the formation of cardiovascular disease (Mayneris-Perxachs et al., 2010), prevention of diabetes mellitus (Woodman et al., 2003), in the treatment of cancer (Fenton et al., 2000), at different stages of cancer treatment (Augustsson et al., 2003) It is supported by these studies.

Of the fatty acids, oleic, palmitic, linoleic, and stearic, palmitoleic fatty acids were the determined as the main fatty acids in different variety olive oil samples however It was determined that oleic acid contents of oil samples ranged between 47.03-86.20% (Konuskan, 2017; Yorulmaz, 2009; Bıyıklı, 2009; Hannachi et al., 2012; Aranda et al., 2004). Olive oil has a source of monounsaturated fatty acids, especially oleic acid (60–80%), which is less susceptible to oxidation, having an important role in terms of contributing to the high stability and long shelf life of olive oil (Anastasopoulos et al. 2012).

Sterols are bioactive compounds and supposed to be present in all vegetable oils and represent the major constituent in the olive oil (Lukic et al. 2013). Sterols are known to be the secondary alcohol in nature, both free and with fatty acids esterified form are available (Yorulmaz, 2009). Edible oils derived from vegetables are known to be rich sources of sterols. Moreover, olive oil that the non-saponified part of the phytosterols are the minor compounds (Lerma-Garcia et al., 2011; Fernandez-Cuesta et al., 2013).

The main components in the unsaponifiable fraction are sterols, alcohols, vitamin E, hydrocarbons, carotenoids, volatile compounds and phenolic compounds, representing only 2% of the whole (Antonini et al. 2015). Additionally, Sterol contents in olive oil samples may show differences according to varieties. It was determined that the total sterol contents of oils ranged between 358 and 2223 mg/kg (Giacalone et al., 2015; Yorulmaz and Bozdoğan, 2017; Cuesta et al., 2013; Konuşkan, 2017; Yorulmaz, 2016; Yorulmaz et al., 2014).

The content of phenolic compounds is an important parameter considering the evaluation of the quality of virgin olive oil since phenols are mainly responsible for oil flavour and aroma (Cioffi et al. 2010; Franco et al. 2014). The phenolic compounds in olive oil have raised attention due to their antioxidant properties and positive health effects recently (Condelli et al. 2015).

Additionally, olive oil is a liquid fat obtained from olives a traditional tree crop of the Mediterranean Basin. Olive is a symbol of the Mediterranean countries and civilizations that have existed in all the holy books for thousands of years (Köseoğlu, 2006). The olive, which is a typical Mediterranean plant, was first discovered in Anatolia. Even though some sources says something else, olive began to be cultivated in 4000 BC and reached out to other Mediterranean countries through the Aegean Islands up to Greece, Italy, France and Spain (Oktar et al., 1983, Bozdoğan Konuşkan, 2008). Olive, the fruit of *Olea europaea* L., one of the oldest cultivated plants of Anatolia, constitutes the subspecies of *Olea europaea sativa* which is *Olea* genus of *Oleaceae* family (Boskou, 1996; Gümüşkesen et al., 1997).

Due to the increasing demand for olive and olive oil in the world, olive growers have given great speed to the production of the countries. In this process, one of the world's leading olive producer countries is Turkey and in a relatively short period of time, area for the cultivation for this plant and the amount of production has increased (Boyras et al., 2010).

Along with many other published which were mentioned above showed that biochemical compounds of these oils (fish and olive oil) supply mostly omega 3 and omega 9 respectively. Whilst majority part of fish oil were found polyunsaturated fatty acid (EPA and DHA), that of olive oil seem to be monounsaturated fatty acids (oleic acid). These fatty acids help heart health.

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Structural Status of Beekeepers and Beekeeping Enterprises in Ardahan

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Abstract: Ardahan province is an important gene center of the Caucasian honey bee (*Apis mellifera caucasica*) and is a place housing one of the four important bee races which are economic values in the world. Ardahan province has an important potential with its delicious, high quality and patent honey production. This research was carried out in Ardahan and its 5 districts to determine the structural condition of the beekeepers and beekeeping enterprises. The data of the study were obtained from the questionnaires of 213 settled and migratory beekeepers selected randomly. The obtained data were analyzed by using chi-square test. In addition to the knowledge run in family and skills, it has been determined that reading and practicing this knowledge is effective in learning beekeeping. This rate was determined as 59.40% for the settled beekeepers and 57.90% for the migratory beekeepers. The difference between learning beekeeping methods of the migratory and settled beekeepers was statistically significant ($P < 0.01$). While a large majority of the settled beekeepers (66.66%) regard beekeeping as an additional source of income, a remarkable proportion of the migratory (51.20%) regard it as their main occupation. The difference observed between the migratory and settled beekeepers was significant ($P < 0.01$) for the purpose of beekeeping. While the vast majority of migratory beekeepers (% 62.80) are beekeeping with 100-200 beehives, a great majority of the settled beekeepers (%81.90) are working with 1-100 beehives. The proportion of the beekeepers attending the beekeeping course was determined as 82,6%.

Keywords: Beekeeping, enterprise, honeybee, migratory and settled beekeepers

1.INTRODUCTION

Ardahan province is an important gene center of the Caucasian honey bee (*Apis mellifera caucasica*) and is a place housing one of the four important bee races possessing economic value in the world. (Farshineh et al., 2007; Önk et al., 2016). Caucasian bee retains the most distinctive characteristic with the longest tongue (7.2 mm) among the other races. Thanks to this long tongue, they can pick up nectar from deeply tubed flowers. They visit various flowers mornings and afternoons, in other words, they often change types of flowers. When the glucose percentage of nectar in the flowers reaches 10-11%, they start working immediately, this ratio is 18% for other bee races (Genç & Dodoloğlu, 2017). Its long tongue, making use of the flowers when the glucose percentage of nectar reaches 10-11% and frequently changed flowers cause honey to be produced from more diversified flowers. This is one of the important factors that enhance the quality of the honey.

The province has an important status in respect of beekeeping in the Eastern Anatolian Region with its high plateaus, deep valleys, highly rich feed plants, planted areas and other high quality nectar and pollen resources. (Özhatay et al., 2010). In this way, approximately 20 thousand colonies are brought to the different parts of the province from Artvin province in the summer months every year, and the available resources are utilized. (Anon, 2018). Furthermore, honey produced in Ardahan has received a geographical indication as of 01.06.2017 in accordance with the decree on the protection of the geographical indications numbered 555 in accordance with the provisional Article 1 of the Industrial Property Law No. 6769. Patent granted on Ardahan honey will stimulate the demand for the honey in the upcoming years. Ardahan is one of the prominent provinces in the Eastern Anatolia in terms of beekeeping with its suitable climate, vegetation, topographic structure, beehive availability and annual honey production. However; the increase in the availability of the colonies and annual honey production over the years have not been achieved in terms of the yield produced per colony. (TUİK, 2018).

The local beekeeping is far behind the desired level despite the ecological morphology of Ardahan which is suitable for the beekeeping. Beekeepers need to be equipped with modern breeding techniques, especially in the autumn season, with regard to beehive maintenance and control, wintering and diseases. Education and raising awareness of the beekeepers will ensure that beekeeping is a sustainable and profitable profession in the region.

It has been chiefly aimed to determine the structural characteristics and problems of the beekeeping in Ardahan and to put forward the data which will constitute the basis of scientific studies to be done in order to determine the priorities and to improve the beekeeping from the current situation by conducting questionnaire to the settled and migratory beekeepers.

2. MATERIALS AND METHODS

The results of this jointly carried out questionnaire applied to 111 settled and 102 migratory beekeepers in the beekeeping villages of the province of Ardahan and its 5 districts in the 2016-2017 production period, form the material of this study. While a researcher (Yamane, 2006) suggested that 3% of the sample size would be sufficient in the survey study, another researcher claimed that 10% of the sample size should be taken into consideration. (Cochran, 1977).

This questionnaire has been conducted face to face with 213 beekeepers who constitute 22,75% of all the beekeeping enterprises in Ardahan city and districts. The number of enterprises according to the districts, the number of enterprises participating in the survey and the number of colony are given in Table 1.

Table 1. The number of enterprises according to the districts of Ardahan province, the number of enterprises participating in the survey and the number of colonies.

District	The number of enterprises	The number of enterprises participating in the survey	Total number of the colonies of the province
Merkez	540	95	46.270
Hanak	162	47	9.800
Posof	113	32	7.450
Çıldır	82	21	5.450
Göle	30	14	2.120
Damal	9	4	727
Total	936	213	71.817

The data obtained from the migratory and settled beekeepers were analyzed in the package program "SPSS 20.0 for Windows". Deductions were made in accordance with the results obtained in the research. A chi-square independence test was used to determine the correlation between the variables (Yildiz & Bircan 2006).

3. RESULTS AND DISCUSSION

Results

The method of learning beekeeping and the purpose

In the research, the method of learning beekeeping in determining the qualities of the beekeepers and the beekeeping enterprises and the reasons of beekeeping were regarded as important criteria and the obtained results are totalized in Table 2.

Table 2. The Method of Learning Beekeeping and the Purpose

Method of Learning Beekeeping	Settled beekeepers		Migratory beekeepers		All beekeepers	
	Number	%	Number	%	Number	%
Paternal Succession	42	37.80	32	31.40	74	34.70
Course	11	9.90	21	20.60	32	15.00
From other beekeepers	28	25.20	14	13.70	42	19.70
Reading and Practice	24	21.60	27	26.50	51	23.90
Internet	3	2.70	8	7.80	11	5.20
Mixed	3	2.70	0	0.00	3	1.40
Total	111	100	102	100	213	100
Purpose of Beekeeping						
Main Occupation	20	18.02	59	57.84	79	37.08
Satisfaction of interest	8	7.21	6	5.88	14	6.57
Additional source of income	74	66.66	33	32.36	107	50.24
Hobby	9	8.11	4	3.92	13	6.11
Total	111	100	102	100	213	100

The size of the business

Beekeeping is an agricultural activity carried out independently of the land. For this reason, the number of the beehives has been prioritized when the size of the business, an important criterion to determine the qualifications of beekeeping is evaluated (Table 3).

Table 3. Business Structure and Experience

The Number of The Beehives in Business	Settled Beekeepers		Migratory Beekeepers		All Beekeepers	
	Number	%	Number	%	Number	%
1-50	43	38.70	18	17.60	61	28.60
50-100	48	43.2	20	19.60	68	31.90
100-150	14	12.60	52	51.00	66	31.00
150-200	6	5.40	12	11.80	18	8.50
Total	111	100	102	100	213	100
Beekeeping Experience						
1-9 years	23	20.70	19	18.60	42	19.70
10-19 years	58	52.30	56	54.90	114	53.50
20-29 years	18	16.20	20	19.60	38	17.80
30 and over	12	10.80	7	6.90	19	8.90
Total	111	100	102	100	213	100

In Table 3, The number of the beehives of the migratory and settled beekeepers is demonstrated. According to the table, a large majority (62.80%) of the migratory beekeepers are beekeeping with 100-200 beehives while the settled beekeepers work with beehives with 1-100 beehives (81.90%). The difference observed between the settled and migratory beekeepers in terms of business size was remarkable ($P < 0.01$).

Main occupations of the beekeepers and the issue of beekeeping course certificate

According to Table 4, it is reported that beekeeping is a main occupation for 47.00% of the migratory beekeepers, but this ratio is found to be 11.70% for the settled beekeepers. A significant majority (55.00%) of the settled beekeepers' main occupation is farming. The percentage of the beekeepers who are public servants doing beekeeping as an additional source of income is determined to be 18.60% for the migratory beekeepers and 14.40% for the settled beekeepers. The main reason for public servants taking beekeeping in the questionnaire is due to economic reasons.

Table 4 Main Occupations of the Beekeepers and the Issue of Beekeeping Course Certificate

Main Occupations	Settled Beekeepers		Migratory Beekeepers		All Beekeepers	
	Number	%	Number	%	Number	%
Beekeeper	13	11.70	48	47.00	61	28.60
Farmer	61	55.00	28	27.50	89	41.80
Public Servant	16	14.40	19	18.60	35	16.50
Self-employed	21	18.90	7	6.90	28	13.10
Total	111	100	102	100	213	100
Issue of Beekeeping Course Certificate						
Issued	84	75.70	92	90.20	176	82.60
Non-issued	27	24.30	10	9.80	114	17.40
Total	111	100	102	100	213	100

Beekeepers' loans, income, expenditure and production levels

As time passes, keeping up with technological advances in beekeeping and supply of different beekeeping products increase the business costs. The supply of tools and equipment, appropriate to the latest technologies is also an important element for beekeeping because the utilization of them is an important factor affecting production on a large scale.

The beekeepers were asked whether they received loan from various institutions and bodies in order to meet the various expenditure and the data is totalized in Table 5. While 18.90% of the settled beekeepers received loan, this percentage was calculated as 17.60% for migratory beekeepers. The migratory and settled beekeepers were determined to have a similar tendency to take out loan. It was stated that 75% of the settled beekeepers pay 75-150 TL per hive whereas 72.5% of the migratory beekeepers pay 150-200 TL per hive. In the chi-square test, the difference between the annual costs per beehive paid by the migratory and the settled beekeepers was statistically significant ($P < 0.01$).

Table 5. Beekeepers' Loans, Income, Expenditure and Production Levels

Beekeepers credit	granted	Settled beekeepers		Migratory beekeepers		All beekeepers	
		Number	%	Number	%	Number	%
Granted		21	18.90	18	17.60	39	18.30
Non-granted		90	81.10	84	82.40	174	81.70
Total		111	100	102	100	213	100.00
Annual Cost Per Beehive							
1-75 TL		26	23.40	4	3.90	30	14.10
75-150 TL		84	75.70	16	15.70	100	46.90
150-200 TL		1	0.90	74	72.50	75	35.20
200 TL and over		0	0.00	8	7.80	8	3.80
Total		111	100	102	100	213	100
Annual Income Per Beehive							
1-300 TL		5	4.50	0	0.00	5	2.30
300-600 TL		79	71.20	16	15.70	95	46.60
600-900 TL		24	21.60	69	67.60	93	43.70
900 TL and over		3	2.70	17	16.70	20	9.40
Total		111	100	102	100	213	100
Average yield of honey per beehive							
1-10 kg		24	21.60	0	0.00	24	11.30
10-20 kg		84	75.70	35	34.30	119	55.90
20 kg and over		3	2.70	67	65.70	70	32.90
Total		111	100	102	100	213	100

Beekeepers' marketing condition and style for bee-related products

In table 6, the answers given by the local beekeepers to the question 'Are you marketing any other bee-related product than honey?' are demonstrated. It has been determined that the local beekeepers mostly produce swarm bee and they have a similar tendency in this regard. This percentage was calculated as 47.70% for the settled beekeepers and 52.90% for the migratory beekeepers. It has been observed that queen bee production is done by permission- issued enterprises, and tendency in pollen and propolis production is low in the area. The dominant tendency of producing swarm bees in the region is thought to be caused by the preparation for the next season by the beekeepers and by the demand of the Caucasian beehive.

Table 6 Beekeepers' Marketing Condition and Style for Bee-related Products

Beekeepers' marketing other bee products	Settled Beekeepers		Migratory Beekeepers		All Beekeepers	
	Number	%	Number	%	Number	%
No Marketing	37	33.30	26	25.50	63	29.60
Pollen	7	6.30	11	10.80	18	8.50
Queen Bee	11	9.90	11	10.80	22	10.30
Propolis	2	1.80	0	0.00	2	0.90
Swarm Bee	53	47.70	54	52.90	107	50.20
All	1	0.90	0	0.00	1	0.50
Total	111	100	102	100	213	100
Honey Marketing Style						
Self-employed Markter	111	100	78	76.50	189	88.70
By Unions	0	0.00	13	12.70	13	6.10
Sales to Wholesalers	0	0.00	11	10.80	11	5.20
Total	111	100	102	100	213	100

Discussion

According to the outcomes; it has been determined that the reading and practice as well as skills and knowledge run in family play a crucial role in learning beekeeping. This ratio was determined as 59.40% for the settled beekeepers and 57.90% for the migratory beekeepers. It has been also understood that the beekeepers appreciate the knowledge and skills of other beekeepers and beekeeping courses while learning beekeeping. The difference between the settled and migratory beekeepers in beekeeping learning methods has been found statistically significant ($P < 0.01$). According to a research done, it was reported that beekeeping family is effective by 28.20% to start beekeeping. (Kadirhanogullari, 2016). This ratio was found as 34.70% in the survey. These results show that our beekeepers also use other learning methods in addition to family knowledge and skills. According to the analysis, considering the Table 2. The ratio of beekeepers doing this job as the main source of income among the migratory beekeepers was determined as 57.84% while this ratio was calculated as 18.02% for the settled beekeepers. A significant majority of the settled beekeepers (66.66%) regard beekeeping as an additional source of income. The difference observed between the settled and migratory beekeepers was found significant ($P < 0.01$) in terms of the purpose of beekeeping. In the study conducted by Cengiz & Genç (1999), while 51.20% of the migratory beekeepers regarded beekeeping as the main source of income, 56.50% of the settled beekeepers reported it as an additional source of income. The perspectives of the settled and migratory beekeepers to the occupation are consistent with the literature report.

The reason why the migratory beekeepers do beekeeping with more beehives is that they take this occupation as their main source of income and earn more income per colony accordingly. In the questionnaire, it has been calculated that the average number of colonies per enterprise is 84 and the experience of the beekeepers is between 20.18 years on average. The difference between the migratory and the settled beekeepers in terms of beekeeping experience has been found insignificant. Average experience years of 20.18 obtained from questionnaire is lower than that of Kuvanci et al. (2017) reported for Rize, Gümüşhane and Trabzon respectively 28.85, 25.24, 25.00, but higher than 18.64 years reported for Bayburt.

According to the researches carried out, it was reported that 50% and 51.51% of the migratory beekeepers' main occupation is beekeeping (Çelik, 1994, Cengiz, 1999). It was calculated as 47.00% for the local beekeepers. According to a study, while the main occupational beekeeping was not reported among the settled beekeepers (Çelik, 1994), this percentage was calculated to be 11.70% for local beekeepers. In the study, in terms of main occupation, the difference between the migratory and the settled beekeepers was found to be significant ($P < 0.01$). It is an important factor among the migratory beekeepers to prefer beekeeping as their main occupation because they earn high income as related to more beehives they produce honey with. The obtained results demonstrate that the migratory beekeepers take it as a main occupation, while the settled beekeepers doing beekeeping along with farming. As shown in Table 4, 92% of the migratory beekeepers and 75.70% of the settled beekeepers have been issued beekeeping course certificate. It is shown that there is a difference in terms of beekeeping knowledge levels between the migratory and the settled beekeepers. The difference was reported significant ($P < 0.01$) in the chi-square test applied to determine whether this difference was statistically significant.

According to a study conducted, it was found that only 16.87% of the beekeepers took the related courses; and those in great enthusiasm to increase their knowledge in beekeeping found such training to be inadequate (Kumova & Özkütük, 1988). In another study, this percentage was reported as 38.30% (Cengiz & Genç, 1999). For local beekeepers this ratio was calculated as 82.60%. This indicates that beekeepers are encouraged to be issued certificate in order to benefit from the projects and supports related to beekeeping with the introduction of the course certificate in recent years.

It was calculated that the annual income of 67.60 % of the migratory beekeepers per beehive is 600-900 TL, while the annual income of 71.20% of the settled beekeepers per beehive is 300-600 TL. The difference observed between the settled and the migratory beekeepers' annual income per beehive was statistically reported significant ($P < 0.01$). The reason of the difference observed in annual income per hive between the migratory and the settled beekeepers is believed to be due to more hives the migratory beekeepers producing honey with, and their watch of the nectar flow.

75.70% of the settled beekeepers stated that they had received 10-20 kg of honey per colony, while 65.70% of the migratory beekeepers reported that they had 20 kg and over of honey per colony. The difference observed in honey yield per colony between the migratory and the settled beekeepers was statistically found significant ($P < 0.01$). In the study, the average honey yield per beehive of the migratory and the settled beekeepers was detected consistent with the literature report indicating that transferring production colonies to places where nectar and pollen sources were abundant resulted in a 50.21% increase in total honey yield (Cengiz & Dülger, 2018). In the study, the average yield of honey of 213 colonies was calculated as 17.16 kg. This amount is higher than that reported by Çiçek and Yücer (1993) and Özbakır et al (2016) respectively, 14.60, 7.7 kg, but found lower than the amount (20.21 kg) reported by Demen et al. (2016).

100% of the settled beekeepers market honey by themselves. The migratory beekeepers reported that 76.50% of them were marketing by themselves, 12.70% were through unions and 10.80% were marketing to wholesalers. 88.70% of the local beekeepers market honey by themselves. In some researches; this fact is consistent with the finding that beekeepers prefer self-employment in marketing in order to find better prices and get cash immediately. (Kumova & Özkütük, 1988, Kaftanoğlu et al., 1995). It is thought that the marketing done by the beekeepers themselves in the region is due to the high demand for Ardahan honey, which is geographically indicated.

Ardahan region has a particularly strong production potential because of not only having very important honeyed plants for beekeeping but swarms of the nomadic bees flocking from Artvin province as well. It has been observed that the production per colony is low despite the enormous potential of the region. It has been determined that beekeeping in the family has an important effect on learning beekeeping in the region and the practices of the experienced beekeepers are well respected in the training of the beekeepers. It has been detected that loan usage is not prevalent throughout the region, and the more migratory beekeepers spend per beehive, the more they earn. It has been found out that in Ardahan the production of other beekeeping related products except from swarm and queen bees production is low, and honey is mostly marketed by the beekeepers themselves. First of all, all the beekeepers in the region should be equipped with the modern beekeeping techniques in accordance with the changing technology. Loan support should be granted for the beekeepers on suitable terms in order to develop beekeeping in the region with modern tools and equipment. Education and marketing support for the products such as pollen, propolis, royal jelly, bee venom should be provided by the associations in order to expand the production of these products. The number of beehives per colony should be increased in order to make better use of the present potential in the region, and so beekeeping should be made an alternative source of income.

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Effects of Gibberellic Acid Applications on Fruit Drop in Black Myrtle (*Myrtus communis* L.)

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Abstract: Myrtle(*Myrtus communis* L.) is one of the main aromatic and medicinal plants of Mediterranean macchia and belongs to *Myrtaceae* family. It can be grown in many locations up to 600 m elevations in Aegean, Marmara and Mediterranean regions of Turkey. The main goal of this study was to investigate the effects of gibberellic acid (GA) which is applied around flowering time for obtaining seedless fruit on seasonal fruit drop in black myrtle plants. Studies were carried out in an orchard of black myrtle located in Antalya. GA at the dose of 100 ppm was sprayed to the whole plant at pre-, post- and full bloom stages, alone or in combination, in black myrtle. Control plants had no GA spray. Fruit drop percentages were monthly recorded from fruit set in July to harvest time in December. GA treatments increased seedless fruit percentage up to 12% and reduced seed number per fruit from 10.69 to 1.98 in 2016 and from 9.20 to 2.17 in 2017. GA applications did not affect early and mid-season fruit drop except pre-harvest fruit drop. Fruit drop at pre-harvest period increased up to 57.25 % when GA applied at pre- and full-bloom stages whereas control plants had a very little percentage of fruit drop in all months. Post-bloom GA spraying alone had lower fruit drop when compared other GA applications. These results suggest that GA applied at different periods, alone or in combination, increased pre-harvest fruit drop.

Keywords: *Myrtus communis*, hormone, yield, fruit set, quality.

1.INTRODUCTION

Black myrtle is a well known fruit crop in Mediterranean basin. Its fruits are mostly used for liqueur making in Italy. Fresh consumption is the main use of black myrtle fruits in Turkey. Consumers have mostly complained about high amount of seed number in fresh fruits. GA is known to induce seedlessness in fruits. But the effects of GA applications for seedlessness how affect the fruit drop is not clear. Its effects fluctuated depending on time of treatment, concentration and pH of GA solution, method of treatment, and variety (Oono, 1973). It has been known in many decades that external applications of GA around blooming have resulted with seedless fruits in many fruit crops such as grape (Dass and Randhawa, 1968; Fellman *et al.*, 1991) and mandarin (El-Shereif *et al.*, 2017). Fellman *et al.* (1991) reported seedless berry development in seeded grapes when GA applied at pre- and post anthesis. They stated that effects of GA could change year to year depending on developmental phase of inflorescences at application time. Dass and Randhawa (1968) demonstrated that application of GA (100 or 150 ppm) at 10 days before flowering and 7 days after flowering, alone or combined, resulted with over 90% seedlessness in seeded Bhokri grapes. Romaquin (2003) found that GA application around flowering and bud break induced seedlessness in rambutan fruit. She stated that applications at before bud-break had more successful than the others and 100% seedlessness were obtained at dose of 200 ppm GA at budbreak. But Uzun *et al.* (2016) observed that GA treatments had no effect on seedless fruit production in black myrtle.

Mechanism of GA induced seedlessness were explained by many researchers. Fellman *et al.* (1991) indicated that seedlessness was the result of developmental incongruity between pistil and embryo sac. They stated that Motomura and Ito claimed that pre anthesis application kills ovules and post anthesis application stimulate subsequent seedless fruit development. Whereas, Chang *et al.* (2013) claimed that GA application had an effect on redox homeostasis, which could cause cell damage and subsequent seed abortion.

Fruit drop is one of the main problems in many fruit crops such as plum, mandarin (El-Shereif *et al.*, 2017), orange (Lima and Davies, 1984; Ullah *et al.*, 2014;) Mango (Ahmed *et al.*, 2012; Hagemann *et al.*, 2014) and date palm (Al-Quarashi *et al.*, 2012). Fruit drop described three distinct stages in mango: 1. Post-setting, 2. Mid-season, 3. Pre-harvest. Treatment and cultivar differences were appeared to remain constant in pre harvest fruit drop of mango. Naphthalenacetic acid (NAA) and N-(2-chloro-4-pyridyl)-N'-phenylurea (CPUU) are reduced fruit drop but combination of both regulators with GA are not lead to higher fruit retention in mango (Hagemann *et al.*, 2014). Ahmed *et al.* (2012) observed reduced pre harvest fruit drop in mango when GA, NAA and 2,4-D applied alone at the dose of 35 ppm in full bloom. The most convenient time to form seedless berries in grape is application of GA before full bloom (Oono, 1973). But Romaquin obtained seedless fruits in rambutan at the application of GA in budbreak (Romaquin, 2003). Garcia-Rojas *et al.* (2018), stated that berry drop was related of hardening and thickening of pedicel produced by over accumulation of cellulose and its lignification. They demonstrated that GA treatments produce severe berry drop in some table grape cultivars due to overexpression of some key genes for pedicel lignification. GA regulate the expression of biosynthesis of lignin genes which are change cell wall composition and pedicel structure.

GA is mostly sprayed before flowering, alone or in combination with after flowering, for seedlessness in fruit crops. Whereas, at full bloom or after flowering applications are necessary to decrease pre-harvest fruit drop in orange (Ullah *et al.*, 2014; Hifny *et al.*, 2017). Meanwhile, Lima and Davies (1984) stated that application of GA alone at 5-9 weeks after mid-bloom had no effect on summer drop but highly decreased it when combined with 2,4-dichlorophenoxyacetic acid (2,4-D). On the other hand, applications of GA or 2,4-D alone at 40-70 days after from pollination significantly decreased pre-harvest fruit drop in date palm (Al-Quarashi *et al.*, 2012). In the same way, synergetic effect of GA (25 ppm) and streptomycin (500 ppm) on decreasing of seed number have been observed in mandarins (El-Shereif *et al.*, 2017). Seedless grapes are produced by applying exogenous GA before flowering for seedlessness and again after flowering for berry enlargement (Hur, 2014). Mesejo *et al.* (2010) showed that loquat trees treated three times with 100 ppm GA developed more than 90% of panicles bearing almost 7 seedless fruits per panicle.

The main objectives of this study was to evaluate the effects of pre-bloom, anthesis and post-bloom treatments with 100 ppm GA for seedlessness on post-setting, mid-season and pre-harvest fruit drops of black myrtle.

2. MATERIALS AND METHODS

Material

This study was carried out in an orchard located at Akdeniz University, Antalya, Turkey during 2016 and 2017 growing season with ten-year-old plants of Yakup black myrtle variety. It is, however, not officially registered variety. Trees were planted 4x4 meters apart. Standard management practices such as pruning, irrigation, weeding were conducted each year.

Methods

Black myrtle trees were sprayed with 100 ppm GA (Sigma, GA₃, product no:48880) containing 0.1% adjuvant (Wax-wet) at different flower bud stages happening in June (Table 1 and 2). The application volume of 2 liter per tree was applied until runoff with a low pressure sprayer. Treatments were applied in early morning. The application was made to the entire tree foliar surface at pre-bloom (ballon, flower buds have white coloured petals but not opened), anthesis (full bloom), and post bloom (fruit set) stages of flower buds, alone or combination with other stages. Three shoots in the outer part of each tree were labelled. All fruits from each labelled shoots of three replicate trees were counted each month after fruit set (July) until harvest at December for fruit drop evaluation. Monthly fruit drop was evaluated by analyzing counts of fruit retention per shoot at each assessment date. Fruit drop stages were classified as post-setting drop (July), mid-season drop (August and September) and pre-harvest drop (October and December). GA application times and dates were given at Table 1 and Table 2.

Table 1. GA application times and doses

Treatments	Flower bud stages	GA doses
Control	Ballon	0 ppm
T ₁	Ballon	100 ppm
T ₂	Ballon + Anthesis	100 ppm + 100 ppm
T ₃	Ballon + Anthesis + Fruit set	100 ppm + 100 ppm + 100 ppm
T ₄	Anthesis	100 ppm
T ₅	Anthesis + Fruit set	100 ppm + 100 ppm
T ₆	Fruit set	100 ppm

Table 2. GA application dates

Uygulamalar	2016	2017
Control	06.06.2016	10.06.2017
T ₁	06.06.2016	10.06.2017
T ₂	06.06.2016+09.06.2016	10.06.2017+12.06.2017
T ₃	06.06.2016+09.06.2016+16.06.2016	10.06.2017+12.06.2017+18.06.2017
T ₄	09.06.2016	12.06.2017
T ₅	09.06.2016+16.06.2016	12.06.2017+18.06.2017
T ₆	16.06.2016	18.06.2017

The experimental design was a randomized complete block with three block, each block containing one plants per treatment. Data were analyzed using MINITAB statistical software. Means were compared using Tukey test.

3.RESULTS AND DISCUSSION

Seed numbers per fruit ranged from 1.98 to 10.69 in 2016 and from 2.17 to 9.20 in 2017. Seed number is significantly affected by GA treatments (Table 3). Control fruits had mostly higher number of seeds than that of GA treatments. The minimum seed numbers per fruits were recorded as 1.98 at T₂ in 2016 and 2.17 at T₃ in 2017.

Seedless fruit percentage had not significantly affected by GA applications. Maximum seedless fruits per shoot were recorded at T₃ treatment in both year. Percentage of seedless fruits per shoot changed year to year but control plants had no seedless fruits in both year.

Effect of GA applications on fruit drop in post-set, mid-season and pre-harvest were given in Table 4. Application of GA did not affect fruit drops in July. But mid-season and pre-harvest fruit drops were significantly affected by GA applications, alone or combined. The highest fruit drops were obtained at T₂ treatment as %57,25 in 2016.

Table 3. Effects of GA applications on seed number and seedlessness in black myrtle fruits

Treatments	Seed number per fruit		Seedless fruits per shoot (%)	
	2016	2017	2016	2017
Control	10.69a*	9.20a	0.00	0.00
T ₁	7.80ab	5.69b	9.33	0.00
T ₂	1.98c	4.43bc	9.33	0.00
T ₃	2.53bc	2.17c	10.67	12.00
T ₄	6.77abc	4.72bc	2.67	0.00
T ₅	7.98ab	3.13bc	0.00	2.67
T ₆	5.09bc	3.64bc	4.00	6.67

*Means followed by the same letter in each column do not differ significantly ($P \leq 0.05$).

Most of the GA treatments significantly affected mid-season and pre-harvest fruit drop in black myrtle. Post setting drops had not observed in all treatments. Higher drops were observed in pre-bloom and anthesis GA treatments Whereas, lower results were recorded in control plants and post-setting GA treated plants. Percentage of seedless fruits obtained by

Romaquin (2003) reported 100% seedless fruits in rambutan fruit when GA applied at budbreak. But the meaning of budbreak is not clear in this study. If it is indicated as floral bud break it is agree with other studies (Dass and Randhawa, 1968; Fellman *et al.*, 1991). Otherwise, there is conflict with other studies dealing with prebloom GA applications. Because if GA applied before vegetatif bud break time, seedlessness will mostly not happen in fruits (Uzun *et al.*, 2016).

Table 4. Effects of GA applications on monthly fruit drop (%)

Treatments	July		August		September		October		November	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Cont.	00.50	1,11	1,49b*	2,18b	2,42b	3,59b	5,74c	4,20b	8,05d	7,01c
T ₁	04.44	4,65	12,06a	10,51a	23,06a	15,86a	29,25ab	23,22a	42,96ab	34,52a
T ₂	04.14	1,47	7,76ab	8,54a	20,29ab	10,76ab	39,11a	20,44ab	57,25a	29,17ab
T ₃	01.92	2,10	8,37ab	8,68a	16,36ab	13,42a	23,05abc	22,55a	34,52bc	31,03a
T ₄	00.00	0,83	1,97b	9,78a	4,61ab	15,58a	7,16c	21,97ab	15,11cd	28,66ab
T ₅	03.28	3,50	7,42ab	8,80a	11,72ab	11,99ab	15,27bc	16,93ab	22,19cd	23,33b
T ₆	01.17	1,75	1,17b	2,07 b	3,06b	3,54b	4,33c	4,33b	4,33d	6,88c

*Means followed by the same letter in each column do not differ significantly ($P \leq 0.05$).

GA treatments for seedless fruit production are depended on fruit cultivar or species studied. In our study, seedless fruit percentage had never exceeded 12% in all treatments. Therefore, it was lower than 100% in Rambutan and 90% in loquat (Romaquin, 2003; Mesejo *et al.*, 2010).

GA treatments induced seedlessness in black myrtle fruits but it is not practical for black myrtle cultivation. In addition, GA treatments increases fruit drops. However, further developments of an economic and functional method such as obtaining seedless cultivars by breeding for cultivation of seedless black myrtle are essential.

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Effects of Nitrogen and Phosphorus Levels on Yield and Quality of Quinoa (*Chenopodium quinoa* Willd.)

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Abstract: This study was conducted to determine the effects of different levels of Nitrogen and Phosphorus fertilizers on yield and quality components of quinoa. The agronomic performance and nutritive value of quinoa was analyzed as an alternative dry-season feed for ruminants and food for human during growing season of 2015-2016 in Ankara. In this study, 4 different levels of nitrogen (N0: 0, N1: 50, N2: 100 and N3: 150 kg ha⁻¹) and phosphorus (P0: 0, P1: 30, P2: 60 and P3: 90 kg ha⁻¹) were tested in randomized block design with three replications. We studied herbage (H), hay (dry matter=DM) and grain yield (GY), crude protein content in DM (DMCP) and grain (GCP), acid detergent fiber (ADF) and neutral detergent fiber (NDF) levels. The highest average herbage yield (47.9 t ha⁻¹) was obtained from the application of 150 kg N ha⁻¹ + 90 kg P ha⁻¹, the highest average crude protein content (14.93%) was determined in DM from 150 kg N ha⁻¹ + 60 kg P ha⁻¹. The highest average grain yield (1.6 t ha⁻¹) and crude protein content of grain (16.8 %) were obtained from the application of 150 kg N ha⁻¹ + 90 kg P ha⁻¹. From the results of the study, it was concluded that the optimum fertilizer levels of N and P for quinoa in terms of yield and quality were N3 and P3.

Keywords: Quinoa, nitrogen, phosphorus, yield, quality

1. INTRODUCTION

Quinoa (*Chenopodium quinoa* Willd.) is a pseudocereal, native to Latin America which has the potential to grow with less inputs, water and tolerate a variety of biotic and abiotic stresses. This plant is one of the most important economic crops belongs to the family Quinoa a stress-tolerant species, has been cultivated along the Andes, from about 3000 B.C and is still being cultivated in Peru, Bolivia, Chile, Ecuador, Colombia and Argentina (Gonzalez *et al.*, 2012). It is upright, reaching heights varying from 0.60 to 3.00 m, depending on the type of quinoa, genotypes, fertility of soil and environmental conditions where it grows. Beside the plant has high crude protein (14,85%) and low ADF (29,24%) and NDF (39,47%) content as compared to other forage plant that NDF content of sorghum 52%, sudanese 53,28%, sorghum-sudanese 50 % and maize 54%, and 8,69 % crude protein content (Budak *et al.* 2017). Accordingly Salcedo genotype is a favorable plant for animal and human food because of it has high digestibility protein and saponin free of seed. Chenopodiaceae. It has fulfilled various roles in these ancestral cultures, in addition to its role in human and animal nutrition, quinoa had a sacred importance (Bonifacio, 2003).

Higher crop yields place greater demand on soil nutrient reserves and applied fertilizer. The objective is to supply nutrient needs during peak crop uptake periods. Nitrogen, phosphorus and potassium, are the primary nutrients. Each of these fundamental nutrients plays a key role in plant nutrition. Because nitrogen and phosphorus are an essential element required for successful plant growth. Nitrogen and phosphorus applications have been inevitable to increase the yield and quality of plant. Although inorganic nitrogen compounds (*i.e.*, NH₄⁺, NO₂⁻, and NO₃⁻) account for less than 5% of the total nitrogen in soil (Brady, 2008). Quinoa can be successfully grown on marginal soils showing its very low nutrient requirements (Jacobsen, 2003). The influence of N (calcium ammonium nitrate (27% N)) rate on grain yield was even stronger than for amaranth. Grain yield was enhanced to 94 % at N 120 compared to N₀, (Erley *et al.*, 2005). Gomaa (2013) informed that the application of 0, 119 and 238 kg N ha⁻¹ with biofertilizers led to consistent increase the grain yield per hectare of quinoa as compared with untreated plants (control) over the years. Nitrogen level of 75 kg N ha⁻¹ was proved to be optimum level for nitrogen supplementation of soil for quinoa (Basra *et al.*, 2014) growth and development to harvest maximum economic yield under ecological conditions of Egypt. Kakabouki *et al.* (2014) reported that nitrogen fertilization increased also the grain yield of quinoa under different tillage system.

Thanapornpoonpong *et al.* (2008) explored the effect of different nitrogen rates (0.16 and 0.24 g N kg⁻¹ soil) on protein content of seed and amino acid profile of amaranth and quinoa. Nitrogen fertilization effected amino acid content of quinoa and amaranth. Both had rich lysine contents (6.3-8.2 g 100 g⁻¹ protein) but low methionine (1.28 g 100 g⁻¹ protein). Thus, diets of humans can be improved by maintaining and increasing essential amino acid content and proteins by applying N fertilizer (Basra *et al.*, 2014). The protein of quinoa seed is rich in essential amino acids, particularly methionine, threonine and lysine, which are the limiting amino acids in most cereal grains (Bhargava *et al.*, 2007; Comai *et al.*, 2007). Quinoa contains gluten-free high-quality protein, so it can play an important role in the diet of people suffering from celiac disease (Kuhn *et al.*, 1996; Doweidar and Kamel, 2011). Quinoa responds to N and P application not only increase yield but also the quality of forage and grain.

The agronomic performance and nutritive value of quinoa was analyzed to define alternatives to local forages for dry season feeding of ruminants and for quality food for human being. So, the investigation was carried out to determine appropriate level of nitrogen and phosphorus for getting the highest yield and quality of quinoa genotypes under central anatolia condition.

2. MATERIALS AND METHODS

The experiment was carried out during growing season (starting 15th March) 2015/2016 in Ankara. Experimental area is located in Central Anatolia zone of the country. Dry and hot in summers cold and snowy in winters. The used soil was a silty-clay loam (20,5 % clay, 21,3 % silt, and 21,6% sand) with pH 6.71, 1,10 % organic matter, 0.058% salt, 0.132% total N, 1.23 ppm phosphorus and 218 ppm potassium. Total rainfall during the vegetation period of the plant (2015-2016) was 179,6 mm, and 172,5 mm. Plants were irrigated three times because of insufficient rainfall (measured quantity about 72 mm). The experiment was conducted in a completely randomized block design with three replications. In the study, 4 different nitrogen (N_0 : 0 kg ha⁻¹, N_1 : 50 kg ha⁻¹, N_2 : 100 kg ha⁻¹ ve N_3 : 150 kg ha⁻¹) and 4 phosphorus levels (P_0 : 0 kg ha⁻¹, P_1 : 30 kg ha⁻¹, P_2 : 60 kg ha⁻¹ ve P_3 : 90 kg ha⁻¹) were tested on Salcedo cultivar. Seeds were sown by hand into rows 35 cm apart and at a depth of 2-3 cm. Each plot was consisted of 6 rows with 5 m).

We investigated herbage (H), hay (dry matter=DM) and grain yield (GY), crude protein (CP) content in DM and grain, acid detergent fiber (ADF) and neutral detergent fiber (NDF) levels in DM. Dry matter (DM) yield, crude protein (CP) content, CP in e-periment. The data obtained were tested to the analysis of variance with the MSTAT-C package program according to the randomized complete blocks e-perimental design, and differences between averages which were found significant were showed by the LSD test (Yıldız and Bircan, 1991).

3. RESULTS AND DISCUSSION

Herbage (H) and Hay (DM) Yield

The results are summarized in Table 1 and 2 Nitrogen and phosphorus level effects were the main sources of variation in all characters tested. The analysis of variance of data revealed effect of nitrogen and phosphorus levels on mean H and DM yield were highly significant differences by a level of significance of $P < 0.01$. H and DM yield of quinoa responded to Nitrogen (N) and phosphorus (P). There were significant differences among fertilization treatments concerning H and DM yields. The analysis of variance of data revealed N-P interaction was highly significant differences by a level of significance of $P < 0.01$. According to the mean result of the N-P interaction on herbage yield. All fertilization (N and P) treatments resulted in values higher than those of the control.. Concerning N-P levels, the average HY ranged from 47.9-28.2 t ha⁻¹, while the highest mean yield (47.9 t ha⁻¹) was recorded in (N_3 - P_3), and the lowest yield (28.2 t ha⁻¹) in N_0 - P_0 applications. Concerning N levels, the average HY ranged from 44.0-32.8 kg ha⁻¹, while the highest mean yield (44.0 kg ha⁻¹) was observed in N_3 (150 kg ha⁻¹), and the lowest yield (32.8 kg ha⁻¹) in N_0 . Concerning P levels, the average HY ranged from 43.4-35.5 t ha⁻¹, while the highest mean yield (43.4 kg ha⁻¹) was recorded in (P_3), and the lowest yield (35.5 t ha⁻¹) in P_0 applications.

Table 1. Average Herbage Yield (HY) (t ha⁻¹)

Fertilizer Level	N_0	N_1	N_2	N_3	Average
P_0	28.2 i	32.8 g	39.1 d-f	42.0 b	35.5 C
P_1	30.5 hi	35.5 f-h	41.4 bc	43.0 ab	37.6 BC
P_2	34.5 g-i	35.2 e-g	40.5 a-d	43.3 ab	38.4 B
P_3	38.0 f-h	41.9 c-f	45.8 a	47.9 a	43.4 A
Average	32.8 C	36.4 AB	41.7 B	44.0 A	

LSD1 %

When the appropriate N and P levels (150 and 90 kg ha⁻¹ respectively) are practiced, the average HY yield increased about by about 69,9 % in N_3 - P_3 plots compared to N-P free, and also it was showned economical. (Table 1,2). In this connection, corresponds with studies of Mahmoud and Sallam (2017) reported that The importance of N application N contents increased by 7.9 and by 39.7% in hay over the control when the plants are fertilized by 14.28 and 28.56 g N m⁻² respectively. Besides, Nitrogen fertilization at rates of 14.28 and 28.56 g m⁻² increased the yield of biomass by about 33.5 and 60% more than the control under fresh and 10 dS m⁻¹ saline water irrigation. Under irrigation with 20 dS m⁻¹, N application by corresponded rates increased the biomass by 57 and 100%, respectively. Kineber et al.(1991) reported that nitrogen application enhance vegetative growth as well as the metabolism process in the plant and increase in dry matter accumulation. Myers (1998) found a mean yield increase of 42% at N application rates of 180 kg ha⁻¹. Quinoa responds well to nitrogen fertilization (Berti et al., 2000; Schooten and van Pin-terhuis, 2003; Erley et al., 2005).

Table 2. Average Hay (DM) Yield ($t\ ha^{-1}$)

Fertilizer Level	N ₀	N ₁	N ₂	N ₃	Average
P ₀	6.9 i	8.2 gh	9.9 e	10.1 d	8.8 C
P ₁	7.8 h	9.0 ef	10.1 d	10.5 dc	9.4 C
P ₂	8.7 g	10.0 de	10.7 c	11.2 b-c	10.2 B
P ₃	9.2 ef	10.3 cd	12.4 b	13.2 a	11.3 A
Average	8.2 C	9.40 B	10.8 A	11.2 A	

LSD1 %

The average DM yield ranged from 11.3 - 8.8 $t\ ha^{-1}$, while the highest mean DM (11.3 $t\ ha^{-1}$) was observed in P₃ (90 kg ha^{-1}) and the lowest (8.8 $t\ ha^{-1}$) in P₀, besides, the mean DM yield ranged from 11.2 - 8.2 $t\ ha^{-1}$, while the highest mean yield (11.2 $t\ ha^{-1}$) was observed in N₃, and the lowest yield (8.2 $t\ ha^{-1}$) in N₀. (Table 2). The analysis of variance of data revealed N-P interaction on mean yield was highly significant differences and ranged from 13.2 - 7.8 $t\ ha^{-1}$. the highest mean DM yield (13.2 $t\ ha^{-1}$) was observed in N₃-P₃ and the lowest in N P free. In this connection Many researchers informed that nitrogen application enhance vegetative growth as well as the metabolism process in the plant and increase in dry matter accumulation (Kineber *et al.*, 1991). Malik *et al.* (1993) found that N₂-fixing bacteria produce plant growth hormones such as indole acetic acid, gibberellins and cytokinins. Nitrogen fertilization is reported to effect developmental stages of crop (Khan *et al.*, 2013; Thanapornpoonpong *et al.*, 2008). Our findings are in accordance with those researcher's results. Quinoa responds positively to the nitrogen and phosphorus levels. Schootenand and Pin-terhuis (2003) reported that N level had a significant effect on DM content.

According to the result the increase in H and DM yield were observed depending on nitrogen and phosphorus levels. These results indicated that H and DM yield of quinoa well responded to N application. The more nitrogen and phosphorus are applied, the more H and DM yield are obtained.

Crude Protein (CP) Content of DM

The analysis of variance of data revealed effect of N and P and N-P interaction on average CP was highly significant differences by a level of significance of $P < 0.01$. CP content responded to N and P positively as a result of statistical analysis. According to the mean result of CP content the ranged from 11.22% - 13.45. In terms of P effect while the average highest CP content (13.45 %) was observed in P₃, and the lowest (12.19 %) in P₀ (fertilizer free). In terms of N effect the average CP ranged from 11.22 % - 14.50 %.. The analysis of variance of the data showed that N-P interaction effect on CP content was highly significant.

Table 3. Average CP Content of DM (%)

Fertilizer Level	N ₀	N ₁	N ₂	N ₃	Average
P ₀	10.90 h	11.80 ef	12.12 fg	13.95 ab	12.19 C
P ₁	10.40 h	12.70 d-f	13.03 a-c	14.15 ab	12.60 B
P ₂	11.51 g	13.26 c-f	13.81 a-d	14.93 a	13.40 A
P ₃	12.06 fg	12.95 b-e	13.89 ab	14.91 a	13.45 A
Average	11.22 D	12.70 C	13.21 B	14.50 A	

LSD1 %

According to the mean result, CP content the ranged from 11.40 % - 14.91 %. In terms of N-P interaction, while the lowest CP ratios were obtained from N₀ - P₁ (10.40 %), the highest average CP content the ranged from 14.93 % were recorded in N₃-P₂. Because N is essential in the formation of protein, and protein makes up much of the tissues of most living thing, N level had more effect on CP content than P level (interaction $p < 0.01$, Table 3). Schootenand and Pin-terhuis (2003) reported that at 70 and 84 growing days there was a substantial effect of N level on CP content.

Acid Detergent Fiber Level (ADFL)

The results are summarized in Table 4. The analysis of variance of data revealed effect of N and P levels and N-P interaction on mean ADFL were highly significant differences by a level of significance of $P < 0.01$. According to the mean result of the ADFL ranged from 28.60 % - 30.95 %. In terms of N-P interaction the highest average ADFL content the ranged from 32.38 were recorded in N₁-P₀, while the lowest ADFL content (26.19 %) were obtained from N₃-P₂. Concerning P levels, while the highest ADFL (30.95 %) was recorded in P₀, and the lowest (28.85 %) in P₂ levels. Likewise, the average ADFL ranged from % 28.60 - 30.81 %, while the highest ADF (30.81 %) was observed in N₁, and the lowest (28.60 %) in N₃. As the N level increase, ADFL decrease. Acid detergent fibre (ADF) is a major indicator of digestibility, negatively affects feed quality (Han *et al.*, 2003). Kakabouki *et al.* (2014) reported that there were significant differences between fertilization treatments concerning the ADF content. The highest ADF content was found

under N₂ (200 kg ha⁻¹) treatment. Forage intake is affected by crude protein, fibre and ash content (Ibrahim et al., 2012). Corresponds with studies of Kering et al. (2011) reported that N fertilization consistently decreased ADF content in berrnuda grass forage.

Table 4. Average Acid Detergent Fiber (ADFL%)

Fertilizer Level	N ₀	N ₁	N ₂	N ₃	Average
P ₀	29.19 e	32.38 a	31.59 b	30.66 bc	30.95 A
P ₁	30.05 bd	31.00 c	29.50 e	29.21 e	29.94 AB
P ₂	30.12 b-d	29.45 e	29.67 e	26.19 f	28.85 B
P ₃	31.60 b	30.41b c	29.30 e	28.31 ef	29.90 AB
Average	30.24 B	30.81 A	30.02 B	28.60 C	

LSD1 %

Correspond with study of Balabanlı et al. (2010) reported that N fertilization significantly decreased native rangeland ADF content from 46.45 to 39.02%. Digestibility is the most common nutritive parameter used in feeding standards for ruminants and is the basal unit when evaluating the nutritive value of forage (Tassone et al., 2014). ADF is insoluble protein, as the ADF level increase, digestible energy levels decrease. The ADF concentration of fertilized herbage were significantly lower in plots with additions N+P than in plots P free. The ADF concentration were affected by N+K fertilization. Increasing N fertilization decreased cellulose and lignin contents from 29.30 to 24.18% and 6.85 to 2.77%. Cellulose and lignin contents decreased from N+P and N+K fertilization. However, application of N, P and K did not affect hemicellulose content of native rangeland. In our study N and P applications have contributed reducing of ADFL, and increasing of digestibility.

Neutral Detergent Fiber Level (NDFL %)

The results of NDFL are summarized in Table 5. In the light of information of analysis of variance of data revealed effect of N levels and N-P interaction on average NDFL were highly significant differences by a level of significance of P<0.01. There were no significant differences among P fertilization treatments concerning the NDF content. That means P levels effect on NDFL was not significant statistically. N levels effect on NDFL was highly significant. According to the mean result of the NDFL ranged from 40.24 % - 44.49 %. While the highest NDFL was recorded in N₂ (150 kg ha⁻¹) and the lowest in N₃. (150 kg ha⁻¹). The analysis of variance of the data showed that N-P interaction effect on NDFL was highly significant. According to the mean result of NDFL the ranged from 38.32% - 47.53 %. The highest average NDFL was recorded in N₁ -P₀, and N₂ - P₁, while the lowest NDFL was observed in N₃-P₁. As the N level increased, NDFL decreased. The NDFL were significantly lower in N₁-P₁ (38.32 %) than N₁-P₀ (47.53 %). The results showed that as N level increases, NDFL decreases. The NDF level is one of the most parameters concerning the digestibility for ruminants.

Table 5. Average Neutral Detergent Fiber (NDFL) (%)

Fertilizer Level	N ₀	N ₁	N ₂	N ₃	Average
P ₀	42.61 bc	47.53 a	45.22 ab	38.52 c	43.47
P ₁	43.01 b	42.08 bc	47.20 a	38.32 c	42.65
P ₂	45.42 ab	44.20 b	43.12 bc	39.55c	43.07
P ₃	44.08 b	45.18ab	44.17 b	44.55 b	44.49
Average	43.78 B	44.75 A	44.92 A	40.24 C	

LSD 1 %

Corresponds with studies of Balabanlı et al. (2010) reported that N and P fertilization significantly decreased native rangeland NDF content from 74.32 to 68.46%. The NDF concentrations were significantly lower in plots with additions N+P than in plots P free. Increasing N fertilization decreased cellulose and lignin contents from 29.30 to 24.18% and 6.85 to 2.77%.

Grain Yield (GY)

The results are summarized in Table 7. The analysis of variance of data revealed effect of nitrogen and N-P interaction on mean GY were highly significant differences by a level of significance of P<0.01. All fertilization (N and P) treatments resulted in values higher than those of the control. But Concerning P levels, the average GY ranged from 0.94 – 1.10 t ha⁻¹, the effect of P levels may be extremely minor. Thus, P level was not statistically significant of P<0.01. In respect of N levels, the average GY ranged from 10.84 – 1.30 t ha⁻¹, while the highest average yield was observed in N₃ (150 N ha⁻¹), and the lowest yield in N₀ (N free). In our study, the grain yield of quinoa increased with the increasing nitrogen level from 0 to 150 kg N ha⁻¹. The analysis of variance of data revealed N-P interaction was highly significant differences by a

level of significance of $P < 0.01$. According to the mean result of the N-P interaction on GY from 0.71 -1.50 t ha⁻¹. The highest average GY observed in N₃-P₂, while the lowest yield by in N₀-P₀. As N and P levels increased, GY increased. Our data showed that N levels effect on GY was higher than P levels, Findings showed that all values of P levels effect were the same in N₂ level, but there were significant differences among other nitrogen treatments (N₀₋₁₋₂ and N₃) statistically. The increase of yield is depends on N and P level in soil. The GY increased in optimum N and P treatments.

In this connection, corresponds with studies of Mohommad et al. (2017) reported that nitrogen fertilization at rates of 14.28 and 28.56 g m⁻² increased the seed yield where the application of nitrogen significantly increased the yield under non-saline and saline conditions of irrigation water. Besides, N contents in seed increased by 15,9 and 36,8% in seeds over the control when the plants are fertilized by 14.28 and 28.56 g N m⁻², respectively.

Table 6. Average Grain Yield (t ha⁻¹)

Fertilizer Level	N ₀	N ₁	N ₂	N ₃	Average
P ₀	0,71 d	0,73 d	1,10 b	1,20 b	0,94
P ₁	0,82 cd	0,82 cd	1,10 b	1,30 ab	1,00
P ₂	0,90 bc	0,91b c	1,12 b	1,50 a	1,10
P ₃	0,93 bc	0,97bc	1,16 b	1,20 b	1,06
Average	0,84 C	0,86 C	1,12 B	1,30 A	

Razzaghi et al. (2012) and Schulte auf'm Erley et al. (2011) reported that nitrogen improved both biomass and seed yield. Geren (2015) reported GY in quinoa crops ranged from 867 kg to 3308 kg ha⁻¹ there were significant differences between nitrogen treatments concerning the yield and the highest grain yield (3308 kg ha⁻¹) was found in the at 150 kg N ha⁻¹ level. Erley et al. (2005) stated that grain yield of quinoa was affected by nitrogen fertilization from 0 to 120 kg ha⁻¹ being 1790 kg to 3495 kg ha⁻¹. Jacobsen et al. (1994) informed that there was a significant grain yield increase when the amount of nitrogen fertilizer was increased from 40 to 160 kg N ha⁻¹ and, the yield decreased by 24–1% when the nitrogen supply was reduced from 160 to 40 kg N ha⁻¹, while the yield decrease was 120 kg N ha⁻¹ and 2–7% when the nitrogen supply was reduced to 80 and 120 kg N ha⁻¹, respectively. In addition, Shams (2012) reported that the increases in quinoa grain yield per hectare with the increase in N fertilizer application from 90 up to 360 kg N ha⁻¹ over the control treatment were 518%, 769%, 936% and 1394% in average of both years. Gomaa (2013) informed that the application of 0, 119 and 238 kg N ha⁻¹ with biofertilizers led to consistent increase the grain yield per hectare of quinoa as compared with untreated plants (control) over the years. Kakabouki et al. (2014) reported that nitrogen fertilization increased also the grain yield of quinoa under different tillage system.

Crude Protein Content of Grain (GCP)

The analysis of variance of data revealed effect of N, P and N-P on GCP content were highly significant differences by a level of significance of $P < 0.01$. All fertilization (N and P) treatments resulted in values higher than those of the control. According to the mean result of GCP content the ranged from 12,03 % - 15.84 %. In regard to P, the average GCP content ranged from 13.35 % - 15.84 %. while the highest average GCP content was recorded in (P₃), and the lowest in P₂. Besides, concerning N levels, the average GCP ranged from 12.03 % - 16.18 %. Wile the highest mean GCP was observed in N₃, and the lowest in N₀. The analysis of variance of data revealed N-P interaction was highly significant differences by a level of significance of $P < 0.01$. According to the mean result of the N-P interaction on GCP ranged from 11,22 % - 16,80 %. The highest mean GCP content observed in N₃-P₃, while the lowest in N₀-P₀. GCP increase was significantly high (about 45,9 %) in N₃-P₃ plots.

Table 7. Average Crude Protein Content of Grain %

Fertilizer Level	N ₀	N ₁	N ₂	N ₃	Average
P ₀	11.22 f	12.43 ef	13.76 c-f	16.27 a	13.42 B
P ₁	12.16 ef	13.90 c-e	14.06 b-d	15.83 ab	13.99 B
P ₂	12.28 d-f	12.56 d-f	12.75 d-f	15.80 ab	13.35 B
P ₃	12.48 d-f	15.52 a-c	15.57 a-c	16.80 a	15.84 A
Average	12.03 C	12.85 C	14.03 B	16.18 A	
LSD 1 %					

In this connection, corresponds with studies of Basra et al., (2014) informed that the major fact that determines the grain protein content is nitrogen availability, and quinoa is highly responsive to nitrogen fertilizer and higher CP content, in a crop with high yield, can be obtained just by application of higher nitrogen quantities. The higher protein content at higher nitrogen levels was mainly due to the structural role of nitrogen in building up amino acids (Finck, 1982; Bhargava et al., 2006; Miranda et al., 2013). The progressive increase in protein contents of quinoa seed with the increasing nitrogen rates

were also reported by many research workers (Jacobsen et al., 1994; Erley et al., 2005; Shams, 2012). Erley et al. (2005) informed that average CP content of quinoa cultivars (Faro and Cochabamba) increased gradually (12.3% to 14.6%, respectively) with the increasing nitrogen levels from 0 kg N to 120 kg N ha⁻¹ and, Miranda et al. (2013) reported an average CP content of 18.8% using cold resistance quinoa cultivars (Regalona Baer and Villarrica). Kakabouki et al. (2014) also stated that increasing nitrogen level, increased CP content of quinoa from 7% to 27% under different tillage system.

The study has shown that quinoa plant has high potential as a an alternate forage crop concerning yield and quality, and its grain for human food and also possibilities of quinoa cultivation in arid affected areas in Turkey.

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Effect on *Fusarium culmorum* of Fungicides Used in Wheat Seed

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Abstract: *Fusarium culmorum* (W. G. Smith) Sacc. In our country, wheat causes significant yield loss in root, stem, stem and head in the fields. It is the cause of severe infections, especially in moist and climatic conditions. Seed application is important with fungicides. This study was carried out to determine the sensitivity of *Fusarium culmorum* isolates to wheat seed licensed fungicides and the effect of fungicides on pathogens, which were obtained from the wheat cultivation areas of Trakya region. It has been determined that the *F. culmorum* isolates differed in sensitivity to prothioconazole+tebuconazole, tebuconazole and carboxine+thiram effective fungicides used in seed spraying and EC₅₀ values were changed according to fungicides or isolates. Germination seeds and plant height (cm) and disease severity (%) were found to be significantly different ($P \leq 0.05$) effect of fungicides used on seed when compared with control.

Keywords: Wheat, *Fusarium culmorum*, fungisid, sensitivity

1. INTRODUCTION

The extensive adaptation ability of wheat along with its use in many areas such as food and industry sectors, especially as bakery products, has placed it on top of the world among the cultivated plants in terms of cultivation and production. Wheat production in our country is 20.600.000 tons. When handled on the regions basis, Trakya Region, with its climate and fertile soil presence, is among the important wheat planting fields in our country. With more than 550 thousand hectares of cultivation and 2.3million tons of wheat production it produces 11% of the wheat production of our country, and with a yield far above the Turkey average, which is 385 kg /decare, it draws attention (TÜİK, 2017).

After-harvest losses in wheat farming have been determined as 20% due to plant diseases of the wheat produced every year (Wiese, 1987). Among these fungal disease agents causing severe infections in wheat, *Fusarium* is of great importance because of having much species, being both seed-borne and soil-borne, and being able to grow saprophytically in different ecological conditions and in harvest residues in quite different hosts (Cook, 1980; Hill et al. 1983). *Fusarium culmorum* and *Fusarium graminearum* have been identified as the most pathogenic species among other *Fusarium* species (Cook, 1980; Smiley and Paterson, 1996; Arslan and Baykal, 2002; Demirci, 2003; Aktaş, 1997; Fernandez and Chen, 2005, Köycü and Özer, 2014).

Since the *F. culmorum* and *F. graminearum*, until the period between planting wheat seeds and coming into ear, cause pre-emergence mortality in the field by adversely affecting the germination and plowing power of the seed via conidial or chlamydospore infections (Jones, 1999; 2000; Lawrence vd., 2007); whereas in seedling infections, symptoms to be seen in post-tillering period as a result of plant development in ill plants to be continued (Beddis and Burgess, 1992); are able to cause severe infections in near-harvest period by causing inhibition of chlorophyll in ears and white ear emergence with no grain (Buerstmayr et al. 2000; Dill-Macky, 2010) in the field by infecting grains in blooming (anthesis) period in humid climate conditions, especially such as our region, in which wheat's sensitivity in head blight disease is highest (McMullen et al. 2008), increase further the importance of these factors. However, mycotoxins such as deoxynivalenol (DON), zearalenone (ZEA) and nivalenol (NIV) are produced on the contaminated grains and *Fusarium* as a result of infections occur during the blooming period (anthesis) of the wheat (Muthomi vd., 2000; Scherm et al. 2013). Researchers have reported that in case the rate of grain with these mycotoxins overpasses 5% in the product, it affects human and animal health adversely (Dubin et al. 1997). There exist studies conducted on the effect of fungicides on *Fusariumculmorum* and *F. graminearum*'s production of mycotoxin. With the field investigations done on the wheat varieties which are resistant to *Fusarium culmorum* on an intermediate level, it is demonstrated that from the Azole group of fungicides bromuconazole, cyproconazole, metconazole, prochloraz, propiconazole, prothioconazole, tebuconazole and strobil (azoxystrobin) are influential in reducing the production of mycotoxin in the dane for a maximum of 70% (Chala et al. 2003; Jones, 1999; Menniti et al. 2003; Paul et al. 2008). Researchers who emphasize especially the importance of the time of application when it comes to decreasing the production of mycotoxin have determined that the applications done during the anthesis period of wheat inhibit the mycotoxin production of the pathogen for 48% (Balandino et al. 2006).

In the research carried out on the wheat breeds cultivated most extensively within our region, Gelibolu, Golia, Sagittario, Nina, Krasunya, Esperia ve Sana, it is detected that the infection severity of *Fusarium* sp. pathogens differed dependent on the wheat varieties and the tolerances against the pathogen of these varieties were diverse (Köycü and Özer, 2014). Within the breed of *Fusarium*, the isolates of *F. culmorum* being frequently acquired and designated as the most pathogen

type (Tunalı et al. 2008; Hekimhan, 2010; Arıcı et al. 2013; Köycü and Özer, 2014) puts forth the cause of disease's importance with regards to our region. The detection of sensitivity level of *F. culmorum* to fungicides licensed for seed in wheat is significant in terms of knowing the sensitivity conditions that may emerge in the population and providing the continuity of the fungicide's effectiveness. The level of sensitivity of *Fusarium culmorum*, which is designated as an important pathogen type in wheat in our country, to fungicides that include carboxin+thiram, prothioconazole+tebuconazole ve tebuconazole licensed to seed in wheat and determination in case of seed/soil infections of *Fusarium culmorum* the effectiveness of fungicides on this pathogen generates the main aim of this research.

2. MATERIALS AND METHODS

The trial is planned in two ways as the detection of *Fusarium culmorum* isolates' sensitivity to fungicides used in seed in petri dishes (*in vivo*) and the detection of the effectiveness of fungicides on the pathogen in pot conditions (*in vitro*). *Fusarium culmorum* (S-14) (Köycü ve Özer, 2014), previously classified as the most pathogen isolate in Flamura-85 and Pehlivan species and fungicides with the effective substance of carboxin+thiram (Vitavax 200 FF, Hektaş Ticaret T.A.Ş.), prothioconazole+tebuconazole (Lamardor New 170 FS, Bayer Cropscience) and tebuconazole (Raxil Ultra FS 120, Bayer Cropscience) which are licensed to seed in wheat are used for the trial.

In vivo Tests

In order to appoint the fungicide's rate of inhibition of the *F. culmorum* isolates' mycelial growth after fungicides' stock solutions are prepared in sterilized distilled water on the basis of 0 (control), 0.01, 0.03, 0.1, 1, 3, 10, 30, 100, 300 µg/ml doses of active substance and diluted, they are added to the PDA (Potato Dextrose Agar, Merck) nutrient media in the erlenmeyer flask sterilized in autoclave under 120°C and 1 atm. pressure and cooled to 50°C. The nutrient media in which fungicide is added and not added (control) are distributed over 25 ml sterilized petri dishes evenly. After isolates' 6 mm diameter disks developed in the PDA nutrient media in darkness and under 22±1°C are placed into the petri dishes, they are left to incubation in complete darkness under 22±1°C for the time period of 6 days. At the end of the duration for the incubation, by measuring *F. culmorum* isolates' colonial development diameter, calculating the EC₅₀ (dose that inhibits mycelial growth by 50%) values according to the control it is determined with the graphing of the percentage development values onto a log-probit paper (Delen et al. 1984). Furthermore, the MIC (minimum inhibition concentration) µg/ml values of the isolates have been detected as the lowest dose in which isolates cannot demonstrate colonial development.

In vitro Tests

For the investigation of the effectiveness of the fungicides F-85 bread wheat which is sensitive to *F. culmorum* S-14 is used. Spore suspensions that are taken from the 10-days cultures of *Fusarium culmorum* S-14 isolate in PDA nutrient media under 22±1°C and prepared as 1X10⁶ conidiospor/ml are inoculated both to the seed and the soil. The mixture of Torf (Klasman-Deilmann) and sand in the ratio of 1/3 is used after sterilizing in the autoclave under 121°C for 1 hour.

Seed inoculation tests; after seeds belonging to the F-85 type are waited in 1% NaOCl (sodiumhypochlorite) for 5 minutes, rinsed in sterilized distilled water for twice and Tween 20 (polyxyethylenesorbitanmonolaurate) is added the seed is inoculated by the pathogen being bathes with the spore suspension for 1 hour in the shaker. Carboxin+thiram (300 ml/100 kg seed), prothioconazole+tebuconazole (50 ml/100kg seed) and tebuconazole (25 ml/100 kg seed) fungicides were applied to the infected seeds according to the recommended mercantile doses and were planted into the pots (12x10 cm) in 20 pieces and 3 cm under the surface, afterwards were placed into the climate chamber for 30 days.

Soil inoculation tests; after the spore suspension prepared in the ratio of 1X10⁶ conidiospore/ml is inoculated into every pot as 200 ml, the pots were incubated under the conditions specified above for a week, these pots were sterilized as in mentioned above and the plantation of the seeds which received the fungicide application were done identically (Stadnik ve Dhingra, 1997). Fungicide applications were not done to the control pots.

The pots were left to incubation for 16 hours under light, 70% humidity and 22±1°C temperature. Pot trials were established according to the coincidence parcels experimental patterns as 5 repetitions and 2 pots in every repetition. In developing young wheat seedlings, 15 days following the plantation date to the pots counting of the plants were done in terms of percent germination ratio (%) in the pots. Subsequently, 30 days after, 10 plants chosen randomly from every pot were taken and with the plant heights of the seedlings measured from the root crown as in cm, the evaluation of the disease severity (%) occurring in the root and the root collar was performed by using the 0-5 scale (0: healthy plant; 1: Necrotic area is lower than 25% 2: Necrotic area is between 25-50% 3: Necrotic area is between 51-75% 4: Necrotic area is greater than 75% 5: Plant is dead) (Modifiye edildi, Wildermuth ve McNamara, 1994). The evaluation of disease severity was executed taking the Townsend-Heuberger formula as the basis (Townsend-Heuberger, 1943).

Data Analysis

The evaluations of the investigations on the effectiveness of the fungicides were subjected to variance analysis and the

differences between the averages were executed using SPSS (version 18; IBM Corp., Armonk, NY) according to the Duncan Multiple Comparison Test.

3.RESULTS AND DISCUSSION

In vivo tests

F. culmorum isolates' sensitivity to fungicides with the active ingredients of prothioconazole+tebuconazole (Lamardor), tebuconazole (Raxil) and carboxin+thiram (Vitavax) used in seed application is detected. As a result of these examinations it is concluded that there exists differences in the sensitivities of isolates to the fungicides; EC₅₀ values vary according to the isolates or the fungicides.

For prothioconazole+tebuconazole (Lamardor), it is determined that the EC₅₀ values of the isolates altered between 1-2.5 µg/ml and the greatest EC₅₀ value belonged to the S-14 isolate (2.3 µg/ml). For tebuconazole (Raxil), it is identified that the EC₅₀ values were between 0.18-0.23 µg/ml and while the greatest EC₅₀ value belonged to the S-14 isolate, the lowest EC₅₀ value was in the Ç-1 isolate. For carboxin+thiram (Vitavax), it is detected that the EC₅₀ value of the isolates ranged between 21-29.5 µg/ml and while the highest EC₅₀ value belonged to the Ç-1 isolate the lowest EC₅₀ value was present in F2-5 isolate. The EC₅₀ value of the S-14 isolate was concluded to be close to the EC₅₀ value of the Ç-1 isolate with 28 µg/ml.

When the EC₅₀ values were evaluated in terms of fungicides, it is discovered that the greatest EC₅₀ value belonged to the fungicide with the active substance of carboxin+thiram and this was followed by prothioconazole+tebuconazole and tebuconazole respectively. The EC₅₀ value of the fungicide with Tebuconazole active substance was <1; yet, the EC₅₀ value of prothioconazole which contains the same active substance was determined as <1.

Considering the isolates' inhibition values of mycelial growth (MIC), they are determined as 10 µg/ml for prothioconazole+tebuconazole, only for tebuconazole, 10 µg/ml for S-14 isolate, 3 µg/ml for all other isolates and 300 µg/ml for carboxin+tebuconazole.

Table 1. EC₅₀ and MIC (µg/ml) values for fungicides with the active substances prothioconazole+tebuconazole, tebuconazole and carboxin+thiram of the *F. culmorum* isolates.

Isolates	prothioconazole+tebuconazole (Lamardor)		tebuconazole (Raxil)		carboxin+thiram (Vitavax)	
	EC ₅₀	MIC	EC ₅₀	MIC	EC ₅₀	MIC
F2-5	1.3	10	0.18	3	21	300
Ç-1	1.2	10	0.16	3	29.5	300
S-4	2.25	10	0.19	3	26.5	300
S-14	2.3	10	0.23	10	28	300

In vitro tests

The influence of fungicides which are used in seed on germination (%), plant heights of seedlings (cm) and disease severity (%) when infecting the plant through the seed/soil path of the pathogen is observed under *in vivo* conditions (Figure 1). As the result of the evaluations performed, it is recognized that for the infections through the pathogen's seed/soil paths there is a significant difference ($P \leq 0.05$) between the germination rate of the seed in which the fungicide application was not executed (control) and the germination rate of the seed in which fungicide application was performed. For fungicide-applied seeds, the germination rate was increased in infection through the seed and the germination rate ranged between 91-96% along with the germination rate in infections through soil altering between 86-89%. For seeds with the lack of fungicide application, the germination rate was determined to be 63% in infections through the seed and 67.4% in infections through the soil. Rate of germination is determined to be higher in infections through seed/soil with the application of the fungicide with the active substance of prothioconazole+tebuconazole (Lamardor) compared to the other two fungicides (89% and 96%); however, when the applications are evaluated among themselves it is noticed that there does not exist an important difference ($P \geq 0.05$) between the fungicides. While, the fungicide with the active substance tebuconazole (Raxil) took the third place (91%) according to the rate of germination in infections through the seed; it took the second place in encouraging the rate of germination of the seed in infections through the soil.

Evaluating the effect of fungicides on the plant height of seedling obtained from seeds, an important difference ($P \leq 0.05$) from the control (33.08 cm) is detected in pathogen's infection through seed; yet, no difference was observed in pathogen's infection through soil. Fungicides are determined to affect to plant height positively in pathogen's seed-borne infections.

Along with this, the greatest plant height (40.33 cm) is recorded with the application of the fungicide containing the active substance of prothioconazole+tebuconazole and a significant difference ($P \leq 0.05$) is noticed between it and the height of the plant in which the fungicide with the active substance of carboxin+thiram (Vitavax) is applied. There were no differences observed between the applications performed afterwards the soil-borne infections of the pathogen. The order indicating the fungicides effect of encouraging the height of the plant is determined to be as follows; prothioconazole+tebuconazole (Lamardor), tebuconazole (Raxil) and carboxin+thiram (Vitavax)

The evaluation of the influence of fungicides on the disease severity of seedlings obtained from seed, has led to the detection that the fungicide application to the seed causes a significant difference ($P \leq 0.05$) from the control after the pathogen's seed/soil-borne infection. After the seed-borne infection, the disease severities for control, prothioconazole+tebuconazole (Lamardor), tebuconazole (Raxil) and carboxin+thiram (Vitavax) were found to be 54.8%, 18.4%, 24% and 39.6% respectively. After the soil-borne infections, the disease severities for control, prothioconazole+tebuconazole (Lamardor), tebuconazole (Raxil) and carboxin+thiram (Vitavax) were found to be %75.6, %21.8, %32.8 and % 31.6 respectively. It is determined that with the application of fungicide to the seed, the disease severity of the seedlings is drastically decreased by all fungicides in the pathogen's seed/soil-borne infection. When the fungicides are evaluated according to seed/soil-borne infections, prothioconazole+tebuconazole (Lamardor) has been determined as the most effective out of all fungicides for both types of infections. Along with this, while the effect of the mixture with the active substance of prothioconazole+tebuconazole (Lamardor) and the fungicide with the active substance of tebuconazole (Raxil) on the disease severity of the pathogen's seed-borne infection did not importantly differ between the two fungicides; after the soil-borne infection of the factor, there appeared a significant ($P \leq 0.05$) difference between the disease severities of the two fungicides.

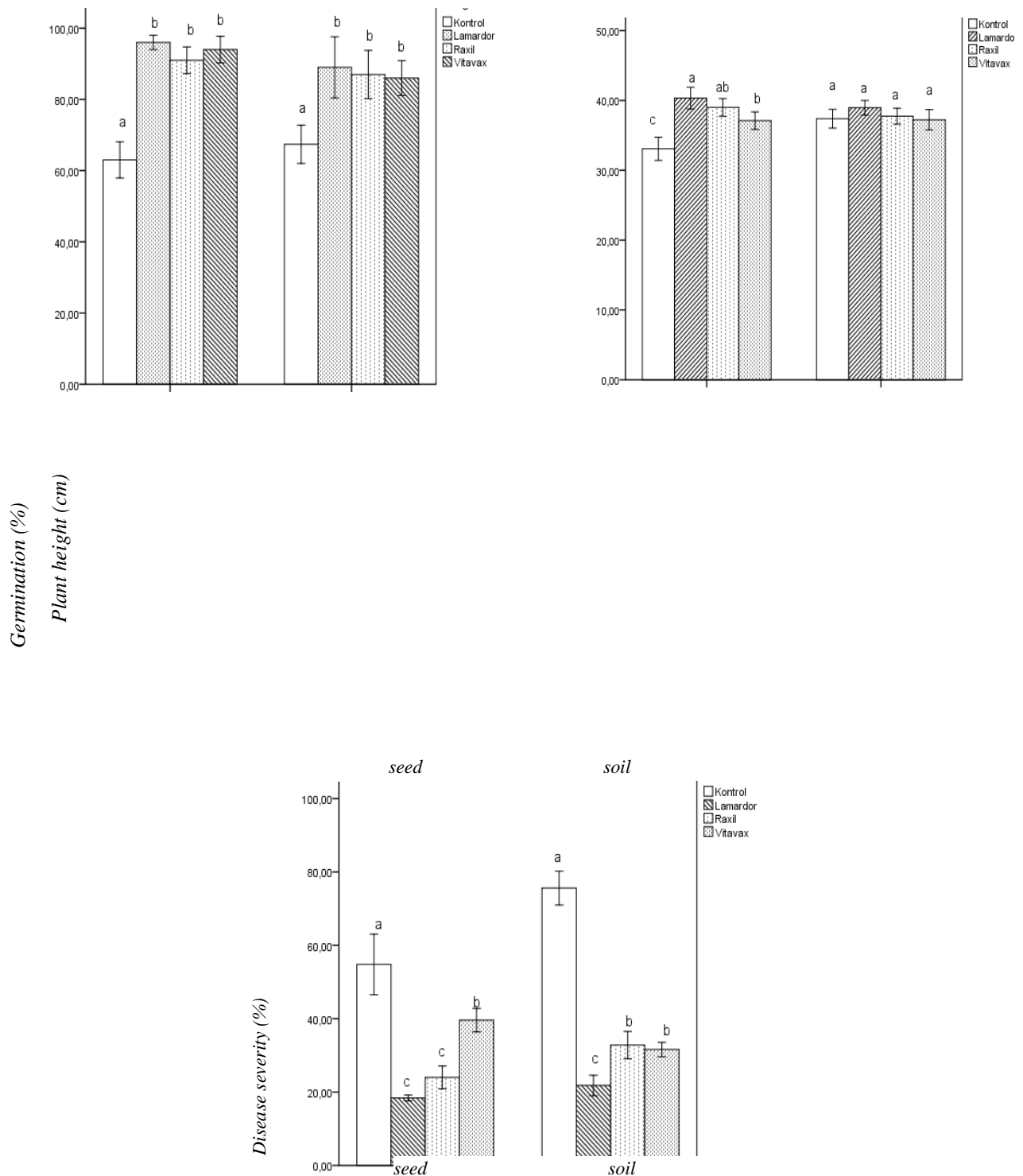


Figure 1. Influence of fungicides on the rate of germination (%), height of the plant (cm) and the disease severity (%) of the seedlings in *F. culmorum* infection through seed/soil.

The variety between the fungicides that belong to the seed/soil application are equally important than each other according to the Duncan Multiple Comparison Test ($P \leq 0.05$).

Interpreting the effectiveness of fungicides on the disease severity of seedlings obtained from seeds, the efficiency of the fungicide with the active substance prothioconazole+tebuconazole (Lamardor) is found to be 66.42% in pathogen's

seed/soil-borne infections (Table 2). Besides, the effectiveness of the fungicide is detected to be higher (71.17%) in pathogen's soil-borne infections. Fungicide with the active substance Tebuconazole (Raxil) is discovered to be 56% effective on the seed/soil-borne infections of the pathogen. Furthermore, the fungicide with the active substance carboxin+thiram is determined to be more effective on the pathogen in soil-borne infections; yet, less effective in seed-borne infections. In conclusion, it is determined that the influence of the fungicide may vary according to the seed/soil-borne infections of *F. culmorum*.

Table 2. Percent (%) effectiveness of fungicides against seed/soil-borne infections of *F.culmorum*

Fungicides (a.i)*	Effectiveness (%)	
	Seed	Soil
Prothioconazole+tebuconazole (Lamardor)	66,42	71,17
Tebuconazole (Raxil)	56,20	56,61
Carboxin+thiram (Vitavax)	27,74	58,20

*a.i.;active ingredient

One of the crucial problems present in the chemical conflict of fungal pathogens is the development of resistivity among the fungus population over time as a result of decrease in the sensitivity to the fungicide. It is known that in case the determined effective concentration (EC_{50}) for an isolate is several times greater than the normal concentration which inhibits the isolate's growth there occur a decrease in sensitivity of the pathogen to the fungicide. Hence, the detection and subsequently following the EC_{50} values of the isolates is highly crucial in determining whether such a risk that may occur within the pathogen population under field conditions exists or not. The generation of resistivity to fungicide within the fungal population is caused by the alterations in the final organism. If such an alteration is caused by a change in the genetic structure of the fungus, the resistivity occurring against the fungicide is permanent. Whereas, for resistance occurring without the cause of a change in the genetic structure of the fungus, the fungus may regain its prior sensitivity. For pathogens to resistance to multiple places inhibitor fungicides which possess multiple impacts mechanism in a fungal cell is greatly difficult when encountered with fungicides which possess a single impact mechanism in a fungus cell. Whereas, previous researches conducted indicate that the fungus may gain resistivity to multiple place inhibitor fungicides (Yeşil ve Boyraz, 2010; Delen, 2016).

Fungicides with the active substances of prothioconazole+tebuconazole and tebuconazole which were utilized during the trials are classified as the sterol biosynthesis inhibitors from the single place inhibitor fungicides group. Fungicides that belong to this group have the feature to inhibit the biosynthesis of ergosterol which plays an elemental role in the cell membrane of the fungi, as well as inhibiting fungal development by causing excess electrolyte loss within the cell. At the same time, as fungicides have systemic features, they are commonly and effectively used in the fungicide applications to seeds and leaves. Mixture fungicide with the active substance carboxin+thiram falls within the group of systemic fungicides which of carboxin belonging to the Succinate Dehydrogenase Inhibitor (SDHI) group; yet, it is mostly specialized to the Basidiomycotina members. Thiram is effective on diseases that are caused by Oomycotina and Ascomycotina/Deuteromycotina belonging to the group of Dithiocarbamate that cannot be a group of systemic fungicides (Siegel, 1981; Delen, 2016). Although it is known that the breeds of *Fusarium* belong to the group of pathogens that carry a low risk of resistance to fungicides, *F.culmorum*'s occurrence of resistance to Benzimidazoles in potato and clove through the factor of pink decay is reported (Anonymous 2016). In this investigation executed, it is considered that in the determination of the EC_{50} values of the fungicide with the active substance tebuconazole being lower than those of prothioconazole+tebuconazole (Lamardor) may be sourced by the fact that the rate of active substance of the fungicide with tebuconazole (Raxil) being higher and a possible decrease in the pathogen's sensitivity to prothioconazole may have occurred. For the fungicide with the active substance carboxin+thiram (Vitavax), when it is compared with the two other fungicides, it is considered that in the detection of EC_{50} values as higher, following the seed application pathogen's exposure to the active substance thiram may have resulted in the decrease of sensitivity of the *F. culmorum* (S-14) isolate to this active substance. Researchers have discovered that the *F. culmorum*'s sensitivity to fungicides may be of different levels. In fact, Akgül (2008) have determined that in wheat *F.culmorum*'s colonial growth in 0,5-50 µg/ml doses of prothioconazole+tebuconazole is greater than that of tebuconazole. Again, in the same study, the MIC value for prothioconazole+tebuconazole is determined to be 25, 50 for tebuconazole and >50 µg/ml for carboxin+thiram. However, studies done with the *F. culmorum* (S-14) isolate, MIC values for prothioconazole+tebuconazole and tebuconazole have been detected as <25 µg/ml. Within our region, although *F. culmorum* is a common pathogen type in wheat and known as the cause of significant efficiency losses for wheat, there exists no study regarding the sensitivity level of the pathogen to fungicides. When the facts that S-14, determined as the isolate with the highest pathogenicity previously, has the greatest EC_{50} values for fungicides with both of the active substances prothioconazole+tebuconazole and tebuconazole and fungicides with the active substance tebuconazole is utilized for green fumigation are considered, this investigation puts forth the importance of constant tracking of the pathogen's sensitivity level amongst the population against the

possibility of encountering a decrease in sensitivity that may occur in the future. Furthermore, when the fact that this isolate is obtained from wheat (Köycü ve Özer, 2014) is considered, it is revealed that the possibility of encountering the presence of these types of isolates under field conditions is high. Because, it is known that the detection of decrease in sensitivity of isolates obtained from field conditions to fungicides have previously occurred amongst the fungal population.

The recognition of wheat breed's inability to demonstrate an absolute and a consistent resistance against *F. culmorum* by researchers (Wagacha and Muthomi, 2007; Scherm et al. 2013), cultural and biological conflict techniques remaining incapable of establishing control over infection along with the effective control of the toxins excreted by the pathogen in Spica's and pathogen's stem infections in wheat put forth that chemical conflict is necessary in tackling with this factor (Haidukowski et al. 2005; Paul et al. 2008). Death of seedlings which occur a short period of time after the pre-emergence and post-emergence of infected wheat seedlings through seed/soil with *Fusariumculmorum* appears as the most important consequence of early infections. In the prevention of such early infections, against the possibility of the fungicide to be used in seed contaminating the wheat through seed/soil the detection of it's level of prevention is highly important for the determination of its influence on the pathogen. Therefore, in this study, it is concluded that in case the isolates of *F. culmorum*, which was designated to have the highest rate of pathogenicity (100%) in wheat, infect the seedling through seed/soil the effect of the fungicides with the active substances prothioconazole+tebuconazole, tebuconazole and carboxin+thiram differ according to whether the infection is seed/soil-borne, and increased the seed's rate of germination, the plant height and decreased the severity of the disease in seedlings. As a result, it is concluded that the effect of the fungicides may vary with regards to the *F. culmorum*'s seed/soil-borne infection. Along with the impact mechanisms of the fungicides used in the trial being varied according to the fungicide group they belong to, they inhibit the mycelial growth of the factor by affecting one or more than one places within a fungal cell (Dekker, 1982). Hence, the determination that the rate of germination of the seed is higher in the soil-borne infections of the pathogen compared to that of seed-borne infections can be explained with the application of fungicide inhibiting *F. culorum*'s mycelial growth before infecting the seed.

Alongside their influence of inhibiting the growth of seed/soil borne fungal diseases it is known that fungicides have a positive impact on the growth of the plants. Researchers have discovered that when applied to the seed Carboxin accelerates the plant's growth and the application of tebuconazole generates a great increase in efficiency for wheat (Delen, 2016). Likewise, this study has revealed that fungicides which are utilized in the transmittance of *F. culmorum* S-14 to the plant through the seed greatly contributes to the plant's height. Additionally, it is discovered that the disease severities of the seedlings differ according to the infection type in *F. culmorum*'s seed/soil-borne infections and the disease severity is greater in soil-borne seedling infections. Also, the detection that the disease severity is greater in soil-borne infections, has put forth the importance of fungicide applications in the field along with seed application in tackling with this disease factor in cases of infection through soil. Thus, Mihuta-Grimm and Forster (1989) have appointed that the fungicide with the active substance carboxin+thiram eradicates the *Fusarium* type fungi which is seed-sourced in wheat and barley; however, under field conditions it failed to prevent the seedling decay caused by these fungi. Therefore, researchers have discovered that especially for the soil-borne infections of fungicide application to seed, along with disease severity and consequently the product amount (Chala et al. 2003; Edwards and Godley, 2010) varied according to the fungicide applications executed during the 31-39 terms (Zadoks et al. 1974) with regards to the zadox scale. Similarly, *F. culmorum*'s disease severity may vary according to the isolates in different ecologies. Hence, the influence of the fungicide on this pathogen may also vary according to the isolates provided from different regions. Arslan and Baykal (2002) have determined that the effect of the fungicides with the active substance tebuconazole (Raxil) on the pathogen's seed-borne infections is 80% in their study conducted on wheat seeds. Akgül and Erkılıç (2016), have determined the influence of the mixture fungicide with the active substance prothioconazole+tebuconazole, tebuconazole and carboxin+thiram on the soil-borne infections of the factors as approximately 11%, 47%, 16% respectively in the first year; as 17%, 47%, 35% in the second year and the disease severity in the control as 24% and 21% respectively. While, Balmaset al. (2006) determined the soil-borne *F. culmorum* infection's disease severity in the control as 45% after the application of the fungicide with the active substance tebuconazole (Folicur WG 25) to the seed, he also detected the disease severity after the application of the fungicide as 37%. Adding to this, in the Trakya region, the influence of fungicides with the active substances prothioconazole+tebuconazole, tebuconazole and carboxin+thiram on the disease severity in soil-borne infections of the *F. culmorum*'s isolate S-14 is discovered to be 71,17%, 56,61% and 58.20% respectively. These differences in the fungicide's impact on the disease severity of the pathogen determined by researchers is considered to be related to the sensitivities of the factors to the fungicide. In this case, pathogen's sensitivity to the fungicide being variable meaning the fungicide would have a different impact on the pathogen and in order for the disease control not being lost in the field, the variance of the sensitivity of the factor to the fungicides must be put forth.

The sensitivity of *F. culmorum* isolates, high in pathogenicity and obtained from the wheat plantation fields in the Trakya region, to prothioconazole+tebuconazole (Lamador FS 170), tebuconazole (Raxil Ultra 120 FS) and carboxin+thiram (Vitavax 200 FF) fungicides used in wheat seeds is initially detected by this investigation in our region. Considering the extensiveness of this pathogen in this region and its potential to cause high disease severity, sensitivity level to fungicide must be tracked among the fungal population under field conditions in order to prevent a possible generation of resistivity by the pathogen against the fungicide. Simultaneously, the variance of the impacts of the fungicide with regards to the pathogen's seed/soil-borne infections is discovered initially with this study. Hence, it is put forth that the mixture fungicides with the active substance prothioconazole+tebuconazole is more efficient in preventing the seed/soil-borne infections of the disease and producers of our region may be consulted in order to increase the product amount by blocking the seedling infections after the factor's pre-emergence/post-emergence.

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Effect of Recycled Carbon Black and Silica Fume on Unconfined Compressive Strengths of a Ch Clay

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Abstract: There have been many studies on the improvement of soils using waste materials in the last decade. In these studies, researchers aimed not only to use waste as additive material for economical point of view, but also disposing of waste for environmental point of view. Recycled carbon black (rCB) and silica fume (SF) are these kind of waste materials. Recycled carbon black (rCB) is a nano-sized waste material that is the result of scrap tires by means of pyrolysis method. Also, silica fume (SF) is a pozzolana which is a waste of ferro chrome facilities. The aim of this study was to investigate the effect of both rCB and SF on unconfined compression strength of a CH clay. For this purposes, a high plastic white clay (WC) was obtained from the reservoir in Erzurum-Oltu region. The samples were prepared at optimum water content and maximum dry unit weight. The unconfined compressive strengths (UCS) tests were carried out in accordance with ASTM D 2166. The loading speed of the experiments was chosen 0.8 mm/min which was carried out in the deformation-controlled UCS tester. Cylindrical specimens 38 mm in diameter and 76 mm in height were used in the experiments. In order to confirm validity and repeatability of the test results, three similar samples were prepared and the results were taken as the average of these three samples. The samples were prepared by mixing rCB and SF to CH clay at certain ratios. The rCB and SF were mixed with CH clay in 5%-0%, 1%-4%, 2%-3%, 3%-2%, 4%-1% and 0%-5% respectively at a dry state. Also, the samples were cured for 1 day and 7 days. The UCS experiments were also performed on unmixed (0%) high plastic clay soil for comparison. From the results of the UCS tests, the peak stress values generally increased in clay-waste mixtures without rCB. With the increase of rCB, a decrease trend in the peak stress values of both 1 day and 7 days cured samples was observed. In addition, the 1 day samples showed about two times more deformation at the same load level than the 7 days cured samples. The results also showed that the mixtures that contain SF behave more ductile than both pure WC clay sample and rCB mixtures.

Keywords: CH Clay, Silica Fume, Recycled Carbon Black, Unconfined Compressive Strength, Waste

1. INTRODUCTION

There have been many studies on the improvement of soils using waste materials in the last decade. In these studies, researchers aimed not only to use waste as additive material for economical point of view, but also disposing of waste for environmental point of view. In some cases in geotechnical applications, structures must be constructed on problematic soils (such as soft clay) which may have less bearing capacity or excessive settlements. In order to improve the geotechnical properties of these kinds of soils, waste materials; Carbon black (rCB) or waste asphalt [1-3], silica fume (SF) [6-11] and fly ash (FA) [12-21] have been used.

Due to the industrial development, huge amounts of solid waste materials are produced all over the world. The storage of these kinds of wastes exposures some environmental problems and threatens human health. Recycling of solid waste materials decreases consumption of the natural resources, also avoids the environmental problems occurred due to storage of solid waste materials. Not only does it solve the environmental problems but also the economic return provides. Many studies have been performed by researchers for re-using these kinds of waste materials in civil engineering. The scrap tire, which is not appropriate any longer to use on wheeled vehicles, is one of these materials. After completion of their lives, the scrap tires are stored in huge disposal areas. This kind of storage causes stockpiling problems due to their large volumes. Also, the components that they contain and the durability of them cause environmental problems. The recycled carbon black (rCB) is obtained by recycling of scrap tires using pyrolysis method.

The aim of this study was to investigate the effect of both rCB and SF on unconfined compression strength of a CH clay. For this purposes, a high plastic white clay (WC) was obtained from the reservoir in Erzurum-Oltu region. The samples were prepared at optimum water content and maximum dry unit weight. The unconfined compressive strengths (UCS) tests were carried out in accordance with ASTM D 2166. The loading speed of the experiments was chosen 0.8 mm/min which was carried out in the deformation-controlled UCS tester. In all experiments, the results were taken as the average of the three samples. Cylindrical specimens 38 mm in diameter and 76 mm in height were used in the experiments.

In this study, the UCS of the mixed clay samples were investigated by adding of rCB and SF to a high plastic clay (CH) at certain ratios. The rCB and SF were mixed with CH clay in 5%-0%, 1%-4%, 2%-3%, 3%-2%, 4%-1% and 0%-5% respectively at a dry state. Also, the samples were cured for 1 day and 7 days. The UCS experiments were also performed on unmixed (0%) high plastic clay soil for comparison.

2. MATERIALS AND METHODS

The high plastic clayey soil used in these experiments was obtained locally landfill area and has been classified as CH according to the Unified Soil Classification System (USCS) with ASTM D2487. Some geotechnical properties of this clayey soil are summarized in Table 1. The scrap tires using pyrolysis method are shown in Figure 1.

The rCB and SF were mixed with CH clay in 5%-0%, 1%-4%, 2%-3%, 3%-2%, 4%-1% and 0%-5% respectively at a dry state. The rCB and SF were mixed with soil randomly for unconfined compression tests. The dry clay was initially mixed with The rCB and SF by manually. Maximum care was taken to ensure that to obtain a homogeneous distribution of the rCB and SF in the clay. The rCB and SF -clay mixtures were stored in a covered container for 24 h. Mixtures were compacted in three layers into a 38 mm diameter and 76 mm high cylindrical mould at optimum water content. The sample preparation method was adapted from the standard compaction test method for ASTM D-698.

Table 1. Some properties of clayey soil (WC) used in tests.

Properties	Value
Liquid limit ¹ , w_L (%)	57.8
Plastic limit ² , w_P (%)	24.4
Plasticity index, I_P (%)	33.4
Optimum water content ³ , w_{opt} (%)	23.6
Maximum dry unit weight ³ , γ_{dmax} (kN/m ³)	15.3
Soil class (USCS)	CH

¹ w_L per BS 1377 (Part 2-1990)

² w_P per ASTM D 4318-00 (2000)

³ Obtained from Standard Proctor Tests (ASTM D 698-78).



Figure 1. Scrap tires and wild storage area (Anonymous ⁽¹⁾; Anonymous ⁽²⁾)

The unconfined compression test (UCS) was performed according to ASTM D 2166. Unreinforced and reinforced samples were tested in an unconfined compression machine with 0.8 mm/min loading rate (Figure 2). Some samples which is loaded in unconfined compression test apparatus are shown in figure 3, also.



Figure 2. Samples of different proportions in cabinet.

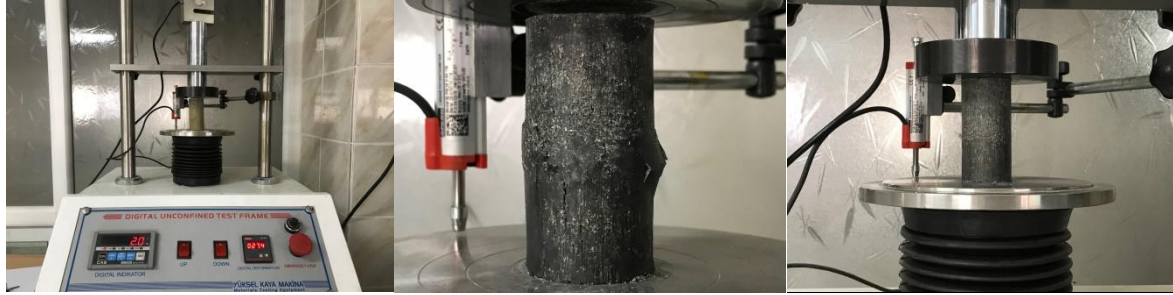


Figure 3. Samples which is loaded in unconfined compression test apparatus.

3.RESULTS AND DISCUSSIONS

The stress-strain curves of reinforced and unreinforced samples at cured on 1 day (i.e. at the rCB and SF were mixed with CH clay (WC) in 5%-0%, 1%-4%, 2%-3%, 3%-2%, 4%-1% and 0%-5%) are given in Figure 4. In addition, the peak stress values of the samples cured for 1 day in the study are shown in figure 5.

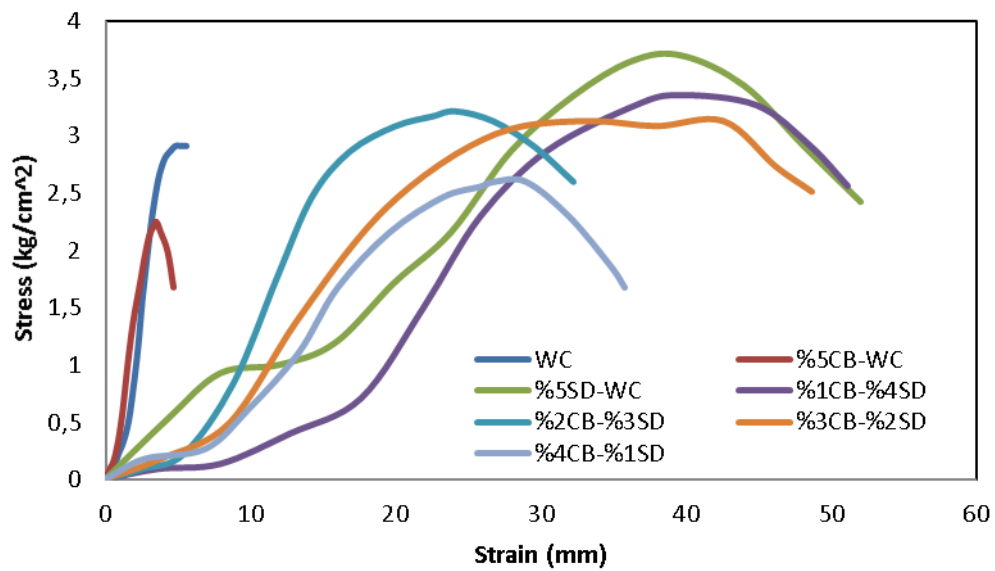


Figure 4. Stress-strain curves (1 day cured samples)

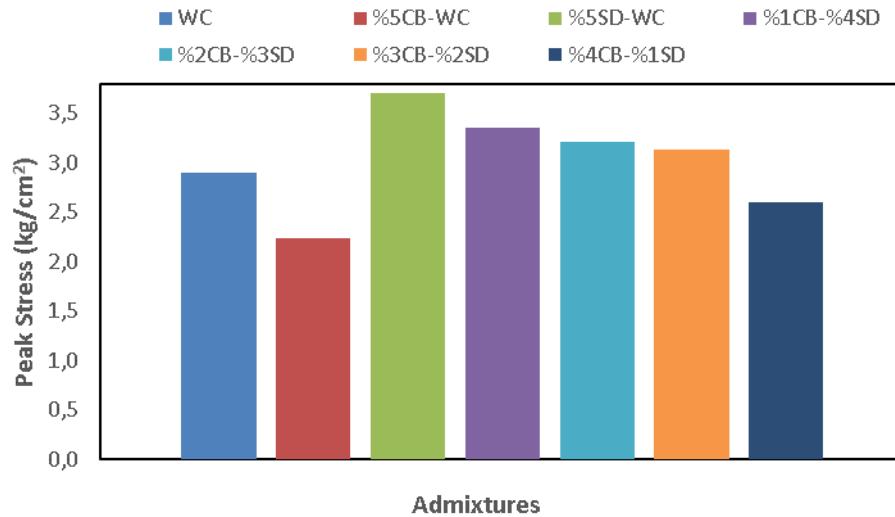


Figure 5. Peak stress values at break of samples (1 day cured samples)

It is seen in figure 4 and 5 that the peak stress values generally increased in clay-waste mixtures without rCB. With the increase of rCB, a decrease trend in the peak stress values of 1 day cured samples was observed. In addition, the 1 day samples showed about two times more deformation at the same load level than the 7 days cured samples. From the results of the UCS tests, the peak stress value was found in clay-waste mixtures in which rCB did not interfere and these values were increased in general. With the increase of SF and rCB, a marked decrease in the peak stress values of the 1 day cured samples was observed.

The stress-strain curves of reinforced and unreinforced samples at cured on 7 day (i.e. at the rCB and SF were mixed with CH clay (WC) in 5%-0%, 1%-4%, 2%-3%, 3%-2%, 4%-1% and 0%-5%) are given in Figure 6. In addition, the peak stress values of the samples cured for 1 day in the study are shown in figure 7.

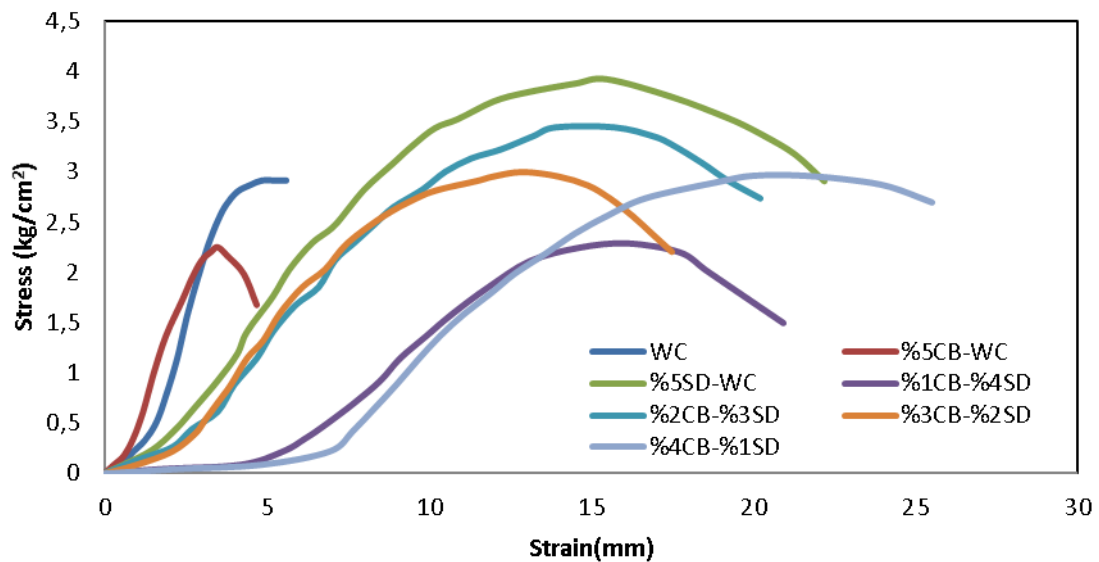


Figure 6. Stress-strain curves (7 day cured samples)

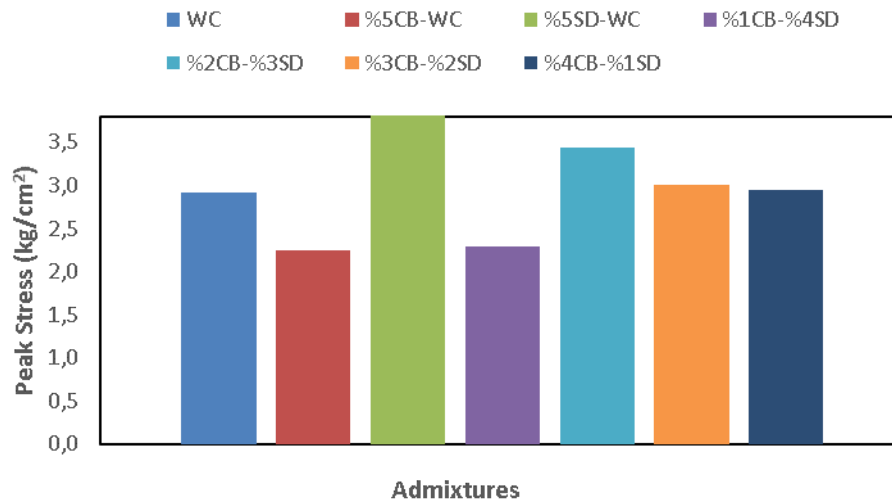


Figure 7. Peak stress values at break of samples (7 day cured samples)

In the 7 day cured samples, the peak stresses were generally reduced by the increase of the waste additive ratio but in totally, all values were increased according to pure WC samples' in both curing conditions (from about 2.9 kg/cm² to 3.8 kg/cm²). In addition, the 1 day samples showed about two times more deformation at the same load level than the 7 day old samples. Finally, it has been observed the experimental results that waste-added clay samples behave more ductile, except for rCB added samples and similar results were found in the literature.

In this study, a series of unconfined compression tests were conducted in laboratory in order to observe the UCS behavior of fine-grained soils reinforced with waste Recycled carbon black (rCB) and silica fume (SF) in different ratios and curing time periods. The general results from the experiments are as follows:

- The results generally indicate that the waste rCB and SF mixed with clayey soils can be used as a reinforcement material.
- Increment in SF ratio generally increases the peak shear stress at all mixed samples. The experimental results also show that the reinforced samples tend to exhibit higher shear stress at large strains when compared with the unreinforced samples.
- The reinforced samples exhibit more ductile behavior than unreinforced samples
- A significant increase is observed in c_u with increasing waste ratio at all cured samples.

In order to achieve more realistic judgments on the subject, experiments are recommended to be continued for further studies with different clay soil types and waste materials contents.

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Effects of Lovastatin Supplementation on Laying Performance, Egg Quality, Yolk Lipid Profile and Some Serum Parameters in Laying Hens

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Abstract: This study was carried out to determine the effects of lovastatin supplementation on laying performance, egg quality, yolk lipid profile and some serum parameters in Lohmann LS white commercial laying hens reared in poultry houses of Food and Livestock Application and Research Center of Atatürk University. In this experiment, Lohmann layers (n=48, 46 wks of age) were randomly divided into two groups such as control (C) fed with basal diet and treatment (T) group fed with diet including 0,0059 % of lovastatin. After one week of the adaptation period, experiment lasted for five weeks. During the experimental period, hens were fed as ad-libitum and water through nipples was available for all the times. Lovastatin supplementation increased feed consumption (FC) and feed conversion ratio (FCR). Except for yolk color, other egg quality traits were not affected by diet including 0,0059 % of lovastatin. Hens fed with treatment diet had greater triglyceride and phosphatidyl serine values than hens fed with basal diet. Differences between the groups in terms of the levels of egg yolk and serum cholesterol were not significant in present study. These differences could be attributed to short experimental period and low lovastatin added to basal diet of hens. In conclusion, further studies should be conducted to clarify the effects of lovastatin supplementation on laying performance, egg quality, yolk lipid profile and some serum parameters in laying hens fed with diets including lovastatin at different levels during long feeding period.

Keywords: Laying hen, Lovastatin, Laying performance, Egg quality, Egg yolk lipid profile, Some serum parameters

1. INTRODUCTION

Egg is one of the most important food with its high protein value, rich in vitamins and minerals and low in calorie. Scientific and technological developments in poultry have enabled the egg to be produced in abundant and economical ways in recent years, but egg consumption has not been reached to the desired level because of cholesterol content. Egg contains about 200 mg of cholesterol and is considered a major source of dietary cholesterol (Çakır ve Yalçın 2004; Elkin et al., 1999; Mori et al., 2000; Kim et al., 2004).

Egg cholesterol level is influenced by genetic, age and nutritional factors. Nutritional factors, such as type of fat, dietary fiber, the amount of vitamin C can affect egg cholesterol level (Naber, 1976; Çakır ve Yalçın 2004). There are many studies dealt with the effect of genetic selection and various dietary factors on egg cholesterol levels. However, it is extremely difficult to reduce the egg cholesterol level by dietary manipulations. Genetic selection programs have resulted in only modest changes in egg cholesterol levels (Elkin and Rogler 1990; Mori et al., 2000).

Therefore, much attention has been focused on the use of several pharmacological agents to reduce the cholesterol content of eggs. Lovastatin, simvastatin, and atorvastatin have been shown to reduce egg cholesterol content as well as liver and plasma cholesterol concentration (Luhman et al. 1990; Elkin et al., 1999; Mori et al., 1999; Kim et al., 2004).

Lovastatin is a statin drug, used for lowering cholesterol in those with hypercholesterolemia to reduce risk of cardiovascular diseases. It acts as competitive inhibitor of 3-hydroxy-3-methylglutaryl-coenzyme A reductase (HMG-CoA reductase) and it inhibits cholesterol synthesis by making an inhibitory effect (Elkin and Rogler 1990; Mori et al., 1999; Kim et al., 2004).

This study was carried out to determine the effects of lovastatin supplementation on laying performance, egg quality, yolk lipid profile and some serum parameters in Lohmann LS white commercial laying hens.

2. MATERIALS AND METHODS

This study was carried out to determine the effects of lovastatin supplementation into the basal diet of Lohmann LS white commercial laying hens reared in poultry houses of Food and Livestock Application and Research Center of Atatürk University. In this experiment, Lohmann layers (n=48, 46 wks of age) were randomly divided into two groups (50x46x46 cm) such as control (C) fed with basal diet and treatment (T) group fed with diet including 0,0059 % of lovastatin. After one week of the adaptation period, experiment lasted for five weeks. During the experimental period, hens were fed as ad-libitum and water through nipples was available for all the times. The experimental diet (16.4% CP, 2670 Kcal ME/kg) was obtained from a commercial feed mill in Erzurum.

Egg production and feed consumption were calculated daily, egg weight was measured biweekly and body weight was measured at the beginning and the end of the experiment. Eighteen eggs from each group were taken and stored for 24 h at room temperature at the beginning and end of the experiment to determine egg quality parameters such as shape index, shell strength, shell thickness, yolk index, albumen index and Haugh unit. Yolk color was estimated according to the CIE standard colorimetric system (Yolk Colour Fan, the CIE standard colorimetric system, F. Hoffman-La Roche Ltd., Basel, Switzerland). After 4wk of lovastatin administration, the blood samples were taken from the wing vena (10 hens) using heparinized tubes for blood parameters. In addition, ten eggs from each group were collected at the end of the experimental period to determine yolk lipid profiles by the HPTLC methods (Hara and Radin 1978; Macala et al. 1983). The yolk lipids were separated into following classes: cholesteryl ester (CE), triacylglycerol (TAG), free fat acid (FFA), cholesterol (COL), phosphatidylserine (PS) ve phosphatidylcholine (PC).

Performance and egg quality characteristics were tested with One-way ANOVA. t-test was used for egg lipid profile and blood parameters. All statistic analyses have been made with the SPSS 10.01 (SPSS 1996) package software

3.RESULTS AND DISCUSSION

The effects of lovastatin on laying performance are presented in Table 1. As seen in Table 1, the highest feed consumption and FCR were observed in the lovastatin group. Differences between the groups were significant ($P < 0.05$). Although the effect of the time on feed consumption was found significant ($P < 0.01$), the effect of the group x time interaction was insignificant. However, Elkin and Rogler (1990) and Kim et al. (2004) did not observe significant change in feed consumption and FCR among groups.

Table 1. The effect of Lovastatin on laying performance

	C		L			
Mean	Mean	SEM	Group	Time	GxT	
Feed consumption (g/d)	95.16	103.12	2.76	*	**	NS
Egg production (%)						
72.37	69.43	2.74	NS	**		NS
Egg weight (g)						
66.01	64.61	0.84	NS	NS		NS
FCR (kg feed/kg egg)						
1.86	2.25	0.20	*	NS	*	
Cracked egg yield (%)	4.41	10.80	1.96	NS	NS	NS

The differences in egg production, egg weight and cracked egg yield between groups were insignificant. The lowest egg production was observed in the lovastatin group compared to the control group. Eklin and Rogler (1990) reported that lovastatin had no effect on egg production, egg weight and cracked egg yield. The findings of Luhman et al. (1990) and Kim et al. (2004) also supported the findings obtained from present study.

Shape index, shell strength, shell thickness, shell weight, yolk color, yolk index, albumin index and haugh unit were determined as egg quality traits of laying hens.

Table 2. The effect of lovastatin on egg quality traits of laying hens

	C	L				
Mean	Mean	SEM	Group	Time	GxT	
Shape index (%)	73.72	74.73	1.07	NS	NS	NS
Shell strenght (kg/cm ²)						
0.57	0.474	0.096	NS	NS	NS	
Shell thickness (mm×10 ⁻²)						
0.34	0.337	0.014	NS	*	NS	
Shell weight (g)						
6.97	7.28	0.25	NS	NS	NS	
Yolk color						
7.21	8.05	0.18	**	*	NS	
Yolk index (%)	38.90	39.79	0.88	NS	NS	NS
Albumen index (%)						
7.45	8.77	0.64	NS	NS	NS	
Haugh unit	77.70	83.03	2.64	NS	NS	NS

It was determined that except for yolk color there was no effect on the shape index, shell strength, shell thickness, shell weight, yolk index, albumin index and Haugh unit. The laying hens fed with diet including lovastatin produced eggs with yolk color significantly higher than the control. The effect of the time on yolk color was significant ($P < 0.05$). Results related to yolk color were similar with the findings of Mori et al (2000), they reported that drug addition did not affect the shell weight, shell thickness, albumin and shell quality.

Table 3. The effect of lovastatin on egg yolk lipid profiles of laying hens

	C	L	P
Mean±SEM	Mean±SEM		
CE (%)	4.87±0.80	4.32±0.60	NS
TG			
56.22±0.62	60.38±1.58	*	
FFA			
0.39±0.11	0.32±0.03	NS	
COL			
20.413±0.51	20.23±0.41	NS	
PS			
0.28±0.01	0.56±0.08	*	
PC			
6.34±0.36	5.31±0.46	NS	

CE, cholesteryl ester; TG, Triacylglycerol; FFA, Free fat acid; COL, cholesterol; PS, Phosphatidylserine; PC, Phosphatidylcholine

The differences between the groups in terms of TG and PS were significant ($p<0.05$). Eklin and Rogler (1990) reported that by adding lovastatin in the amount of 0.059-0.0265%, egg cholesterol could be reduced by 15.5%. Luhman et al (1990) observed that relatively low doses of lovastatin or cholestipol did not reduce the egg yolk cholesterol. Kim et al (2004) found that oral intake of 0.06% provastatin reduced egg cholesterol by 20% when compared to control group. Mori et al (2000) reported that lovastatin had no significant effect on egg yolk cholesterol. The lack of significant differences in present study may be due to the low proportion of lovastatin.

Table 4. The effect of lovastatin on serum parameters of laying hens

Mean±SEM	C Mean±SEM	L	p
Uric acid (µmol/L)	7.43±0.48	4.40±0.37	**
Total protein (g/L)			
4.71±0.29	4.95±0.21	NS	
Albumin (g/L)			
1.40±0.08	1.56±0.10	NS	
Globulin (g/L)			
3.31±0.24	3.39±0.12	NS	
Alkaline phosphatase (U/L)			
11164.00±749.83	6114.00±1589.62	*	
Triglycerides (mg/L)			
874.00±148.94	1230.50±236.86	NS	
Cholesterol (mmol/L)			
97.00±13.069	124.00±10.78	NS	
HDL (g/L)			
16.50±3.26	17.50±2.84	NS	
VLDL (g/L)			
174.83±29.79	246.00±47.40	NS	
LDL (g/L)			
89.00±28.55	46.50±3.85	NS	

The mean values of uric acid and alkaline phosphatase in lovastatin group were lower than in the control group ($p<0.05$, $p<0.01$). There were no significant differences total protein, albumin, globulin, alkaline phosphatase, triglycerides, cholesterol, HDL, VLDL and LDL values between the groups ($p>0.05$). Elkin et al. (1999) reported that VLDL did not affect cholesterol levels in lovastatin or simvastatin, these researchers' findings were similar with results obtained from present study. Although Mori et al. (2000) found that lovastatin with 0.005% tended to decrease the mean of triglyceride (14.9%) and total cholesterol (10.1%), Mori (2000) observed that 0.001% of lovastatin caused a significant reduction of triglyceride (38.5%) and cholesterol (36.5%) levels. Kim et al. (2004) reported that 0.08% of lovastatin decreased the plasma total cholesterol concentration by 28% compared to the control group. Similar to the present study, Elkin and Rogler (1990) and Hugged et al (1993) found that plasma cholesterol and triglyceride concentrations were not affected by lovastatin.

In this study, laying performance, egg quality traits, egg yolk lipid profile and some blood parameters were examined. It has been determined that the results related to egg yolk and serum cholesterol parameters, performance and egg quality traits from present study are different when compared to the findings of other studies. Lovastatin did not affect egg quality

traits except for yolk color. Feeding with relatively low doses of lovastatin did not affect serum and egg yolk cholesterol parameters

In conclusion, further studies should be conducted to clarify the effects of lovastatin supplementation on laying performance, egg quality, yolk lipid profile and some serum parameters in laying hens fed with diets including lovastatin at different levels during long feeding period.

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Comparison of Forage Evaluation in Buffalo and Cattle

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Abstract: The aim of this review was to understand why buffalos kept under similar conditions with cattle could better evaluate low quality forages especially agricultural crop residues. The general principles of buffalo feeding are similar to those recommended for cattle. Despite these similarities, wide differences have been mentioned between buffalos and cattle with respect to digestion and utilization of various feeds, particularly low quality forages under similar feeding system. Firstly, buffalos have greater rumen-reticulum volume but lower intestine length than cattle. Buffalos have longer rumination time, more chews per cycle, stronger contraction force in rumen and a slower rate of ingesta output than cattle. The longer retention time of fibrous material in rumen results in higher degradability and digestibility. Rumen microfauna in buffalos could be different from that of cattle when both of them have fed a similar diet. Rumen microbial population and metabolism in buffalos can supply an advantage for especially in terms of the activity of cellulolytic microorganisms compared to cattle. It has been shown that buffalos have higher population of cellulolytic bacteria and fungal zoospores but lower protozoal population in the rumen. Regarding digestibility, buffalos can utilize low quality forages and crop residues more effectively (up to about 5%) than cattle. Moreover, buffalos produce a higher concentration of rumen ammonia nitrogen. Additional researches which include bio-molecular techniques is required for rumen microorganisms, their potential roles in fermentation process, improving digestibility and productivity in buffalos.

Keywords: Buffalo, Cattle, Forage evaluation, Ruminant fermentation

1. INTRODUCTION

As a result of comparative studies, Wanapat et al. (1999) and Kennedy and Hogan (1994) was reported to wide differences between cattle and buffalo in terms of ruminal ecology and digestion of low-quality roughages which contain high lignocellulose. It was determined that buffaloes could digest 2-5% units more of each nutrient than cattle when fed low quality roughages such as agricultural crop-residues and industrial by-products (Chanthakhoun et al. 2012). Many authors attributed that this may be explained that buffaloes have a greater contraction force in the rumen, longer rumination time, a higher ammonia (NH₃) in the rumen, a higher urea concentration in the blood, higher cellulolytic bacteria and fungal zoospores and lower protozoal population (Wanapat, 2000; Chanthakhoun et al. 2012). Up to date, very limited research data have been reported in regards to comparative forage digestibility, microbial population and fermentation products of buffalo and cattle (Iqbal et al., 2018).

The aim of this paper is to compile the relevant publication on forage evaluation of buffalo and cattle under similar feeding conditions.

Rumen Ecology in Buffalo

Ruminal pH is one of most important factors that determine the numbers and composition of fibrolytic bacteria and functional diversity of ruminant digestive ecosystem (Sung et al. 2007). Optimal ruminal pH in swamp buffalo rumen was observed 6.2-7.0 when fed large quantities of roughage (Wanapat and Pimpa 1999). Ammonia nitrogen (NH₃-N) in the rumen has been noted to be one of the important nutrient in supporting rumen fermentation (Wanapat and Rowlinson, 2007). According to Wanapat and Pimpa (1999), the concentration of NH₃-N is 9.2–15.6 mg/dL in buffaloes fed mostly on rice straw diet. The microbial ecology in the rumen is variable and highly complex due to several factors including mainly the diet. A good summary of the rumen ecology characteristics of buffaloes have been provided in the work of Wanapat and Rowlinson (2007) (Table 1). As shown in below Table 1, ruminal pH, NH₃-N, acetate, propionate and butyrate was observed 6.5-6.8; 7.1-17.7 mg %; 66.9-73.8, %16.2-28.8, 4.7-6.6, respectively. The microorganisms in the buffalo rumen fluid are comprised of bacteria (1.82-2.40x10¹² cell/ml), protozoa (2.30-5.20x10⁵ cells/ml) and fungal zoospores (1.02-7.30x10⁶ cells/ml). Predominant fibrolytic bacteria were found with higher population of *F. succinogenes*, *R. flavefaciens* and *R. albus* in both buffalo rumen digesta and fluid.

Table 1 Rumen ecology characteristics of swamp buffaloes under various feeding.

Item	
Ruminal pH	6.5-6.8
Temperature, °C	38-39
NH ₃ -N, mg%	7.1-17.7
Blood-urea N, mg%	13.0-21.3
Ruminal volatile fatty acids (VFA), %	
Acetate (C ₂)	66.9-73.8
Propionate (C ₃)	16.2-28.8
Butyrate (C ₄)	4.7-6.6
Total VFA, mM	96.7-115.3
Ruminal microbial population	
Bacteria	
Total viable count, x10 ¹² cells/ml	1.82-2.40
Cellulolytic, x10 ¹⁰ cells/ml	4.06-5.62
Proteolytic, x10 ⁶ cells/ml	3.84-5.33
Amylolytic, x10 ⁷ cells/ml	3.51-4.12
Protozoa, x10 ⁵ cells/ml	2.30-5.20
Holotrich	1.80-2.52
Entodiniomorph	0.35-1.30
Fungal zoospores, x10 ⁶ cells/ml	1.02-7.30
Urinary purine derivative, mM/d	
Allantoin	22.4-37.4
Uric acid	4.9-9.1
Creatinine	660-722

Source: Wanapat and Rowlinson (2007)

Comparative Studies on Digestibility and Fermentation

Many recent studies have shown that DM, OM and plant cell wall component (NDF, ADF) of digestibility in buffalo were higher than in cattle (Granum et al. 2007; Calabro et al. 2008; Jabbari et al. 2011; Chanthakhoun et al. 2012; Shakarami et al. 2015). Calabro et al. (2008) found dramatic differences in the rate of increase of organic matter digestibility (dOM) between buffalo and cattle. Researchers observed that the in vitro forages dOM and concentrates dOM at 120 h for buffalo and cow rumen fluid was higher in buffalo rumen fluid compared to cow rumen fluid (76.2% vs. 70.9% and 92.8% vs. 91.3%, respectively). In particular, the difference in forages was higher than in concentrates. In a comprehensive another study in swamp buffalo and beef cattle fed on rice straw as a main and minimal amount of concentrate, Chanthakhoun et al. (2012) determined that the nutrient digestibilities of DM, OM, CP, NDF and ADF were higher in buffalo (54.8%, 60.8, 68.8, 78.4, 42.9, respectively) than in cattle (49.9%, 56.0, 53.1, 71.6, 34.8, respectively). Similarly, Jabbari et al. (2011) found that who writes that the DM and NDF digestibility by buffalo was 1.22 and 1.51 times more than Holstein cow. In a study conducted to compare digestibility of wheat straw by ruminal fungi and whole rumen microorganisms, Shakarami et al. (2015) found that DM, NDF and ADF digestibility of wheat straw (60.80, 49.93 and 17.45%, respectively) by whole rumen microorganism of buffalo were more than cattle (53.00, 38.63 and 10.62%, respectively). It supports the earlier findings that have shown buffalo to use feed nutrients better than cattle when fed with poor quality rations containing a high level of cellulose (Homma, 1986). However, the advantage of buffalo over cattle is lost when the quality of feed is high (Lapitan et al. 2004). These differences may be explained due to differences in density and type of rumen bacteria (Bahatia et al. 2004), higher fungal cellulase activity (Samanta et al. 1999) or differences in active rumen fungi strains (Shakarami et al. 2015) and physiological differences of buffalo and cattle (Wanapat, 2001; Chanthakhoun et al. 2012).

As for the studies with respect to ruminal fermentation products, in a study conducted by Calabro et al. (2008), rumen fermentation parameters of alfalfa hay, barley meal, beet pulp, corn meal and silage, ryegrass hay and silage and soya bean meal commonly used in ruminant nutrition were determined the quantity gas and VFA different between buffalo and cattle after 120 h of in vitro incubation and this situation was explained by different microbial activity of the two animal species. Iqbal et al. (2018) also found that concentrations of total VFA, acetate and propionate in buffalo were higher than Jersey cows. The higher total VFA in buffalo rumen may be explained due to its higher bacterial and fungal populations (Iqbal et al. 2018). Unlike Calabro et al. (2008) and Iqbal et al. (2018), Chanthakhoun et al. (2009) reported that rumen pH, rumen NH₃-N, rumen total VFAs, propionate, butyrate, acetate, NH₃-N in the cattle rumen fluid were more than buffalo fluid, while total gas production, propionate and butyrate in buffalo rumen fluid were higher than cattle. In addition, in swamp buffalo and beef cattle fed on rice straw as a main and minimal amount of concentrate, Chanthakhoun et al. (2012) reported that rumen pH (6.78, 6.51), total VFAs (110.1, 112.1 mol/100 mol), propionate (22.4, 22.6%), butyrate (11.7, 13.3%) in the buffalo rumen fluid were no different compared to than cattle fluid, except for

acetate (65.8, 63.9%). In another study, Franzolin et al. (2010) found that buffaloes had lower production of acetic acid than cattle (58.7 vs. 61.6 mol/100 mol) and higher of propionic acid (27.4 vs. 23.6 mol/100 mol). There was no difference in the butyric acid production between the buffaloes (13.6 mol/100 mol) and cattle (14.8 mol/100 mol) and neither in the total volatile fatty acids concentration (82.5 vs. 83.6 mM, respectively).

Differences between cattle and buffaloes in urea-N metabolism are reported in the literature (Kennedy et al. 1987). Sangwan et al. (1990) administering diets based on wheat straw or oat hay with protein supplements found higher levels of rumen $\text{NH}_3\text{-N}$ in buffalo. This view is supported by Lwin et al. (2012) who writes that buffaloes can maintain the level of NH_3 production better than cattle under the same conditions. Conversely, Chanthakhoun et al. (2012) reported no significance difference in ruminal $\text{NH}_3\text{-N}$ concentration between buffalo and cattle (14.7, 12.7 mg/100 ml, respectively) when receiving the waste rice straw based diet with minimal amount of concentrate. Franzolin et al. (2010) observed that the buffaloes maintained a lower rumen $\text{NH}_3\text{-N}$ concentration (11.7 mg/dL) than the cattle (14.5 mg/dL) under the same feeding conditions.

Comparative Studies on Ruminal Microorganism

The rumen is an ideal microbial habitat because the conditions that exist are conducive for the survival and growth of microorganisms. The microorganisms in the rumen and the ruminant animal live in symbiotic relationship (Nagaraja, 2016). Plant cell components are degraded by a combination of bacteria, fungi and protozoa, with bacteria and fungi contributing approximately 80% of the degradative activity, and protozoa 20% (Dijkstra and Tamminga, 1995). Rumen has a dense population of bacteria with numbers ranging from 10^8 – 10^{11} per g of contents. Bacteria produce a wide range of highly active plant fiber degrading enzyme. Rumen bacteria have higher metabolic activity than protozoa and fungi. *Fibrobacter succinogenes*, *Ruminococcus flavefaciens* and *Ruminococcus albus* have been considered the major fibrolytic bacterial species in the rumen (Kioko et al. 2009). In addition, the ability of these three species to digest cellulose is much higher than that of other fibrolytic species (Kioko et al. 2009).

Ruminal fungi are classified into two broad groups: Yeasts and Molds. Compared to bacteria, fungi do not predominate (up to 10% of the total microbial mass) in the rumen due to slower generation time (6–9 vs. 0.5–3.5 h) (Forsberg and Cheng, 1992). Therefore, contribution to plant fibre digestion of ruminal fungi digestion may be low due to small biomass (Kioko et al. 2009). However, they produce the hydrolytic enzymes (cellulases, hemicellulases, pectin lyases, amylases, and proteases) required to break down the major components of plant cell wall. Fungi in the rumen also produce phenolic esterases (p-coumaroyl and feruloyl) that can break cross linkages between hemicelluloses and lignin, which allow the fungus to have increased access to hemicelluloses (Wang and McAllister, 2002). It is generally recognized that with forage-based diets, particularly of low quality plant materials, ruminal fluid has a lot of zoospores and a substantial portion of plant components in the rumen are penetrated with fungi as well (Wang and McAllister, 2002) and are facilitate access to the cell wall of bacteria (Bhatia et al., 2004). These observations have led to the suggestion that fungi may contribute to a greater extent to the digestion of fibrous plant material. In a study reported that fungi degraded 37–50% of barley straw, whereas rumen bacteria digested only 14–25% (Joblin et al. 1989). The diets rich of forage such as wheat straw or silages that have long retention time in the rumen, leading to the development of anaerobic fungi (Skharamai et al. 2015).

Protozoa in the rumen are broadly classified into flagellates and ciliates. Cilia are small and thin, more numerous (10^4 – 10^6 per ml or g of ruminal contents) and function in motility and also aid in ingestion of food. In general, there are two broad groups of ciliated protozoa that differ in morphological features for most domestic ruminant: a) 'holotrichs (common genera, *Isotricha* and *Dasytricha*) b) Entodiniomorphs (most prevalent genus, *Entodinium*, *Diplodinium*, *Metadinium*). The entodiniomorphs are more numerous in the rumen compared to holotrichs. The genus *Entodinium* based on the number accounts for 60–80% of the total protozoa. Holotrichid ciliates are primary users of starch, pectin, soluble sugars, proteins, while entodiniomorphs use cellulose, hemicellulose, starch, pectin, soluble sugars, proteins (Nagaraja, 2016). The contribution of protozoa to plant cell wall polymers digestion is estimated to be less significant in terms of the proportion of total NDF degrading activity (Dijkstra and Tamminga, 1995) and their absence from the ruminal fluid may have a negative effect on the extent of NDF digestion (Wang and McAllister, 2002).

In a comparative study in swamp buffalo and beef cattle fed on rice straw, it was determined relatively higher bacterial (3.36 vs 2.2×10^8 cells/ml) and fungal zoospores (7.1 vs 3.8×10^8 cells/ml) (Table 2) (Chanthakhoun et al. 2012) compared to cattle. Similarly, Wanapat (2000) reported that significantly higher fungal zoospore counts were found in swamp buffalo compared with cattle (7.30 and 3.78×10^6 , respectively) under a similar condition. In contrast, in vitro study conducted by Shakarami et al. (2015) determined that fungi concentration per ml rumen fluid (2×10^3) of buffalo was less than cattle (2.7×10^3 per ml rumen fluid).

Table 2

Rumen population of bacteria, protozoa and fungal zoospores in the rumen of swamp buffaloes and cattle.

Items	Buffaloes	Cattle	P value
Microbial population			
Bacteria, $\times 10^8$ cells/ml			
0 h post-feeding	2.01 ± 0.46	1.61 ± 0.32	0.29
4	3.60 ± 0.39^a	2.84 ± 0.10^b	0.02
8	3.35 ± 0.40^a	2.29 ± 0.73^b	0.04
Mean	3.3 ± 1.3	2.2 ± 0.6	0.25
Protozoa, $\times 10^6$ cells/ml			
0 h post-feeding	2.01 ± 0.27	3.75 ± 0.51	0.23
4	4.63 ± 0.23^a	6.63 ± 0.62^b	0.03
8	4.25 ± 0.40	5.22 ± 0.43	0.06
Mean	3.6 ± 1.4	5.0 ± 1.7	0.34
Fungal zoospore, $\times 10^5$ cells/ml			
0 h post-feeding	5.55 ± 0.11^a	2.22 ± 0.29^b	0.04
4	7.54 ± 0.62^a	3.54 ± 0.12^b	0.01
8	8.35 ± 0.95^a	5.58 ± 0.36^b	0.03
Mean	7.1 ± 1.4	3.8 ± 1.7	0.06

^{a,b}Means in the same row with different superscripts differ ($P < 0.05$, $P < 0.01$).

Source: Chanthakhoun et al.(2012)

In a study conducted by Chanthakhoun et al. (2012), it concluded that quantification of *Ruminococcus albus* in the digesta and rumen fluid of swamp buffalo was higher than in the digesta and rumen fluid of cattle, while *F. succinogenes* was found higher in cattle than buffalo (Table 3). Similarity, Iqbal et al. (2018) found that *Ruminococcus* was significantly higher in buffalo than in the Jersey cows with similar diets (Both animal groups were fed with three kilograms (kg) of concentrate per head per day, and corn silage was offered ad libitum. Recent evidence suggests that the abundance of bacterial genus *Prevotella* (proteolytic activity) was significantly lower in buffalo than in the Jersey cows (Iqbal et al. 2018). There are also studies reporting the opposite of these results. In a study, Lwin et al. (2012) showed that the profiles of the fermentation process, microbial population and diversity were similar in crossbred water buffaloes and crossbred cattle. These results suggest that data in explaining why swamp buffaloes could perform better when fed on low-quality roughages

Table 3

Quantitative measurement, *R. albus* and *R. flavefaciens* and *F. succinogenes* population in rumen digesta and fluid between swamp buffalo and beef cattle using Real-Time PCR technique.

Items	Buffalo	Cattle	P value
Rumen digesta			
<i>R. albus</i> ($\times 10^8$ copies/g rumen content)			
0 h post-feeding	3.27 ± 0.35^a	0.16 ± 0.14^b	<0.001
4 h	5.34 ± 0.49^a	1.70 ± 0.98^b	0.04
8 h	8.38 ± 2.31^a	4.32 ± 1.54^b	0.03
Mean	6.04 ± 0.84^a	2.92 ± 1.96^b	0.03
<i>R. flavefaciens</i> ($\times 10^8$ copies/g rumen content)			
0 h post-feeding	5.65 ± 6.10	5.06 ± 6.44	0.91
4 h	16.58 ± 17.98	5.76 ± 6.12	0.30
8 h	1.90 ± 1.46	9.20 ± 7.70	0.18
Mean	8.31 ± 5.43	5.57 ± 4.99	0.48
Rumen fluid			
<i>R. albus</i> ($\times 10^7$ copies/g rumen content)			
0 h post-feeding	3.70 ± 2.63	1.80 ± 1.73	0.30
4 h	2.34 ± 0.10^a	1.37 ± 0.24^b	0.003
Mean	3.02 ± 1.67	1.58 ± 1.13	0.11
<i>R. flavefaciens</i> ($\times 10^7$ copies/g rumen content)			
0 h post-feeding	0.11 ± 0.11^a	17.97 ± 10.20^b	0.05
4 h	5.07 ± 4.29	4.11 ± 1.63	0.74
Mean	2.09 ± 2.64	2.95 ± 1.29	0.64
<i>F. succinogenes</i> ($\times 10^8$ copies/g rumen content)			
0 h post-feeding	$1.90 \pm 1.06 \times 10^{4a}$	1.53 ± 0.09^b	0.0021
4 h	3.30 ± 0.49^a	24.7 ± 7.02^b	0.0062
Mean	1.17 ± 0.32^a	14.45 ± 3.88^b	0.0438

^{a,b}Means in the same row with different superscripts differ ($P < 0.05$, $P < 0.01$).

Source: Chanthakhoun et al. (2012)

According to some studies, the concentration of rumen protozoa in buffalo was more than cattle (Jabbari et al. 2011; Jabbari et al. 2012; Iqbal et al 2018). Others observed concentration of rumen protozoa was less than (Wanapat et al. 2000; Franzolin et al. 2010; Chanthakhoun et al. 2012). Iqbal et al., (2018) suggested that there was a higher protozoal population in buffaloes with higher numbers of protozoal genus *Metadinium* and lower *Entodinium* compared to those Jersey cattle. However, Wanapat et al. (2000) who observed lower rumen protozoal populations in swamp buffalo with lower numbers of holotrichs (*Isotricha* and *Dasytricha*) and entodiniomorphs compared to those in cattle raised under traditional village conditions. In addition, Chanthakhoun et al. (2012) reports that lower protozoal population (3.6 vs 5.0×10^5 cells/ml in swamp buffalo than cattle (Table 2). Similarity, Franzolin et al. (2010) found that the zebu cattle had higher rumen protozoa population than the buffaloes (mean 6.1×10^5 vs 8.8×10^5 /mL), except for *Dasytricha* and *Charonina*, while lower *Entodinium* population was observed in buffalo.

Fed with similar diet and kept with the same condition, a number of researchers showed that swamp buffaloes were more efficient than cattle in many aspects, namely N-recycling, digestion of the fibrous low-quality feeds including crop-residues and ruminal $\text{NH}_3\text{-N}$ due to higher total bacterial and fungal zoopores. Additional researches which include bio-molecular techniques is required for rumen microorganisms, their potential roles in fermentation process, improving digestibility and productivity in buffalos.

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Carbon Dioxide Changes of Civril Bean at Different Moisture Contents

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Abstract: The main cause of spoilage during storage of seeds is high moisture content. For this reason, high moisture content can cause a change in the levels of carbon dioxide (CO₂). Depending on this, the respiration rates of seeds may vary. In the current study, experiments were performed to use the CO₂ measurement system for early detection of spoilage in bean seeds instead of spoilage detection, using the traditional methods, such as temperature measurement, visual or smell inspection. In this study, the effects of different moisture contents (6.4, 11.7, 17.3 and 23.7% (d.b.)) on the CO₂ level of civril bean seeds harvested in the fall of 2017 from Bolu province, Turkey was investigated. Respiratory rates were determined by examining the CO₂ levels at the end of 10 days storage of the civril bean seeds. In the present study, it was found that CO₂ production increases with moisture content increases. The CO₂ levels increased from 524 to 593, 666 to 2376, 538 to 9974, and 967 to 9993 ppm, respectively, as the moisture content increased from 6.4 to 23.7%. The device capacity, 9999 ppm level, was reached earlier in seeds with high moisture content due to their respiration at high speed. The seeds with moisture content of 17.3% was reached to the device capacity (9999 ppm) at 112th h of storage and the seeds with moisture content of 23.7% at 28th h of storage. Therefore, the measurements were terminated without reaching the targeted 10th day. As a result, it was determined that respiration rates of civril bean seeds at 6.4, 11.7, 17.3 and 23.7% moisture contents ranged from 0.03 to 6.49, 0.19 to 7.23, 0.97 to 5.38 ve 3.80 to 10.29 mgCO₂ kg⁻¹ h⁻¹, respectively. Significant differences were found in the respiration rate of civril bean seeds at different moisture contents. It is shown that the measurement of CO₂ production rate may be useful for spoilage detection at early stage in stored bean seeds.

Keywords: Civril bean, carbon dioxide, respiration rate, moisture content

1.INTRODUCTION

Bean plants have a common culture mainly in Turkey and in the world. It has an important place in healthy nutrition in terms of protein, vitamin and mineral (Kaçar et al., 2004; Miklas et al., 2006; Marotti et al., 2007). The most important advantage of Civril bean is having both fresh and dry consumption characteristics. The total planting area in 2017 is 7 da in the Civril bean variety, which is a bean variety unique to Bolu province.

Seed yield loss during storage period due to spoilage at various types of grain storage facilities remain a major problem all over the world (Raudiene et al., 2017). Seed storage environment must be controlled in such a way that biological processes taking place in the grain pile would be beneficial for grain or would not affect grain quality. Seed moisture content (MC) is one of the most important factors that describes seed biological activity. Dry seed have a low respiration rate. Whereas, wet seeds are usually a good medium for microbial processes resulting in more intense CO₂ production rates.

Seed deterioration is related to respiration of the seed itself and of the accompanying microorganisms. Breathing is a carbohydrate oxidation (burning) process, which produces carbon dioxide, water vapor and thermal energy (Kaleta and Gornicki, 2013). Moisture and temperature (Kuzmiene et al., 1991; Saika et al., 2015) are the primary factors, affecting seeds, grains or other agricultural product quality. If these factors are not properly monitored and controlled, seed quality can deteriorate quickly due to mold growth and insect infestation (Gonzales et al., 2015).

The main objective in the long-term storage of dry bean seeds is to maintain conservation by keeping nutrient losses to a minimum. This is only possible with optimum storage conditions. This study was conducted to determine the rate of respiration by measuring the amount of Carbon Dioxide (CO₂) in civril bean seed at different moisture contents.

2.MATERIALS AND METHODS

The Collection and Preparation of Civril Bean Seed

Civril bean seed was used as material in the research. Bean seeds were collected from Çampınar village in Bolu province center in 2017. The collected bean samples were first physically cleaned. Purpose of this is to remove the inorganic wastes, broken, dead and rotten seeds and foreign matter from bean seeds.

Determination of Seed Moisture Content and Desired Moisture Level

In the study, moisture levels of 6.7, 11.7, 17.3 and 23.7% were investigated as seed moisture content.

10 g sample of bean seeds were dried in oven vessels with 3 repetitions and 130 ± 5 °C for 19 hours (AOAC, 1984). The seeds at the end of this training extracted from the oven were left in the desiccator for 30 minutes. In determining the moisture content, the following Equation 1 was used (ISTA, 2005);

$$MC = \frac{W_i - W_f}{W_f} \times 100 \quad (1)$$

where;

MC : Moisture content of seed, %

W_i : Initial weight of seed, g

W_f : Final weight of seed after drying, g

The initial moisture content of the seeds was determined to be 11.7% (d.b.). The moisture content under laboratory conditions was taken as the reference for the desired moisture content in civil seeds Equation 2 developed by Balasubramanian (2001). Equation 2 was used for calculating the amount of moisture to be added over the level of equilibrium moisture. Calculated amount of distillate water was added to the seeds and were packed in polyethylene bags. The seeds were then stored in a refrigerator (4 °C) for attaining equilibrium.

$$Q = \frac{W_i(M_f - M_i)}{100 - M_f} \quad (2)$$

where;

Q : Amount of added water, g

M_i : Initial moisture content of seed, %

M_f : Final moisture content of seed, %

In the CO₂ measurements, the temperature and humidity test cabin was used. The temperature of the test cabin was kept at 10 ± 2 °C and relative humidity (RH) at 65 ± 5 %. CO₂ measurements were maintained for 5 days. In order to determine the CO₂ respiration rate (RR) of civil bean seeds, the level of CO₂ emitted by the seeds through the Testo535 CO₂ meter was measured in ppm. For this purpose, a 250 g seed was placed in a 1500 mL jar and the CO₂ measurement probe was placed in the jar. The measuring jar was tightly sealed with parafilm to prevent air entry and the jar was disconnected from the outside atmosphere. Using the following Equations 3 and 4, respiratory rate changes due to different moisture content were determined (Raudiene et al., 2017).

$$RR = \frac{\Delta C_{CO_2} \times M_{CO_2} \times V_h}{V_m \times m \times \Delta t} \quad (3)$$

where;

RR : CO₂ respiratory rates, mgCO₂ kg⁻¹ h⁻¹

ΔC_{CO_2} : The change in CO₂ volumetric concentration in ppm, 10⁻⁶ L L⁻¹

M_{CO_2} : The molecular weight of CO₂ gas, 44.01 g mol⁻¹

V_h : The volume of headspace in the jar, L

V_m : The molar volume of a gas, L mol⁻¹

m : Grain seed of mass, kg

Δt : Duration of the experiment, h.

Molar volume was calculated evaluating temperatures of the experiments.

$$V_m = \frac{R \times T}{P} \quad (4)$$

where;

R : Gas constant, 0.08206 L mol⁻¹ K⁻¹

T : Temperature, K

P : Pressure, atm

3.RESULTS AND DISCUSSION

The variation in the temperature and RH of the climate test cabin are shown in Figure 1. Generally, there were fluctuations in the temperature and RH values in the test cabin. The temperature values ranged from 8.9 to 10.9 °C and peaked at 61th h of the measurement. The RH inside of test cabin ranged from 44.5 to 75.6%. The RH inside the test cabin peaked at 36th min of the measurements.

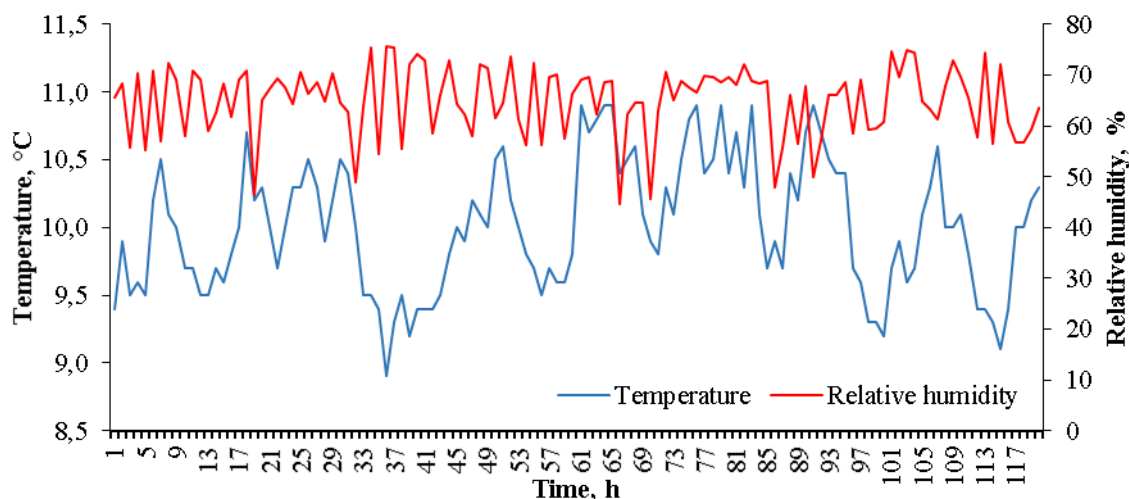


Figure 1. Temperature and relative humidity change of the climate test cabin

Figure 2 showed the raw data related to CO₂ concentration in this study. After 5 days of measurement, CO₂ concentration was significantly different from the initial values (Fig. 2) and the lowest CO₂ concentration values were observed especially in the beginning of the measurements. According to the Figure 2, civril bean with higher moisture content emits more CO₂. The CO₂ sensor saturate after a day in experiments with higher seed moisture contents. The CO₂ levels increased from 524 to 593, 666 to 2376, 538 to 9974, and 967 to 9993 ppm, respectively, as the moisture content increased from 6.4 to 23.7%. The device capacity, 9999 ppm level, was reached earlier in seeds with high moisture content due to their respiration at high speed. The seeds with moisture content of 17.3% was reached to the device capacity at 112th h of storage and the seeds with moisture content of 23.7% at 28th h of storage.

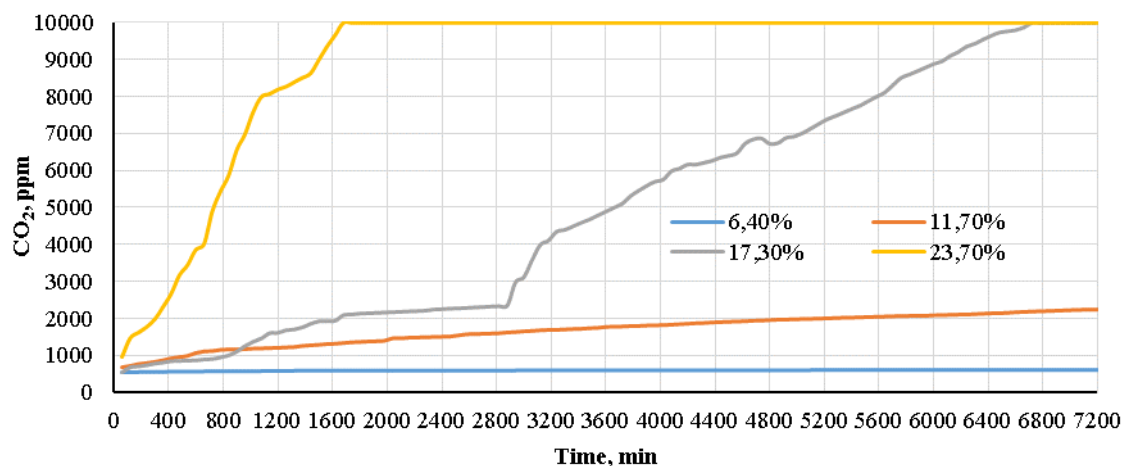


Figure 2. Measured CO₂ concentrations in different moisture contents depending on time

The change in the CO₂ respiration rate (RR) depending on measure time of civril bean seed for the different moisture content is shown in Figure 3. In the experiments with a higher moisture content in seeds CO₂ RR may be so high, that after a day the CO₂ level measurement sensors become saturated (CO₂ concentration 9999 ppm) and then further analysis of the data is no longer possible. The CO₂ RR was found to increase with increase in moisture content. The highest mean value for CO₂ RR (4.76 mgCO₂ kg⁻¹ h⁻¹) was determined at 1th day in the moisture content of 23.7%. The lowest mean value for CO₂ RR (0.07 mgCO₂ kg⁻¹ h⁻¹) was at 5th day in the moisture content of 6.4%. In all cases, the highest seed respiration rate was during the first day of each experiment, and then it decreased. It was considered that at the beginning of the experiment, after moistening seed with distilled water, most of the water is still on the seed surface. After that, moisture penetrates into the seeds and decreased the activity of seed respiration.

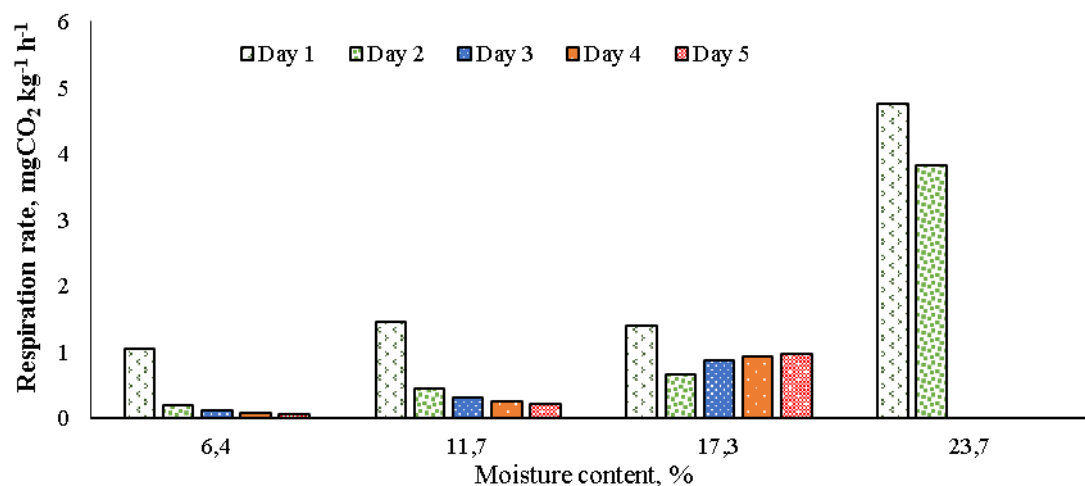


Figure 3. The respiratory rates of civil bean seed measured depending on time in different moisture contents

Dillahunty et al. (2000) investigated the respiration rate of the rice at different temperatures (20 to 80 °C) and seed moisture contents (12.5, 15.0 and 20.2%). As a result of the research, they found that respiration increases at high temperature and humidity levels. In addition to, they stated that the storage temperature should be 20 °C and the seed moisture content should be below 15%.

Raudiene et al. (2017) have determined that CO₂ concentrations and respiration rates increase with increasing temperature and humidity content in wheat seeds stored at different moisture contents and temperatures.

Ubhi (2017), investigated the respiration rate of corn grain product at 23, 35 and 45 °C temperature and with 12.9, 14.8, 17.0, 18.8 and 20.7 seed moisture content. As a result, researcher found that the cumulative respiratory rate increased and the highest increase was at 45 °C temperature and 20.7% seed moisture.

According to the results we have obtained in the research, it is similar to the studies increased of respiration rate with the increase of the seed moisture depending on the storage period.

As a result of the study, the respiration rate increases with the increase of the seed moisture content, which increases the probability of seed degradation. For this reason, it has been shown that the seed should be stored at low humidity and the storage environment must be provided for proper environmental conditions.

These research results demonstrated that, seed moisture content has a significant effect on CO₂ respiration rate. In this context, it is necessary to keep the seed moisture at 10% or lower during storage to minimize nutrient losses. This requires absolutely adequate ventilation and cooling for low temperature and relative humidity in the storage environment.

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A Study on Some Physical Properties of Hulled Siyez Einkorn Wheat

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Abstract: In the current study, experiment was conducted to investigate physical properties such as length, width, thickness, arithmetic mean diameter, geometric mean diameter, sphericity, seed surface area, seed volume, 1000 unit mass and bulk density of hulled siyez einkorn wheat seeds as well as establish a database for engineering properties. The physical properties were determined moisture contents range of 5 to 25%. The mean values of the length, width, thickness, arithmetic mean diameter, geometric mean diameter, sphericity, seed surface area, seed volume and 1000 unit mass of einkorn wheat seeds ranged from 8.76 to 10.11 mm, 3.53 to 4.16 mm, 2.40 to 2.86 mm, 4.89 to 5.71 mm, 4.19 to 4.92 mm, 0.48 to 0.49, 55.34 to 76.17 mm², 18.70 to 25.27 mm³ and 40.37-50.40 g, respectively as the moisture content increased. The bulk density decreased linearly from 486.6 to 383.6 kg m⁻³ with the increase of moisture content. Little is known about the functional properties of the stored einkorn wheat relative to their storage conditions. Recently, there has been an increasing interest by food industry and producers to assure consumers on the preservation of their einkorn wheat foods. These research results demonstrated that the internal climatic conditions should be kept under constant control to provide the requirements of the optimum design of grading, conveying, processing and packaging systems.

Keywords: Siyez wheat, moisture content, physical properties

1. INTRODUCTION

Hulled wheat species (Siyez, einkorn, kavlca, kaplica and iza in Turkish) are among the most ancient cereal crops of Turkey. In Turkey are cultivation in Kastamonu, Sinop and Bolu provinces of Western Blacksea Region. However, it is widely cultivation in Kastamonu region. Accordingly, it is stated that the nutrient content is higher quality than the einkorn wheats in other provinces.

Einkorn wheat has been found to be a more tolerant species compared to bread and durum wheat, although there is little yield against cold and hot climate, diseases and poor soils lacking nutrients (Hidalgo et al., 2009). Moisture content has been reported to be among the most important conditions affecting the physical properties of seeds. Especially for post-processing use of wheat, the amount of ash contained and the seed color are a display of quality. In this respect, seed moisture content should be considered in storage to avoid quality deterioration.

There is no study related to the effects of moisture content on the physical properties of Einkorn siyez wheat seeds. The reason for this is the level that will contribute to this study area. This study was carried out to determine some physical properties (seed length, width, thickness, shape indexes, thousand seeds, unit weight, ash, electrical conductivity and color) in different moisture contents of hulled einkorn siyez wheat seeds.

2. MATERIALS AND METHODS

The research was carried out in Seed Science Laboratory of Abant İzzet Baysal University, Faculty of Agriculture and Natural Sciences. In the research, hulled einkorn siyez wheat seeds collected from İhsangazi district of Kastamonu province were used as material. Physical cleaning was first performed in siyez wheat (Figure 1). The objective is to remove inorganic wastes, broken and dead and rotten seeds and foreign matter from the wheat seed.



Figure 1. Siyez einkorn wheat a)inorganic waste cleaning operation b)cleaned hullled wheat c) unllled wheat

In the study, moisture levels of 5, 10, 15, 20 and 25 were investigated as seed moisture content. 10 g sample of wheat seeds were dried in oven vessels with 3 repetitions and 80 ± 5 °C for 24 hours (ASABE, 2008). The seeds at the end of this training extracted from the oven were left in the desiccator for 30 minutes. In determining the moisture content, the following Equation 1 was used (ISTA, 2007);

$$MC = \frac{W_i - W_f}{W_f} \times 100 \quad (1)$$

where;

MC : Moisture content of seed, %

W_i : Initial weight of seed, g

W_f : Final weight of seed after drying, g

The initial moisture content of the seeds was determined to be 9.73%. The dry basis moisture content under laboratory conditions was taken as the reference for the desired moisture content in einkorn siyez seeds Equation 2 developed by Balasubramanian (2001) was used for calculating the amount of moisture to be added over the level of equilibrium moisture. Calculated amount of distillate water was added to the seeds and were packed in polyethylene bags. The seeds were then stored in a refrigerator (4 °C) for attaining equilibrium. The seeds were removed from the refrigerator (duration of storage was 10 days).

$$Q = \frac{W_i (M_f - M_i)}{100 - M_f} \quad (2)$$

where;

Q : Amount of added water, g

M_i : Initial moisture content of seed, %

M_f : Final moisture content of seed, %

Three principal dimensions of seeds, namely, length (L), width (W) and thickness (T) were measured using a digital caliper with an accuracy of 0.01 mm in 30 randomly selected seeds.

The geometric mean diameter (D_g) of the seeds was calculated from the three axial dimensions by using Equation 3 (Mohsenin, 1986):

$$D_g = (L \times W \times T)^{1/3} \quad (3)$$

The sphericity (ϕ) of seeds was calculated using the following formula given according to Equation 4 by Mohsenin, (1986):

$$\phi = \frac{D_g}{L} \quad (4)$$

The surface area (Sa) of seeds was found using following equation as described according to Equation 5 by Jain and Bal (1997):

$$Sa = \pi \times D_g^2 \quad (5)$$

The seed volume (S_v) was obtained using the following formula as reported according to Equation 6 by Jain and Bal (1997) and Kibar et al., (2014).

$$S_v = \frac{\pi \times \sqrt{W \times T} \times L^2}{6 \times (2L - \sqrt{W \times T})} \quad (6)$$

1000 unit mass was determined according to ISTA (2007).

To determine bulk density (ρ_b), a cylindrical container of 1000 ml in volume was filled to 5 cm above the top with seeds. The seeds were then allowed to settle into the container, the excess seeds were removed by sweeping the surface of the container and then filled container was weighed using an electronic balance. Bulk density was determined using the following Equation 8 (Kibar et al., 2010):

$$\rho_b = \frac{m_2 - m_1}{V_b} \quad (7)$$

ρ_b = bulk density, kg m^{-3}

m_1 = the free weight of bulk density bucket, kg

m_2 = the free weight of bulk density bucket, kg

V_b = the volume of bulk density container, m^3

The results related to physical properties were subjected to analysis of variance (ANOVA) using SPSS statistical software. Differences among means were evaluated by Duncan's multiple range test.

3.RESULTS AND DISCUSSION

Dimensional properties and the values of seed shape properties of hulled siyez wheat seeds at different moisture content are presented in Table 1 and Figures 2, 3 and 4. Dimensional properties of seeds markedly differed among the moisture content. The length, width and thickness of hulled siyez seeds at different moisture content ranged from 7.70 to 11.41 mm, 2.84 to 4.83 mm and 1.84 to 3.16 mm, respectively (Figures 2, 3 and 4).

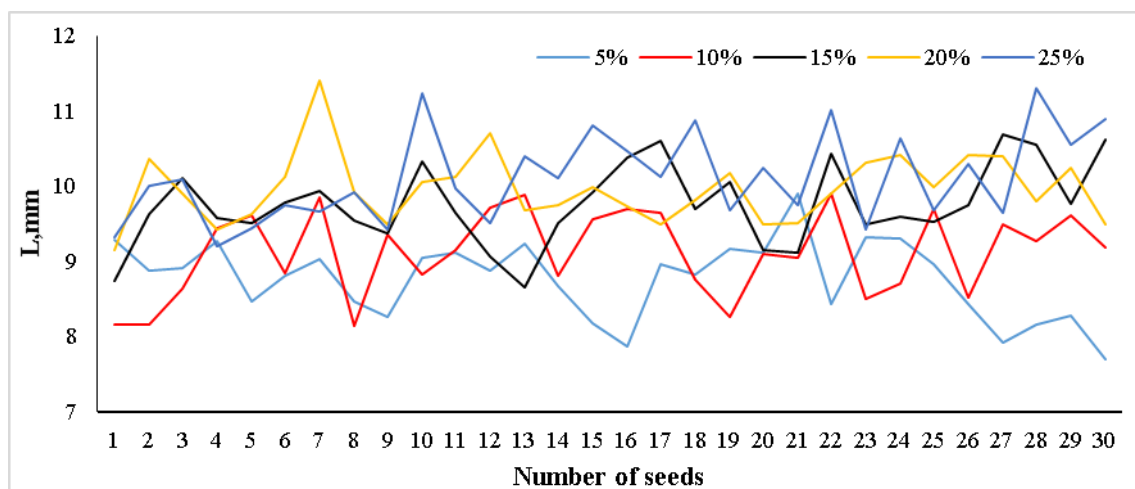


Figure 2. The effects on seed length of different moisture content

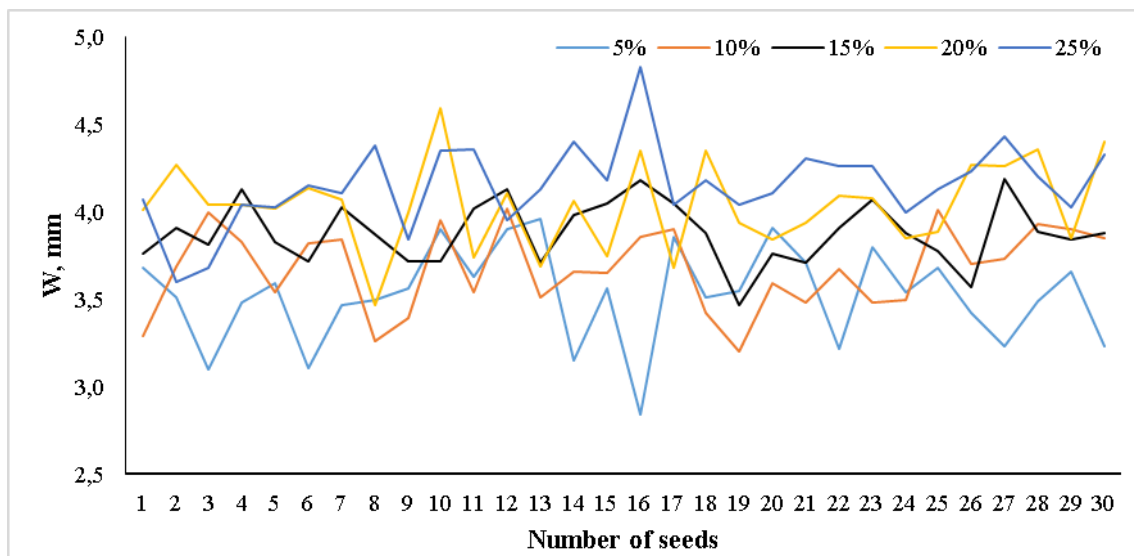


Figure 3. The effects on seed width of different moisture content

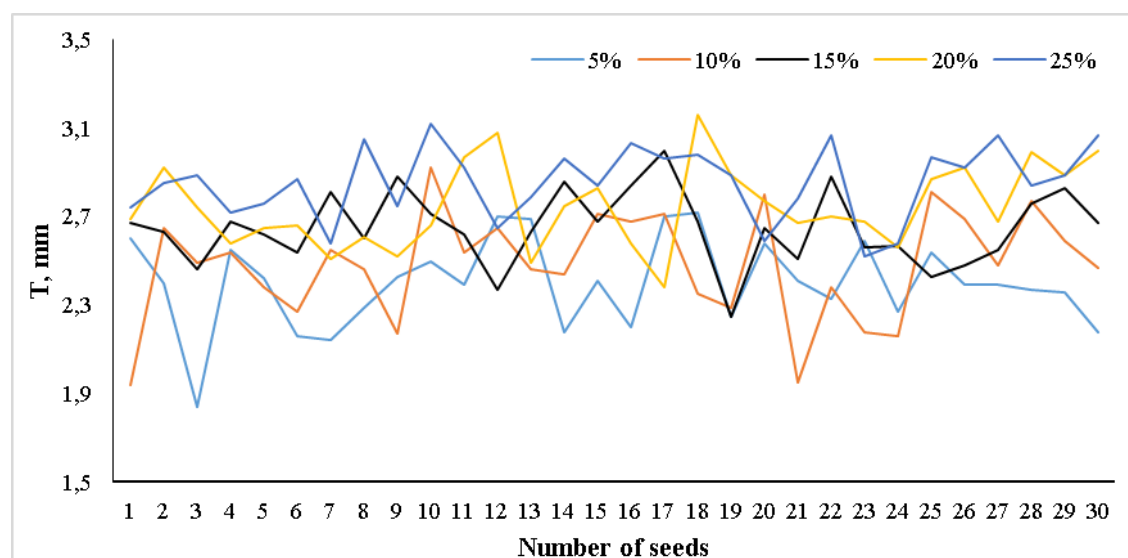


Figure 4. The effects on seed thickness of different moisture content

From Table 1, it can be seen that the values of length, width and thickness in 25% moisture content were considerably higher than that of 5, 10, 15 and 20% moisture content. The dimensions increased with increase of moisture content (L , W , T , D_a and D_g). Differences between the values were statistically significant at $P < 0.01$ (Table 1). The increase in the dimensions are attributed to expansion or swelling as a result of moisture uptake in the intracellular spaces within the seeds. Among the moisture content, the highest arithmetic and geometric mean diameter was obtained in 25% moisture content. The geometric mean diameter of seed is positively related to its length, width and thickness. The geometric mean diameter can be used for the theoretical determination of seed volume and sphericity.

Table 1. The effects on seed shape of different moisture content

Nem İçeriği, %	L, mm	W, mm	T, mm	Da, mm	Dg, mm	ϕ	Sa, mm ²	Sv, mm ³
5	8.76d**	3.53d**	2.40d**	4.89d**	4.19e**	0.48a ^{ns}	55.34e**	18.70d**
10	9.12c	3.67c	2.48d	5.09c	4.35d	0.48a	59.72d	20.27c
15	9.75b	3.88b	2.64c	5.42b	4.63c	0.48a	67.56c	22.97b
20	9.96ab	4.04a	2.75b	5.58a	4.79b	0.48a	72.06b	24.27a
25	10.11a	4.16a	2.86a	5.71a	4.92a	0.48a	76.17a	25.27a

** Significant at $P < 0.01$; ns: non significant.

The sphericity of seeds not changed with increasing moisture content (Table 1). The sphericity of seeds calculated at different moisture contents exhibited as 0.48, indicating that sphericity of seed was statistically non significant ($P < 0.05$) by the change in moisture content from 5 to 25% d.b.

As seen from the Table 1, the surface area of siyez wheat seeds increased linearly from 55.34 to 76.17 mm² (statistically significant at $P < 0.01$) when the moisture content increased from 5 to 25% d.b. The increase in the values might be attributed to its dependence on the three principal dimensions of siyez einkorn wheat seeds.

The volume of siyez wheat seeds increased linearly with the increase of moisture content (Table 1). The seed volume increased from 18.70 to 25.27 mm³ (statistically significant at $P < 0.01$) when moisture content increased from 5 to 25% (db). This volumetric expansion may be attributed to the expansion in the dimensions which contributed to weight increase of siyez wheat seeds thereby resulting to the displacement of more liquid.

1000 unit mass was found to between 40.37 g (5% MC) and 50.40 g (25% MC). Based on Duncan multiple range tests, there were significant differences between 5% and 25% MC. 1000 unit mass, which can be used to determine the potential flour yield for stored wheat grain is accepted as the main quality factor by the milling industry (Boz et al., 2012).

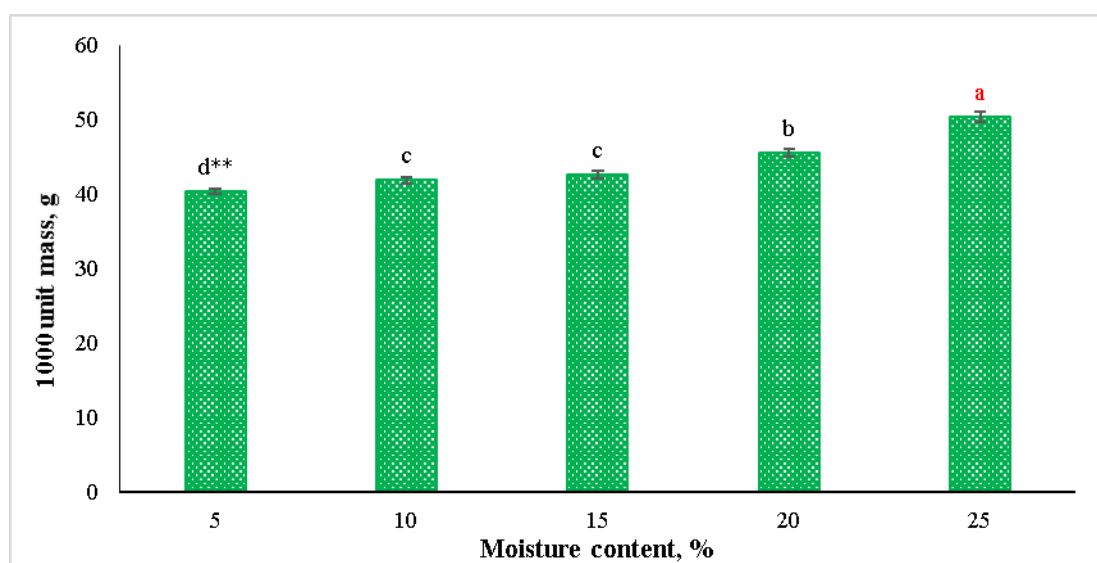


Figure 5. The effects on 1000 unit mass of different moisture content
** Significant at $P < 0.01$.

Figure 6 clearly indicated that the bulk density of hulled siyez wheat seeds changed considerably depending on moisture contents. The values of bulk density for seeds decreased from 486.6 to 383.6 kg/m³ (statistically significant at $P < 0.01$) with an increase in moisture contents. This was due to the fact that an increase in mass owing to moisture gain in the sample was lower than accompanying volumetric expansion of the bulk (Pradhan *et al.*, 2008; Solomon, 2009).

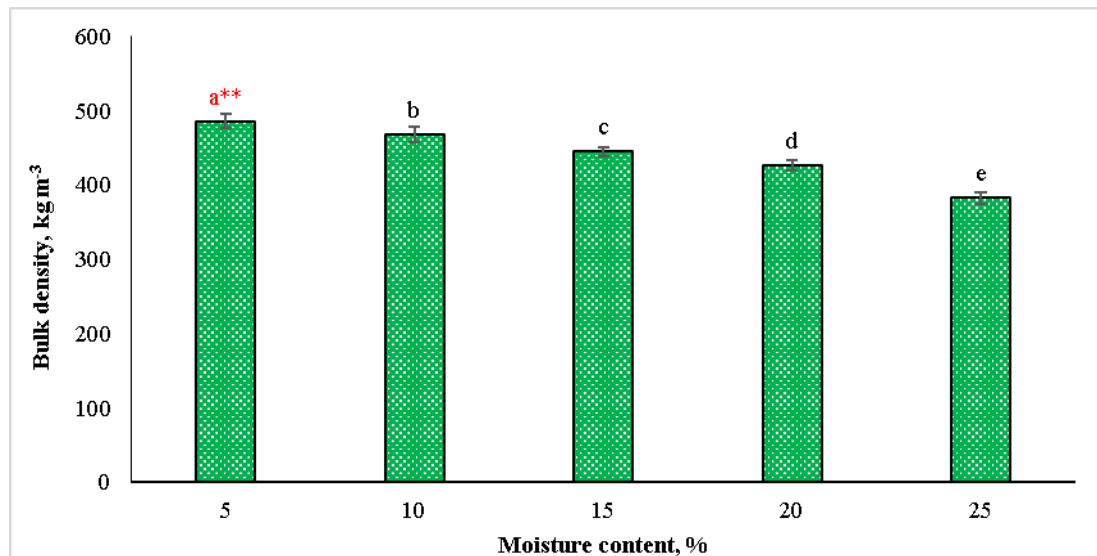


Figure 6. The effects on bulk density of different moisture content
** Significant at $P < 0.01$.

As a result of the study, it has been determined that the optimum seed moisture value of einkorn siyez wheat is 5 and 10% in terms of physical properties.

However, more cooling and ventilation is required to keep the seeds at 5% moisture content. It may not be economical to reduce the moisture content of seeds harvested at high humidity by 5% by drying. Depending on these factors the ideal seed moisture can be taken as 10%. However, it has been determined that other moisture contents are not suitable.

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A Review of Determining Principles of Industrial Wood Windows Manufacturing

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Abstract: In this study, manufacturing conditions and quality control processes that has impact on success for implementation of laminated window profiles were discussed within the framework of essentials for manufacturing laminated wood window profiles that has very important impact on improvement for industrial wood window manufacturing. In recent years, it has been observed that the expectations of the windows and windows, which are changing continuously in terms of quality and quantity of production in the world, are becoming different today due to the ecologic approaches dominated by every field especially with the developing technology. In comparison with these changes, it can be said that the use of solid wood material, which is the traditional and indispensable material of window production, has lost its advantage against alternative materials (plastic, aluminium, composite material etc.) in window production with laminated joinery profiles developed in the framework of technological innovations. Due to the fact that the produced laminated wooden window profile is not anisotropic as it is in the massive wood, within the use of lamination technology the product properties are becoming more homogeneous. Thus, using lamination technology makes it possible to produce a much more stable and long-lasting material. Moreover, thanks to the production of window profile from laminated wood material; advantages such as savings from raw materials, removal of natural defects in massive woods, access to high quality materials, evaluation of very short parts and the ability to reach desired dimensions can be achieved. As a result, it is found out that industrial wood window manufacturing is based on production conditions and quality control processes that has effect on the success of implementing laminated window profiles. Manufacturing conditions consist of the following; general facility conditions, material properties, the structure of profile sections and the suitability of longitudinal and transverse joints, whereas quality control process include preparation of system identification, control of materials and control of the laminated profile section.

Keywords: Industrial Wood Windows, Laminated Profiles Manufacturing, Laminated Window Profiles, Wooden Materials, Quality Control Process for Laminated Profiles.

1.INTRODUCTION

Laminated wood products are getting popular in various applications such as construction, furniture units, and indoor decorations due to utilization of raw material with sustainable approach. They also have advantages being more dimensionally stable and better looking than those of manufactured from solid wood. Characteristics of adhesive and their application methods for lamination processes play an important role on both physical and mechanical properties of laminated product influencing its final quality. Therefore, it is vital to select right adhesive type and control overall process to have laminated product with accepted strength properties. Laminated windows profiles are also another application of this process (Kurtoglu and Dilik, 2012, Dilik et al., 2007, Dilik and Hiziroglu, 2004, Dilik, 1997, Bozkurt and Göker, 1987).

In this study, manufacturing conditions and quality control processes that has impact on success for implementation of laminated window profiles were discussed within the framework of essentials for manufacturing laminated wood window profiles that has very important impact on improvement for industrial wood window manufacturing. This research examines production conditions and quality control procedures on the basis of the production of Laminated wooden window profiles;

Production conditions; plant conditions, material properties, structure of profile sections and also longitudinal and transversal joints

Quality control process; preparation and control of system introduction, control of material and laminated profile section contents are discussed within the each topic.

In this content, it is aimed to obtain the best results in laminated window profiles optimum properties.

2.MATERIALS AND METHODS

In this study, it has been underlined to determine the production essentials which are very effective on the application of the lamination technique and laminated window profiles that brings the advantages such as easier access to the properties

required in the selection of wood materials to be used in the production of wooden windows and the rational use of raw material wood (TS EN 386, 1999).

In this research, an instruction provided by as per regulation governing Laminated Wooden Window Profiles by German Window Technique Industry Institute is followed as method for the production requirements of wooden window profiles (IFT,1986).

3.RESULTS AND DISCUSSION

Production Conditions

General conditions (plant conditions)

- During the production process, the temperature of the production area should be at least 15-20 ° C and the relative humidity of the air should be between % 40-75.
- Drying and storage facilities at adequate capacity should be provided to maintain the desired moisture content and temperature.
- Unless the resin and hardener are directly pumped from the storage tanks, a separate room (area) must be provided for the preparation of the adhesive.
- Resin and hardener storage should be arranged according to the principle of "First in First Out-FIFO “.
- The press pressure in the glue is determined according to the wood type and glue type. For this reason, the intensity of pressure used in production has to be adjustable.
- There must be a device continuously showing temperature and relative humidity in the warehouse, production area and bonding areas.

Material properties

Wooden material

The types of trees used should be suitable for window production. Appropriate tree species according to DIN 68360/1 are Spruce, Yellow pine, Dark Red Meranti, Sipo, Maun and so on. There is no standard for the appropriate production of laminated joining profile production of natural wood species in our country. However, according to the results of the research done on the laminated window profiles used with Yellow pine and Red pine, it has been determined that Yellow pine and Red pine are suitable.

Wooden humidity

The amount of wood humidity should be 12±3% and not more than 2% in single profile laminates (figure 1).

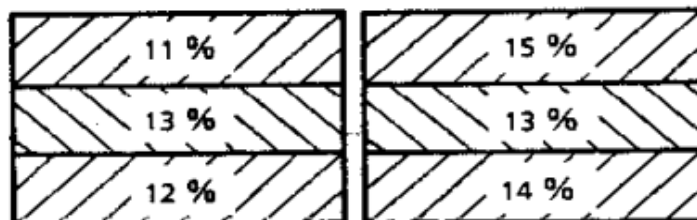


Fig.1: Humidity distribution in profile section.

Wooden quality

The quality of the wood used must comply with the standards. Deviations from the standard are allowed in the lamination to be used in the middle layer in the profile section. However, brown or brown rot, insect holes (except for fresh wood insects), transverse cracks larger than half of the laminated width, large knot diameter greater than half of the laminar thickness and fiber curvature greater than 2% are not allowed (figure 2).

For the laminated to be used in the middle part, it is necessary to systematically determine if different wood types are used according to the upper laminates. For this, for example, apply to each layer of the wood material to be used; At least 0.35 gr/cm³ for coniferous wood and at least 0.45 gr/cm³ for leaved wood. it is necessary to determine the suitability of whether or not to use such properties.

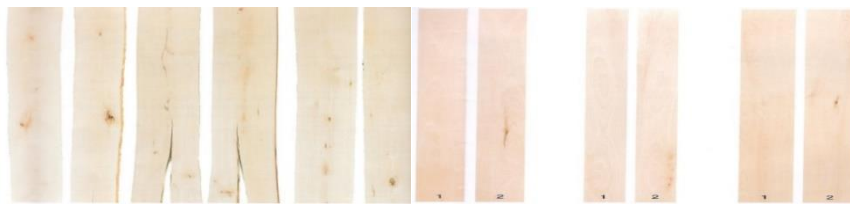


Fig.2: Determination of the wood quality to be used in the middle and upper layers for laminated profiles.

Adhesive (Glues)

Adhesive materials are classified according to the adhesion strengths according to various national standards and the adhesive material to be used for laminating materials for window profiles must conform to DIN and B4 loading group according to EN 204 and D class according to TS5430. That is, it must withstand temperatures up to 60 °C. On the other hand, the suitability of the adhesive used must be checked. Another points to consider here is the necessity of compliance with the data of all the adhesive materials used.

Structure of Profile Cross Section (crosscut)

Profile sections should be arranged symmetrically first and the lamella opposite to each other must be the same in terms of thickness, tree type and wood structure. In addition, the cross-section should be glued at same amount of moisture content. Profile sections must consist of at least 3 lamel. However, it must be ensure that the wood material used are the same wood type and the same moisture content, if two lamellar sections are to be produced. Lamellar thicknesses should be at least 15 mm. Thus, the glue line is not found in the profile joint and is not directly exposed to the weather conditions.

Profile forms

According to the German Window Technique Institute L, Z and T forms are allowed in the production of window profiles, although it is possible to produce laminated profiles in almost any form used in windows. However, it is necessary to apply equal pressure on the glue joints with the press. In other words, all glue joints must be of equal width and on top of each other (figures 3). Dimensions and machining tolerances in the profiles are foreseen as 4 - 6 mm in both thickness and width.

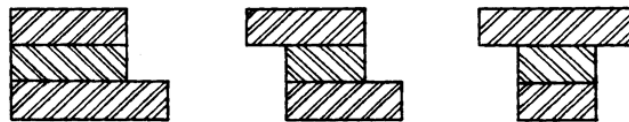


Fig.3: Samples of profile forms.

Place and form of glue joints

The glued surface must be absolutely planed and free from surface processing defects. So, gluing should be done on planed and clean surfaces. Despite the use of finger joints in general, in exceptional cases, the glue joint can be used to join the tongue with the lamp. It is important to make sure that the lamellae are arranged on top of each other.

Annual ring orientation

Essentially, it is possible to combine the lamella of any cross section (radial, tangential, half radial and half tangent). However, it is appropriate to ensure that there are no large differences between the lamella in the same profile section. Another point to be considered when choosing lamella is that the same timber structure is used in the upper lamella in the produced profile section.

Longitudinal and transverse joints

If longitudinal joints are to be used on both the upper and middle plates in lamine profiles, they must be in the form of finger joints in accordance with the standards.

- Wooden humidity difference should not exceed $\pm 1\%$.
- Ensure that the structure is the same in the parts joined together.
- The wedge teeth must be fully aligned Optimum pressure must be applied to maintain adequate adhesion.
- Cross-linking is only allowed on the laminae to be used in the middle layers. In this case, the spliced mid layer joints must be glued.

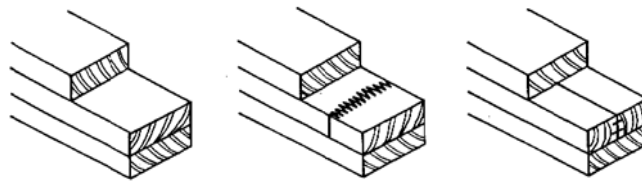


Fig. 4: Samples of longitudinal and transverse joints.

Gluing conditions

As stated in the General Conditions section, the room where the wood materials and glues are made should be between 15-20 ° C. The glue preparation room should be separated from the production area by volume. It should also be considered that the gluing is carried out within the first 24 hours after planning because the old form of the wood surface has the effect of reducing the wetting ability.

During use of the glue, the instructions of the glue manufacturers (amount to be applied to the m², open time, press press and press duration) should be followed. The press pressure in the glue is determined according to the wood type and glue type. For this reason, the intensity of pressure used in production has to be adjustable. After pressing, the profiles should be stored at a certain temperature and relative humidity for at least 2-3 days for stress and humidity balance.

Quality Control Procedures in Laminated Window Profiles

Quality control in laminated material production is the preparation of the system identification and quality control procedures; consists of operations to check whether the laminated material to be produced conforms to the system identification (Turkilin, 1992).

Control of system suitability

First of all, for the laminated materials to be produced by the manufacturer; evidence of conformity beginning with the preparation of a system identification which specifies the materials to be used, measurements, wood quality, gluing conditions, form stability and dimensional tolerances; First inspection serves to determine whether the personnel and the plant conditions are in accordance with the production in relation with the continuous and regular production and the controls during production. Thus, it is checked whether the profile section to be produced before the start of production conforms to and whether it conforms to the special request between the parties according to the production conditions.

Materials control

1. Specific Gravity of Wood

The specific gravity should be at least 0.45 gr / cm³ in the leaved tree and 0.35 gr / cm in the conifer tree if it is not specified in the system description.

2. Wood Humidity Before Cutting

Wood humidity should be checked with humidity meters before cutting to check compliance with production conditions. At these controls, it should be ensured that the moisture content is at most 15%.

3. Ability in using glue

Prior to use, the glue should be checked for storage time and for damage.

4. Control of production and processing conditions

It is important to control the production process whether it is applied appropriate with a planned framework. According to this following should be checked;

1. Climate conditions of production area
2. Control of lengthening joints
3. Mixing ratio of glue
4. Press conditions

Control of Laminated Profile Section

The control of the finished laminated profile is made using a control plan that is prepared according to the system introduction

1. Measurement of wood humidity

Wood humidity should not exceed 15% after processing. The wood humidity difference between the individual layers should not exceed 2%.

2. Determination of shape change

It should be checked whether it is more than 1 mm / m from deviation from straightness deviation and straightness distortion

3. Control of gluing joint and gluing quality

All joints must be glued. If there is no glue flooding from the joints after pressing, gluing should be checked according to the following guidelines.

It should be checked whether the penetration material penetrates the joints by applying lots of penetration materials on open glue joints.

The penetration material must not penetrate the glue joint. Otherwise, it is decided that the gluing quality is insufficient. On the gluing quality, it is checked whether or not it is separated by applying a force effect with a glue casting wedge in short samples cut to a length of 50 mm. In this control, glue breakage (separation) should not occur (Figure 5 and 6).

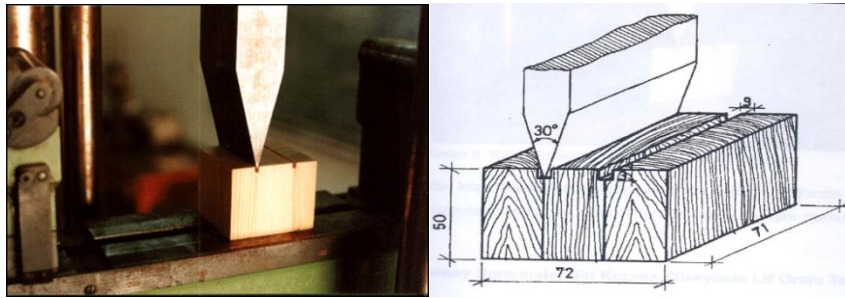


Fig. 5: Application of splitting (breaking) experiment with wedge effect.

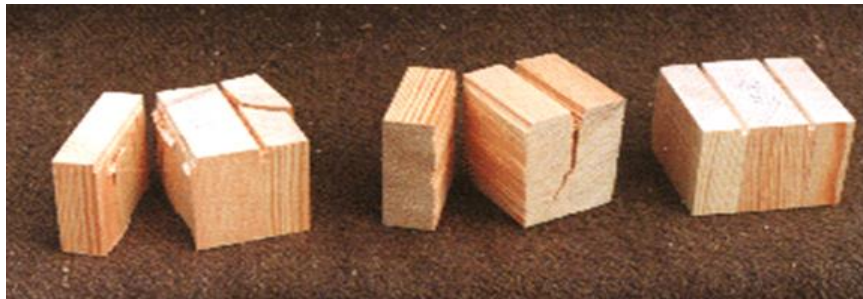


Fig. 6: Samples of splitting of glue line in splitting experiment by wedge effect.

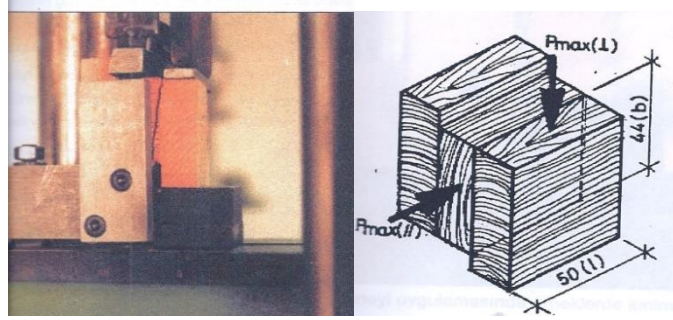


Fig. 7: Adhesion resistance (breakage) test with shear resistance test.

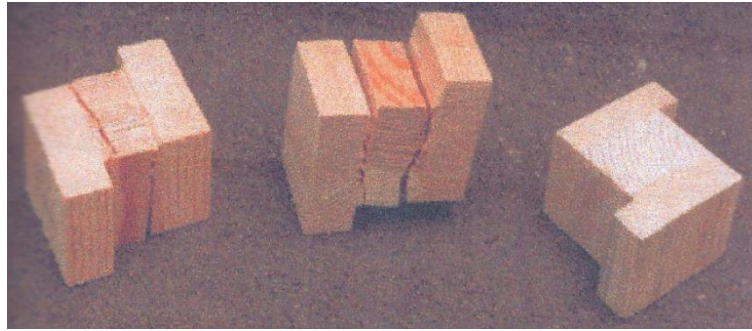


Fig. 8: Samples of splitting in glue line in adhesion experiment with shear force.

- It is observed that production conditions and quality control processes are the basis of production which is effective in the success of the application of laminated window profiles to be used in the production of wooden windows.
- Production conditions; general facility conditions, material properties, the structure of profile sections and the suitability of longitudinal and transverse joints, whereas quality control process include preparation of system identification, control of materials and control of the laminated profile section.
- In the research, the German Window Technique Institute (IfT) instructions used for the production and control of window profiles from laminates. In this framework, it can be said that it is necessary to prepare a similar directive considering the technological characteristics of our natural conditions and our natural tree species since there is not a similar regulations in our country.
- Thus, it is seen that the consumption in the production of wooden windows, which is known as the most used area of solid wood materials, is considered to be a positive contribution to the consumption of wood materials and rational use in consideration of the world scale (Godman, 1988).
- As a result, it appears that the systems developed in the framework of technological innovations in the window area in recent years have emerged as one of the most important factors in regaining the superiority of wooden materials lost against alternative materials in window production. It is stated and suggested that most of the laminated window systems designed to produce a window meet the expectations as they are applicable to any architectural project in terms of form, color and construction advantages.

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Machinability of Az21, As21 and Am20 Magnesium Alloys

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Abstract: This study investigates the effect of Zinc (Zn), Silicon (Si) and Mangan (Mn) in (AZ91: 2% Al, 1% Zn, AS21: 2% Al, 1% Si, and AM20: 2% Al, 0.5% Mn) magnesium alloys on mechanical properties, wear resistance and machinability. In magnesium alloys, the effect of mechanical properties, wear resistance and machinability was investigated by establishing the impact of 1% zinc (in AZ21), 1% silicon (in AS21), and 0.5%Mn (in AM20) within the microstructure in these alloys with aluminium amount less than 3%. It was found that the intermetallic phases found in the microstructure within the alloy had an effect on mechanical properties (ultimate tensile strength, yield strength, elongation, hardness), wear resistance and machinability.

Keywords: *Machinability, Cutting Force, Mechanical Properties, Hardness, Magnesium Alloys*

1.INTRODUCTION

Magnesium and its alloys have many areas of use thanks to their mechanical, physical and chemical properties. Especially due to the fact that being among the lightest structure metals in addition to their low density and high resistance characteristics, magnesium alloys find many areas of use predominantly in logistics, automotive, and aviation sectors[1,2,3]. For this reason, magnesium alloys with various alloy properties are prepared and studies are being carried out on improving such characteristics of these alloys as mechanical properties, hardness, and wear[4,5].

Another significant property of magnesium alloys is that it is among construction metals with ease of machinability[6,7,8]. However, the most important risk in machining magnesium alloys is the presence of combustion and burning potential at higher cutting speeds. It may be noted that such possibility may increase especially in finishing operation and high cutting speeds. Risk of combustion rises in the event of magnesium alloys reaching 600°C which is the melting point of fine chips[6]. Especially in certain magnesium alloys, Flank Build-up (FBU) formation on the cutting surface during machining with cemented carbide tools was reported at higher cutting speeds, under dry machining conditions[6,8,9]. FBU formation was also reported to facilitate the occurrence of combustion/burning[6,10]. The reason why FBU is formed in certain alloys has not yet been completely clarified with systematic investigations. FBU formation is believed to correlate with components of alloys. However, a systematic study is not present on the issue. Our study on the machinability of AZ21, AS21 and AM20 series magnesium alloys might be a resource[11].

Studies conducted on alloy properties affecting the improvement of mechanical properties and wear characteristics of magnesium alloys and their correlation with machinability are quite low in number and insufficient. The use of magnesium alloys in engine, piston, and cylinders especially in automotive sector is in the process of development depending on investigating such characteristics as hardness, wear resistance, and machinability. It is known that wear resistance is closely related with tensile properties of the material. Wear can be defined as resistance of metal against friction in its most basic sense. Today, the most commonly used Mg-Al (magnesium-aluminium) alloys are AZ21, AS21 and AM20 alloys. The most significant properties of these alloys are their well castability and improvable mechanical properties.

This study investigates the effect of Zn (Zinc) (in AZ21), Si (Silicon) (in AS21) and Mn (Mangan) (in AM20) magnesium alloys on wear resistance and machinability, and also the effects on mechanical properties (UTS, YS, El, HV), wear resistance and machinability depending on microstructure in AZ21, AS21, and AM20 (containing 1% Zn, 1% Si, and 0.5Mn). Also investigated were the effects of alloy components in magnesium alloys on microstructure and FBU formation and the resulting effect of all this on machinability.

2. MATERIALS AND METHODS

Mechanical and Microstructural Properties

The most common magnesium alloys AZ21, AS21 and AM20 were used in this study. These alloys were obtained by melting in specially designed atmosphere-controlled melting furnace (750°C) by method of casting into metal moulds (preheated to 270°C). As the protective gas, protective SF₆ was used during casting. Extruded samples were 22mm in diameter and 200mm in length. The chemical compositions of the extruded alloys were determined by a Spectrolab M8 Optical Emission Spectrometry (OES). Detailed information on casting methods of magnesium alloys were provided in a study by Ünal (2008)[12]. Components of alloys used in the study are given in Table 1. Later on, microstructure examination, hardness, and wear tests were carried out on samples obtained by casting method.

The sample surfaces prepared (in 15mm diameter and 12mm thickness) and used in microstructure examinations of alloys were cleaned by sanding (emery papers from 200 up to 1200 grits were used). Then, surfaces of samples were polished by diamond paste of 6µm, 3µm, and 1µm, respectively. Following polishing process, surfaces of samples were etched in a specially prepared solution (contents: 100ml ethanol, 5ml Acetic acid, 6g picric acid, and 10ml water) and thus, microstructure images were obtained (Nikon Eclipse LV150).

Table. 1. Chemical composition of the studied AZ21, AS21 and AM20 alloys

(wt %, “A” refers Al content and “Z” refers to Zn, “S” refers to Si, “M” refers to Mn content of the alloy).

Alloys	Al%	Mn%	Zn%	Si%	Fe%	Mg%
AZ21	2.0	0.13	1.2	0.08	0.02	Rest
AS21	2.1	0.2	0.2	1.2	0.02	Rest
AM20	2.1	0.5	0.15	0.01	0.01	Rest

The hardness values of the samples were determined using the Vickers hardness test (HV) with a load of 10N on the microhardness tester (Shimadzu HMV-2). At least ten hardness measurements were determined for each sample. Wear tests of experimental samples (15mm in diameter and 12mm in thickness) were carried out on pin-on disk test device (Tribotester TM, Clichy) (Fig.1.) At the end of wear experiment, sizes of marks left on sample surfaces were measured and thus wear resistances of samples were estimated. Wear tests were performed on a reciprocating wear tester under a load of 4N. Al₂O₃ balls having a 6mm diameter rubbed on the surfaces of the samples with a sliding speed of 5mm/s. The stroke of the Al₂O₃ balls was 5mm for a total sliding distance of 25m.

Tensile tests were carried out. Data on the tensile strengths of alloys (Ultimate Tensile Strength-UTS, Yield Strength-YS) and Elongation % (El) values were obtained from tensile tests. Samples used in the tensile tests were prepared in compliance with ASTM E 8 M-99 standards. Tensile tests were carried out at room temperature (20°C) (Shimadzu Autograph AGS-J 10 kN Universal Tester). Tensile test data were established by averaging the 6 samples. The strain rate used for tensile testing was $0.8 \times 10^{-3} \text{ s}^{-1}$.

Machining Properties

This study investigated the machinability of alloys by obtaining data on cutting forces by keeping the chip section fixed at various cutting forces on AZ21, AS21 and AM20 magnesium alloys acquired through casting method. Data on cutting forces were obtained under dry machining conditions and vertical processing method. Machining tests were carried out by turning process in DMG CTX Alpha 300 CNC lathe machine. Polycrystalline Diamond (PCD) tool (CCGT 120408 FL K10) was used as the cutting edge. Data on cutting forces were obtained from specially-designed strain gauge. Surface roughness values of sample surfaces were measured with Time-TR200. Machining parameters used in the study are given in Table 2.

Table.2. Machining Parameters and Conditions used during the test.

Parameters and Conditions	
Operations	: Turning
Feedrate (f , mm/rev)	: 0.10 (Constantly)
Depth of Cut (DoC , mm)	: 1.0
Cutting Speed (V_c , m/min)	: 56, 112, 168
Cutting Conditions & Lubricant-Coolant	: Orthogonal and Dry Cutting,
Workpiece Materials	: AZ21, AS21 and AM20 Magnesium Alloy
	: CCGT 120408 FL K10

Cutting Tool Properties	α	γ	λ	ε	κ	Γ_s
	7°	5°	0°	80°	50°	mm

3.RESULTS AND DISCUSSION

Microstructural, Mechanical and Microstructural Properties

Microstructure photographs of AZ21, AS21 and AM20 magnesium alloys used in the study are given in Fig.1. Microstructure of magnesium alloys analysed in the study was generally observed to be made up of α -Mg matrix and intermetallic phases ($Mg_{17}Al_{12}$ and Mg_2Si , Al_8Mn_5). In AZ series magnesium alloys, the fact that β intermetallic phase within the microstructure ($Mg_{17}Al_{12}$) occurred in the form of network within the scope of α -Mg matrix was reported in studies[11,13,14-26]. In AS21 magnesium alloys, the fact that Mg_2Si intermetallic phase was observed in the form of Chinese script form within the microstructure was already known through the literature[14-17,24]. It was reported in literature that the formation of β intermetallic phases within the microstructure ($Mg_{17}Al_{12}$ and Mg_2Si) was correlated with the Al% amount in the alloy. β intermetallic phases were reported to become clear along with the increase in Al amount to above 3% in alloy[6,11]. It was reported in previous studies that the formation, appearance and shape of intermetallic phases in magnesium alloys shifted depending on changes in the alloy components and in the solidification behaviour [5,14-24]. It can be found in Fig. 1 that β intermetallic phases in microstructure of AZ21, AS21 and AM20 alloys were not observed and did not occur in a completely apparent manner. Microstructure images obtained in this study are in concordance with the literature.

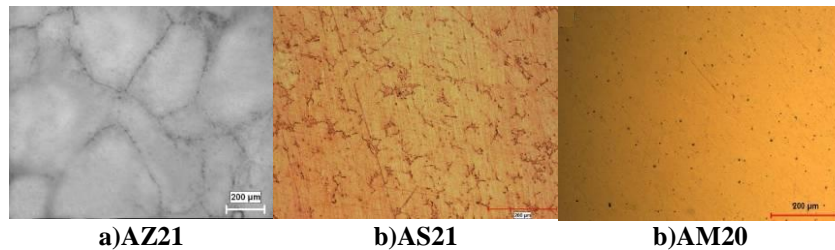


Fig.1. Optical Micrographs of a) AZ21, b) AS21 and c)AM20 magnesium alloys.

Hardness and wear values of the analysed AZ21, AS21 and AM20 alloys are given in Fig.2. When checked the mean hardness values of alloys, these were estimated to be 47.2 HV₁₀ in AZ21 alloy, 49.3 HV₁₀ in AS21 alloy, and 48.1 HV₁₀ in AM20 alloy. It was observed from the hardness tests that AS21 and AM20 alloy demonstrated a higher hardness property compared to AZ21 alloy. The fact that AS21 and AM20 demonstrated a higher hardness property resulted from the intermetallic phase (Mg_2Si , Al_8Mn_5) found in the microstructure [14-17,24].

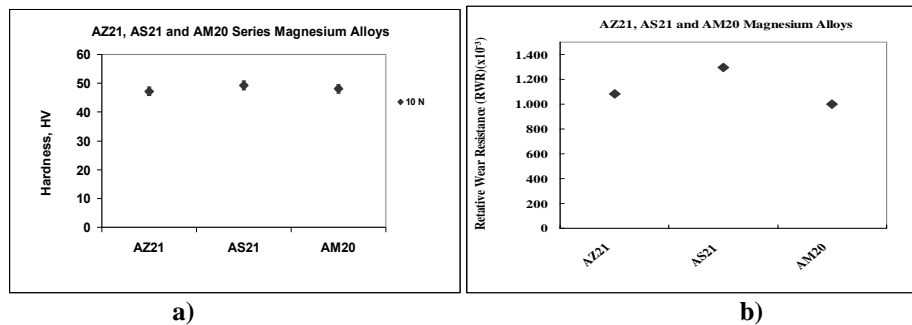


Fig.2. Hardness (HV) of AZ21, AS21 and AM20 Magnesium Alloys

Based on the data obtained from wear tests, presence of intermetallic phase (Mg_2Si) in AS21 alloy microstructure provided the demonstration of a higher wear resistance at a rate of ~29% compared to AM20 alloy. According to this, it was observed that the Mg_2Si intermetallic phase that occurred thanks to the effect/presence of Si in AS21 alloy increased wear resistance compared to $Mg_{17}Al_{12}$ intermetallic phase formed due to the effect/presence of Zn in AZ21 alloy or Mn in AM20 (Al_8Mn_5).

Tensile tests (UTS, YS and EL%) of alloys analysed in the experimental study were carried out. Data obtained from the study were prepared in the form of graphs (Fig.3.). The highest UTS and YS values were produced by AZ21 in tensile tests. On the other hand, AZ21 alloy had the lowest EL% value. Evaluation of results indicated that intermetallic phases ($Mg_{17}Al_{12}$, Mg_2Si and Al_8Mn_5) could be very effective at strengthening magnesium alloys [7-16].

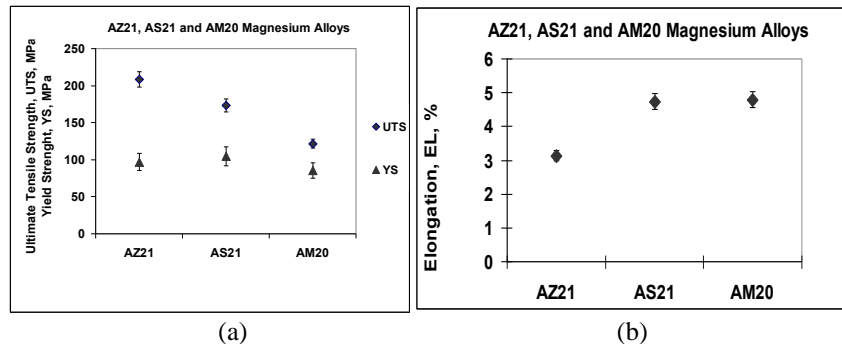


Fig.3. Tensile tests of AZ21, AS21 and AM20 magnesium alloys (a)UTS, YS and (b) EL%

It was reported in previous studies that hardness and strength of alloy increased parallel to the rise in Al% amount in magnesium alloy. Microstructure images of intermetallic phases causing the increase in hardness and strength of alloys are given in Fig.3. Massive β intermetallic phases were reported in previous studies to appear along with the increase in Al amount to above 3% in alloy[11]. It was observed in studies that these intermetallic phases within microstructure affected the mechanical properties of the alloy.

Machining Properties

In the turning processes of the samples used in the experimental study, data obtained (cutting force and surface roughness) are given in Fig.4. Figure 4a-b shows the effect of cutting speed variations on the cutting force for the machined samples as a function of alloy composition. When compared the cutting forces formed during the machining of these alloys, the highest cutting force value was obtained from AM20 alloy (Fig.4). The lowest cutting force in all cutting speeds (three cutting speeds) was obtained in AZ21 alloy. While the cutting force value at the lowest cutting speed (56m/min) was measured in AZ21 alloy as 25.3N, in AS21 alloy 41.9N, and it was measured as 52.8N in AM20 alloy. When the cutting speed was raised to 168m/min, cutting speeds were measured as 27.6N in AZ21, 43.1N in AS21, and 51.3N in AM20 alloy. From this point of view, it may be noted that the increase in cutting forces depending on cutting speed could occur due to dislocation build-up with chips in cutting edge. The surface roughness (R_a) of the samples given in Fig.4b revealed that surface roughness for all the alloys decreased as the cutting speed increased. This shows that the alloy content had considerably affected the R_a .

It was observed that that the (in AM20 alloy; Al_8Mn_5 , in AS21 alloy; Mg_2Si) intermetallic phase found in the microstructure of these alloys compared to $Mg_{17}Al_{12}$ intermetallic phase (in AZ21 alloy) was more effective, and that it caused cutting forces to increase during machining along with rising the hardness and wear resistance of the alloy.

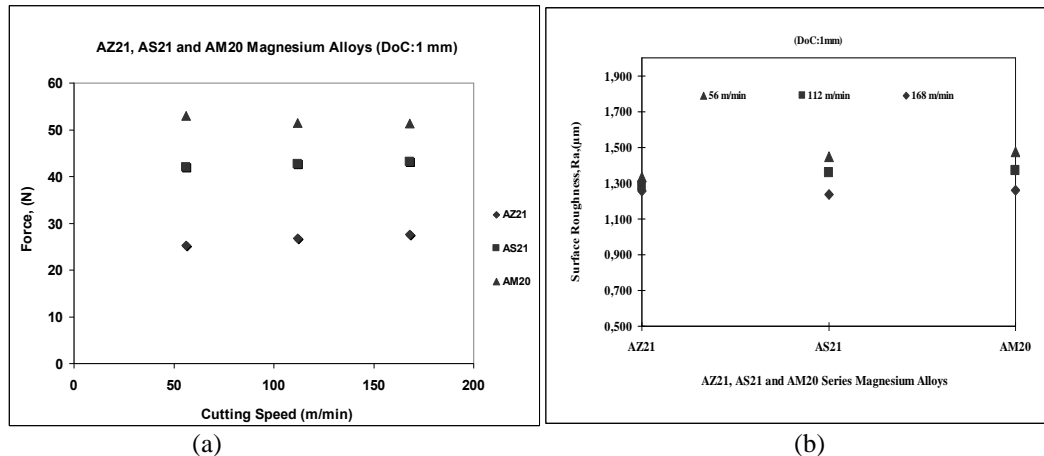


Fig.4. Relationship between cutting forces and alloy compositions (a) and surface roughness of AZ21, AS21 and AM20 magnesium alloys (DoC: 1 mm, f: 0.102 mm/rev).

Wear occurring on the cutting edge surface due to machining the alloys are shown in Fig.5. When analysing the cutting edge surfaces used in the experiment, it was observed that Flank Build-up (FBU) occurred due to dry friction between the work piece and cutter surface during the machining of the samples [4,6-8,14], and that the cutting edges were worn. This wear was found to be deeper on the cutting edge belonging to AM20 alloy. It is shown in Fig.5 that the $(Mg_2Si$ and $Al_8Mn_5)$ intermetallic phases that occurred in the alloys were effective in the increase of the cutting forces, and thus, the surfaces of the AS21 and AM20 were more worn.

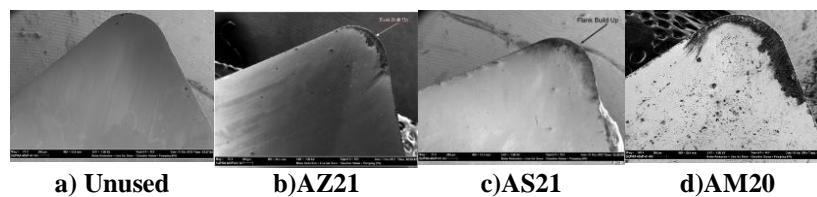


Fig.5. SEM image of cutting tool tip used for machining of (a) Unused, (b) AZ21, (c) AS21, (d) AM20 magnesium alloys (V_c : 168 m/min, DoC: 1 mm, f: 0.10 mm/rev).

Flank Build-up (FBU) formation increases depending on the cutting speed. That $Mg_{17}Al_{12}$ β intermetallic phase was formed in AZ21 alloy and that affected FBU formation were reported[11]. It is known that β intermetallic phase within the structure is correlated with Al amount and that β intermetallic phase increases along with the rise in Al% amount. Also known is that this increased FBU formation and has an impact on the rise in surface roughness and tool wear.

Chips Images obtained (with fixed chip section) from machining AZ21, AS21 and AM20 magnesium alloys are given in Fig.6. When analysed the chip images, it was observed that chips formed from AZ21 alloy were longer compared to chips from AS21 and AM20. Chips from AS21 were found to be firmer and in an overlapping helical form[6,18]. It may be noted that chips from AM20 alloy were smaller in length and occurred as a result of brittle breaks due to the effect of Al_8Mn_5 intermetallic phase, and in AZ21 alloy, chips were longer and formed as a result of ductile breaks due to the effect of intermetallic phase ($Mg_{17}Al_{12}$, Mg_2Si , Al_8Mn_5)(Fig.6.). In these alloys, chip formations were observed to occur due to intermetallic phases thanks to Zn, Si and Mn effect/presence ($Mg_{17}Al_{12}$, Mg_2Si and Al_8Mn_5) found in the alloy[6]. It may be mentioned that chips obtained from AM20 alloy were harder and more fragile compared to AZ21 and AS21.

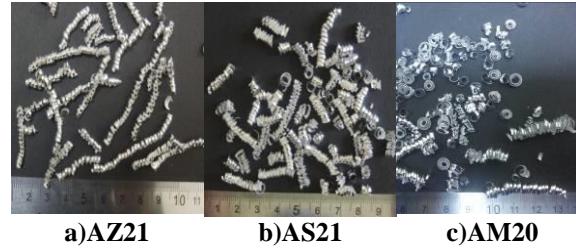


Fig.6. Chip Formation of a) AZ21, AS21 and c) AM20 Magnesium Alloys ($V_c: 168 \text{ m/min}$, DoC:1mm, f:0.10 mm/rev).

Moving from the experimental study, ($\text{Mg}_{17}\text{Al}_{12}$, Mg_2Si and Al_8Mn_5) intermetallic phases occurred/found in the microstructure of AZ21, AS21 and AM20 alloys were observed to have an effect on cutting forces and mechanical properties.

Since the Mg_2Si and Al_8Mn_5 intermetallic phase formed due to the effect/presence of Si and Mn in AS21 and AM20, respectively, demonstrated a higher increasing effect on hardness and wear resistance of alloys compared to $\text{Mg}_{17}\text{Al}_{12}$ intermetallic phase formed due to the effect/presence of Zn in AZ21. It may be noted that this increased cutting forces and caused wear in cutting surfaces[7,18]. Flank Build-up(FBU) increase in the cutting surface between the cutting edge and sample surface due to intermetallic phases also causes a rise in cutting forces (Fig.4). Flank Build-up(FBU) formation increases with friction and temperature rise occurring on the cutter surface due to an increase in cutting speed and this may be noted to raise cutting forces[7,18,27-30]. Increase in cutting forces reduces the machinability of materials.

Zn, Si and Mn found in the alloys that were investigated in this study were effective on the hardness, wear resistance and machinability of alloy in addition to having an impact on formation and type of intermetallic phases ($\text{Mg}_{17}\text{Al}_{12}$, Mg_2Si and Al_8Mn_5) formed in the microstructure. It was observed that intermetallic phases had an increasing effect on hardness and wear resistance of the alloys.

It was found that the Mg_2Si and Al_8Mn_5 intermetallic phase that occurred thanks to the effect/presence of Si in AS21 and Mn in AM20 alloy increased wear resistance and hardness compared to $\text{Mg}_{17}\text{Al}_{12}$ intermetallic phase formed due to the effect/presence of Zn in AZ21 alloy.

It was observed that the Mg_2Si and Al_8Mn_5 intermetallic phase found in the microstructure of AS21 and AM20 alloy compared to $\text{Mg}_{17}\text{Al}_{12}$ intermetallic phase in AZ21 alloy was more effective, and that it caused cutting forces to increase during machining along with rising the hardness and wear resistance of the alloy. This, as a result, reduces the machinability of alloy.

Both alloys were observed to have an increase in surface roughness as the cutting speed rises. It was observed that the surface roughness values obtained from AM20 alloy were higher compared to surface roughness values from AZ21 and AS21 alloy.

The mechanical properties of AZ21 alloy was higher compared to AM20 alloy. Its machinability was higher (lower cutting force) compared to AS21 and AM20.

It was observed that chips formed from AM20 alloy were longer compared to chips from AZ21 and AS21. Chips obtained from AM20 alloy were established as harder and more fragile compared to AZ21, AS21. Intermetallic phases ($\text{Mg}_{17}\text{Al}_{12}$, Mg_2Si and Al_8Mn_5) were found to have an effect on chip formation.

Intermetallic phases within the microstructure have an impact on cutting forces, FBU formation, chips form and machinability. Cutting speed influences cutting forces reaching the cutting tool, surface roughness and chip form.

Hardness of AZ21 alloy was found to be higher compared to AS21 and AM20 alloy. However, machinability of AZ21 was higher compared to AS21 and AM20.

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Electrospun Conductive Polycaprolactone (Pcl)/Carbon Black Nanofibers and their Optical Properties

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Abstract: In this study electrical and optical properties of electrospun polycaprolactone (PCL)/carbon black composite nanofibers were investigated. PCL was chosen for its low cost and easy spinnability. PCL nanofibers were produced by electrospinning with the addition of carbon black into the spinning solution. Carbon black was used to make PCL nanofiber conductive. The effect of deposition time on optical and electrical properties of the samples were investigated. Nanofibers with diameters around 1 μm were obtained. With the increasing deposition time, the conductivity values were increased while transmittance values were decreased. It can be concluded that conductive PCL/carbon black nanofibers are promising for optoelectronic applications.

Keywords: electrospinning, conductivity, transparency, nanofibers, polycaprolactone, carbon black

1. INTRODUCTION

Nanofibers are defined as fibers with diameters in nanometer scale. The reduction in diameter gives nanofibers unique properties such as small pore size, high porosity, high surface area to volume, light weight, flexibility and high mechanical strength. Therefore, nanofibers have found many different application areas from medicine to filtration (1-3).

With the increasing demand for nanofibers, researchers have also focused on their electrical conductivity and optical properties. Electrical conductivity of the nanofiber increases due to the confinement in small diameters. Transparent electrically conductive nanofibers can be used in optoelectronic devices such as touch screens, e-readers etc. where electrical conductivity and transparency is needed. Moreover, nanofibers offer light weight and flexibility which make them preferable for such applications (4,5).

Nanofibers can be produced by electrospinning. Electrospinning uses electrical forces to produce polymeric nanofibers. In this method, high voltage is applied to a polymer solution held in a syringe. With increasing voltage, polymer jet ejects from the tip of the syringe and travels towards to a collector under the influence of electrical field. During the travel of the jet, the solvent evaporates and polymeric nanofibers were collected on the collector (6-8).

The aim of this study is to investigate the effect of deposition time on the electrical and optical properties of PCL/carbon black nanofibers. For this purpose, PCL/carbon black nanofibers were produced by electrospinning with different deposition times. Optical and electrical properties of the nanofibers were evaluated.

2. MATERIALS AND METHODS

Polycaprolactone (PCL) (Mn: 80 kDa), dimethylformamide (DMF) and dichloromethane (DCM) were purchased from Sigma-Aldrich Inc., carbon black (CB2000) grade was purchased from Cabot Corporation and Polydimethylsiloxane (PDMS) was purchased from Dow Corning. All chemicals were used without further purification.

PCL/carbon black solutions were prepared in DMF/DCM mixture, as the final concentration of PCL will be 8% wt. and the final concentration of carbon black will be 2% wt. in the solution. The mixture was sonicated by a probe sonicator (QSONICA, 500 Hz) and kept on a hot plate at 45 °C until PCL was completely dissolved.

The PCL/carbon black nanofibers were fabricated by electrospinning with different deposition times from 1 min to 3 min. The flow rate was kept at 0.7 mL/h and the electrical field was 0.6 kV/cm. After electrospinning the samples were covered with PDMS and kept on a hot plate until they were fully cured.

Thickness and the morphology of the nanofibers and the electrospun mats were calculated by a light microscope (Olympus BX51). Resistance of the samples were measured by a multimeter. Optical properties of the samples were investigated by a UV-vis spectrophotometer.

All the experiments were carried out at the Laboratories of University of Illinois at Chicago (UIC), USA.

3.RESULTS AND DISCUSSIONS

Figure 1 shows the light microscope image of the PCL/carbon black nanofibers. It can be seen that PCL/carbon black nanofibers are black in color indicating that the fibers were covered with carbon black. The fibers had diameters around $\approx 1 \mu\text{m}$ due to the size of the carbon black chunks.

The fiber mats showed different resistance values from 1.26 to 0.725Ω depending on the deposition time (Table 1, Figure 2). This indicates that conductive nanofibers were successfully produced. In order to enhance the conductivity of the nanofibers, carbon black amount in the spinning solution can be increased.

With the increasing deposition time, the transmittance values of the nanofiber mats were decreased, as expected (Table 1, Figure 2). This means the fiber mats became less transparent with increasing deposition time.

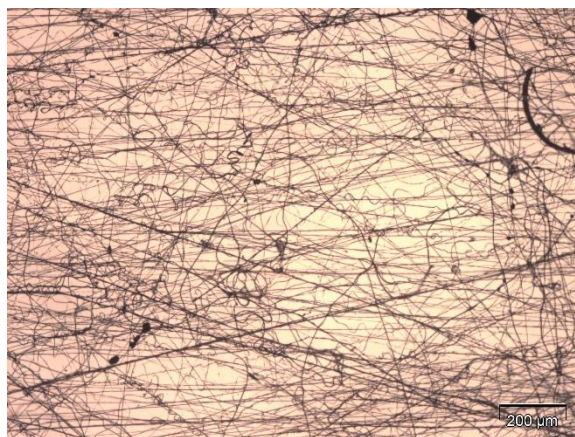


Figure 1. Light microscope image of PCL/carbon black nanofibers

Table 1: Properties of the samples with increasing deposition time

Deposition Time (min)	Resistance ($M\Omega$)	Transmittance (%)
1	1.26	94.32
2	1.035	93.07
3	0.725	82.99

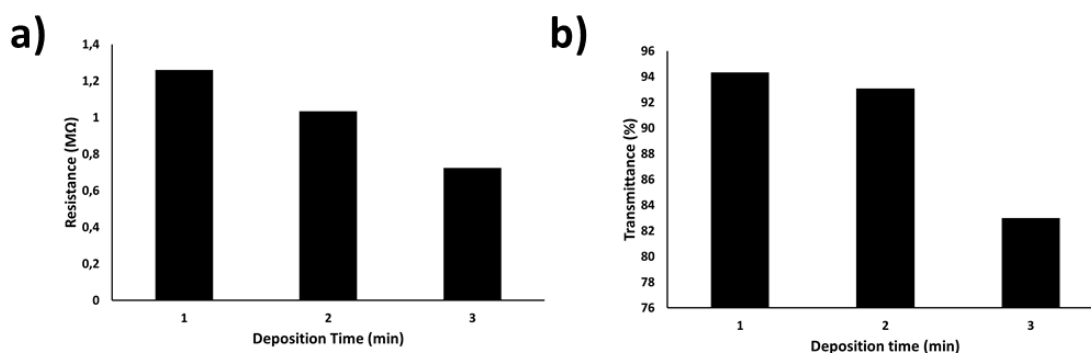


Figure 2. Electrical and optical properties of samples with increasing deposition time, a) resistance, b) transmittance.

Conductive nanofibers have gained importance especially for sensor, energy harvesting device, field-effect transistor and photovoltaic device applications for due to their adequate electrical conductivity, high surface area per volume, high flexibility, high mechanical strength and low weight.

In this study, conductive nanofiber particles were added into the spinning solution and PCL/carbon black nanofibers were fabricated by electrospinning. The effect of deposition time on electrical and optical properties of PCL/carbon black nanofibers were investigated.

The resistance and the transmittance values of the nanofibers were decreased with the increasing deposition time indicating that the surfaces became less transparent.

It can be concluded that, PCL/carbon black conductive nanofibers can be produced successfully by electrospinning. The electrical properties of the nanofibers can be enhanced by increasing the carbon black content in the spinning solution. These results indicate that PCL/carbon black nanofibers are promising for applications where both transparency and electrical conductivity are needed.

Acknowledgments

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Possibility of Silica Removal from Low Grade Metallurgical Bauxite by Size Reduction and Sieving

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Abstract: In this study, possibilities of silica removal from low-grade bauxite sample was investigated by means of size reduction. For this purpose, bauxite ore with 57.33% Al_2O_3 and 9.01% SiO_2 content (and module 6.36) was used in experimental studies. Experimental studies were carried out in two stages. In the first stage, the bauxite ore sample was crushed to coarse size (-2360 μm) and then ground to medium and fine sizes (-500 μm and -150 μm), respectively. In the second stage, crushed and ground bauxite ore was sieved to determine particle size distribution, and then Al_2O_3 and SiO_2 contents of the sieve fractions were determined with XRF analysis. According to experimental results, when going from coarse size fractions to fine size fractions, it was seen that while SiO_2 grade tends to increase and Al_2O_3 grade decreases, relatively. However, high-grade bauxite concentrate (i.e. containing low-silica) could not be obtained that could be fed directly to the Bayer process.

Keywords: Bauxite, silica removal, size reduction and sieving

1. INTRODUCTION

Nowadays, all of the alumina (Al_2O_3) and aluminum (Al) production in the world is provided with the Bayer process, and metallurgical-grade bauxite is the major raw material in this process. However, alumina production by Bayer process has some common technical problems and economic challenges such as excessive caustic soda consumption, scale formation caused by high silica, and the environmental problems caused by red mud. The major problems with the Bayer process result from silica, which is present in the form of clay (e.g. kaolinite, illite also called reactive silica). Alumina losses are associated with the use of bauxite because reactive silica reacts with a considerable amount of alumina and insoluble sodium aluminum silicate, also known as desilication product (DSP) is formed (Habashi, 1999; Barnes et al., 1999; Indrajith de Silva, 2013; Smith, 2017).

The most significant determinations for metallurgical-grade bauxites are its alumina and silica content. The alumina (Al_2O_3) to silica (SiO_2) mass ratio of bauxite ores, which is also defined as “module” or “silica module”, plays a critical role in the viability and economics of the Bayer process. Although the optimum module varies from plant to plant depending on bauxite type and technical-economic conditions in countries with bauxite plant, it is assumed that the limit module is around 7-8. The module value in high grade bauxites is above 10 (Jiang et al., 2011; Ahmad et al., 2014; Gibson et al., 2017).

However, the high grade (i.e. low silica) bauxite deposits are limited and its reserves are gradually decreasing in the world. Therefore, the bauxites are upgraded by the removal of silica to increase the module rate before it is sent to the Bayer process. Conventional beneficiation methods (i.e. washing, gravity separation, magnetic separation, flotation, etc.) have been tried to remove silica content from some bauxite ores. However, the silica problem has not been completely resolved yet and investigations on the processing of high silica bauxites has been continuing progressively. Smith (2009) has reviewed various processes for the processing of high-silica bauxite. He suggested that soda losses in the Bayer process can be reduced if the source of reactive silica in the bauxite is decreased.

In this study, it is predicted that the clay minerals (e.g. kaolinite) with lower hardness can be separated from the bauxite minerals (e.g. boehmite) in fine particle size by the effect of crushing and grinding. For this purpose, the high-silica bauxite sample was tried to be enriched by size reduction.

2. MATERIALS AND METHODS

Bauxite ore used in the experiment was supplied Seydişehir Aluminum Plant (Konya, Turkey). The primary minerals in the ore are identified by the X-ray diffraction (XRD) technique, and the peak pattern of the mineral crystals is given in Fig. 1. According to these results, the main mineral peaks found in the ore are boehmite, kaolinite/illite, hematite, rutile/anatase.

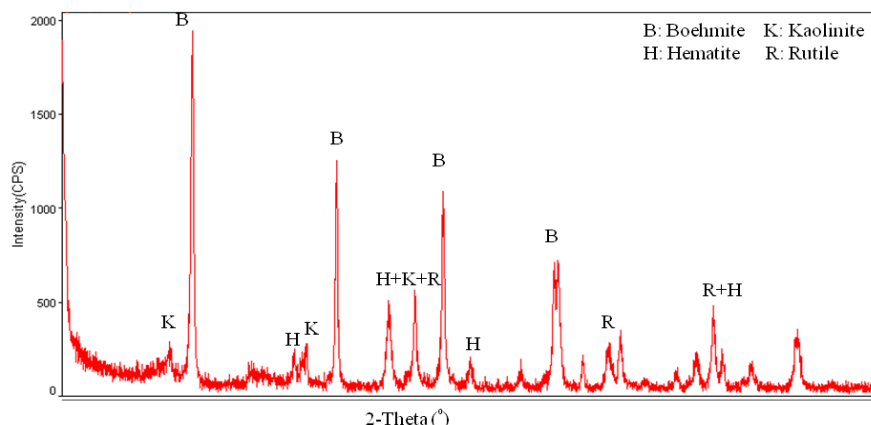


Figure 1. XRD pattern of the raw bauxite ore used in the study

Chemical analysis results obtained by X-ray fluorescence spectroscopy (XRF) are given in Table 1. It is seen that the ore contains 57.33% Al_2O_3 and 9.01% SiO_2 . According to these values, the silica module of the ore is 6.36.

Table 1. Chemical composition of the raw bauxite ore used in the study

Basic oxide compounds (%)						Module rate
SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	LOI*	$\text{Al}_2\text{O}_3/\text{SiO}_2$
9.01	57.33	17.25	2.59	0.46	13.19	6.36

* Loss on ignition (1000 °C)

For enrichment experiments, the bauxite ore was subjected to systematic size reduction using crushers and grinders. Firstly, the ore sample was crushed to minus 2.36 mm with jaw and hammer crusher. The broken ore was divided into four parts by quartering, and then two parts of them were dry-ground below 500 and 150 μm using laboratory rod and ball mill, respectively. Sieve analysis of the crushed and ground materials was performed using laboratory test sieves with ASTM standards. After sieving, Al_2O_3 and SiO_2 contents of the sieve fractions were analyzed to calculate the silica modules. All experiments were conducted on the dried samples which drying temperature was 105 °C.

3.RESULTS AND DISCUSSION

Results

Experimental results of the particle size distribution and the chemical analysis results for coarse, medium and fine size bauxite sample (i.e. crushed and ground ore) were given Table 2, Table 3 and Table 4, respectively. When the findings given in Tables 2, 3 and 4 are commonly evaluated, when going to fine sizes (i.e. from 2360 μm to 45 μm), Al_2O_3 grade decreases and SiO_2 grade increases. These results indicate that there is a slight improvement in module value in the coarse particle sizes, especially. However, when compared to module value (6.36) of the original ore, there is no significant change.

Table 2. Sieve analysis results of crushed bauxite ore in coarse size (-2360 μm)

Particle (μm)	Size	Weight (%)	Grade (%)		Distribution (%)		Silica Module
			Al_2O_3	SiO_2	Al_2O_3	SiO_2	
-2360 +850		56.06	58.01	8.98	56.43	55.08	6.46
-850 +300		26.45	57.54	9.13	26.41	26.42	6.30
-300 +106		10.84	57.19	9.41	10.76	11.15	6.08
-106 +45		4.42	56.27	9.86	4.31	4.75	5.71
-45		2.23	54.01	10.67	2.09	2.60	5.06
Sum		100.00	57.63	9.14	100.00	100.00	6.31

Table 3. Sieve analysis results of ground bauxite ore in medium size (-500 μm)

Particle (μm)	Size	Weight (%)	Grade (%)		Distribution (%)		Silica Module
			Al_2O_3	SiO_2	Al_2O_3	SiO_2	
-500 +300		41.29	57.66	8.81	41.53	40.38	6.54
-300 +212		16.56	57.52	8.86	16.61	16.28	6.49
-212 +150		11.84	57.43	8.98	11.86	11.80	6.39
-150 +106		8.62	57.12	9.05	8.59	8.66	6.31
-106 +75		5.86	57.15	9.16	5.84	5.96	6.24
-75 +53		4.21	56.81	9.21	4.17	4.30	6.17
-53 +38		3.45	56.35	9.25	3.39	3.54	6.09
-38		8.17	55.13	9.70	7.86	8.80	5.68
Sum		100.00	57.33	9.01	100.00	100.00	6.36

Table 4. Sieve analysis results of ground bauxite ore in fine size (-150 μm)

Particle (μm)	Size	Weight (%)	Grade (%)		Distribution (%)		Silica Module
			Al_2O_3	SiO_2	Al_2O_3	SiO_2	
-150 +106		37.61	58.01	8.78	38.16	37.30	6.61
-106 +75		18.41	57.44	8.32	18.49	17.30	6.90
-75 +53		13.50	57.07	8.96	13.47	13.66	6.37
-53 +38		10.47	56.94	9.02	10.42	10.65	6.31
-38		20.01	55.63	9.33	19.46	21.09	5.96
Sum		100.00	57.19	8.85	100.00	100.00	6.46

Discussion

Experimental results clearly show that the content of Al_2O_3 relatively decreased in fine particles, whereas the content of SiO_2 increased for the same particles. Accordingly, the increased content of SiO_2 in the fine particles means that there is an enrichment of clay minerals such as kaolinite (i.e. kaolinite tends to accumulate in fine particle sizes). In contrast to fine particles, while Al_2O_3 grade increases in the coarse sizes SiO_2 grade decreases. This finding indicates that there is a partial enrichment of bauxite minerals such as boehmite. However, the requirement of 7 rate for the silica module, which is one of the most important criteria for bauxite ore fed to the Bayer process, is not reached.

The effectiveness of this method is heavily dependent on the micro-mineralogy of bauxite. For instance, in the case of the pisolitic bauxite, kaolinitic silica is sometimes more prevalent in the outer layers of the pisolite, and thus the silica concentration increases with increasing surface area and thus decreasing size (Owada, et al., 2005; Smith, 2009). However, these types of bauxite deposits are limited. Actually, bauxite is a naturally occurring, heterogeneous material composed primarily of one or more aluminum hydroxide minerals, various mixtures of silica, iron oxide, titania, aluminosilicate, and other impurities in minor or trace amounts. Finally, since the bauxites have a complex structure and are composed of minerals with similar physical properties (e.g. hardness, tenacity, brittleness, etc.), it is difficult to enrich method. As the bauxites have a complex structure and it is very difficult to reduce silica from bauxite by size reduction only.

The general results obtained from this study are given below:

- 1) Reactive silica in bauxite ores causes serious technical and economic problems in the Bayer process and leads to excessive caustic consumption. Therefore, the bauxite ores are enriched by the removal of silica to increase the module rate before it is sent to the Bayer process.
- 2) According to experimental results, size reduction and sieving provided a little improvement in removing silica and also module value, as well.
- 3) However, no high grade bauxite concentrate could be obtained that could be fed directly to the Bayer process.

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Investigation of The Effect of Coating Thickness on Surface Roughness of Wc / Co Coating on Aisi 304 Stainless Steel by Hvof Method

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Abstract: In this study, an experimental study has been carried out to investigate the effect of coating thickness on surface roughness of WC/Co coated on AISI 304 stainless steel using HVOF method in thicknesses of 150 µm, 250 µm and 350 µm. WC/Co powders were deposited onto substrate with and without NiCr as bond coating layer using a HVOF method. WC/Co was selected as coating powder. Tungsten carbide is a hard material with high melting point and high resistance to wear. HVOF method was selected as the coating process of this study. In the HVOF method the base material does not reach very high temperatures. It have high spray speed. The distance of the spray torch to the base material during processing can be adjusted. So with this method, low porosity, high density coatings with high bond strength can be obtained. The produced layers were characterized by optical microscope, scanning electron microscope and microhardness tester. The cross-section of all samples were sand papered and polished before microstructural observations and microhardness measurements. The effect of the coating thickness of the coated specimens on the surface roughness was investigated in the computer aided TR200 surface roughness measuring tester. The average roughness R_a , defined as the arithmetic mean of departures of the profile from the mean line, was used to quantify the coating surface roughness. As a result of experimental studies, it has been observed that as the coating thickness increases, the coating hardness and surface roughness amounts increase. Also, when the surface roughness values of samples with the same coating thickness were compared, it was found that the surface roughness values of the NiCr-binding samples were lower than those of the binder-free samples.

Keywords: HVOF, Coating, Surface roughness, Hardness, Microstructure

1. INTRODUCTION

While the parts of the machine are working in contact the friction, wear, surface losses come to the scene due to such reasons. Surface phenomena like this cause the part dimensions to change, to get out of tolerance and as a result parts not to work in harmony with each other. Components can be made from completely special materials resistant to abrasion and corrosion. However, this is a very expensive solution. Coatings that have low cost and mass production capability against surface damage have emerged as engineering solutions. It is expected that the materials to be used in industrial applications must have properties such as strength, toughness, lightness, low cost with the advances in technology.

Some heat treatment techniques have shown that even if mechanical properties are improved, such properties as wear, impact resistance, corrosion resistance, fracture toughness and lightness cannot be achieved at the same time. Coatings are surface improvement methods that are applied to the working surfaces of the parts to prevent wear, friction, corrosion, thermal degradation and the like. Coatings are used to improve corrosion and wear resistance, fatigue strength, physical properties of steel and alloys. Coating applications are needed in many fields such as aviation, automotive, medicine, textile, power plants, iron and steel industry, paper industry, shipping industry and petroleum industry.

2. MATERIALS AND METHODS

In this study; the specimens were designed and produced in Ø 50x10 mm dimensions. The substrate surface must be thoroughly cleaned and then sand blasted to ensure good adhesion between the substrate surface and the coating prior to coating process. In the first stage, the surfaces of the substrate materials were cleaned by using thinner form oil, dirt and as well as undesirable residues. After the cleaning process, heat treatment in the range of 70-80 ° C is applied to the surface of substrate to avoid oxidation. Subsequently, sandblasting process was done to roughen the surface in order to ensure that the coating powders adhere well to the substrate material surface. It is observed that surface roughness value became $R_a = 5.286 \mu m$ after the sand blasting process. The image of the sanded base part is shown in Figure 2.1.

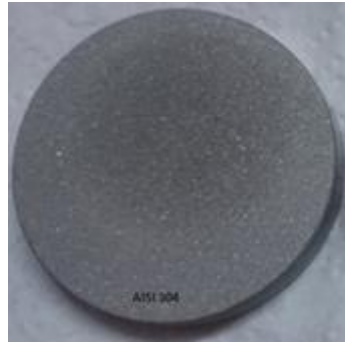


Figure 2.1 Image of the substrate after sandblasting process

NiCr binding powders were first sprayed onto the samples as bond coat layer to be produce specimens with bond coat. The SEM image of NiCr (80/20) powders is shown in Figure 2.2.a. The samples to be produced without bond coat were directly coated with WC / Co powders. The SEM image of the WC/Co (88/12) powders is shown in Figure 2.2.b.

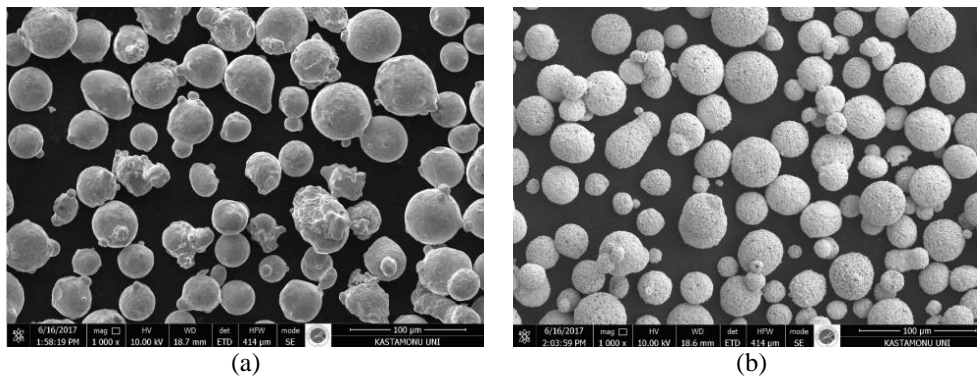


Figure 2.2 (a) SEM image of NiCr (80/20) binder powders
(b) SEM image of NiCr (88/12) binder powders (1000X)

The samples were coated by using MEC brand Hipojet 2700 model coating machine. Table 1 shows the parameters of the coating process done by using the HVOF method.

Table 1. Coating parameters of HVOF method

WC-Co 88/12 Coating Parameters	
Tube Outlet Pressure Values	
Oxygen Pressure (bar)	17
Acetylene Pressure (bar)	10
Air Pressure (bar)	6
Powder flow (g/min)	38
spray distance (mm)	250
Flow Rate (Flow)	
Oxygen (L/min)	250
Acetylene (L/min)	60
Air (L/min)	800

Surface roughness measurements of the coated specimens were done with the TR 200 computer aided surface roughness tester shown in Figure 2.3.

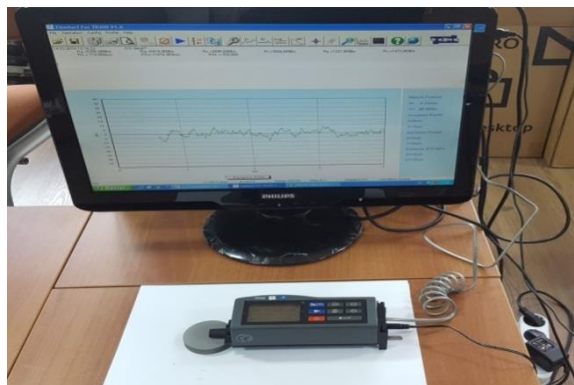


Figure 2.3 TR 200 surface roughness measurement device

3.RESULTS AND DISCUSSION

Vickers microhardness method was preferred to measure the microhardness values of the specimens. Measurements were done from the section of the specimen which is perpendicular to the coating surface. For a test specimen with a bond coat layer; four microhardness measurements were done from the substrate surface, from the substrate-bond coat layer boundary, from the bond coat-coating layer boundary, and from the coating layer. For a test sample that does not have a bond coat layer; three microhardness measurements were done from the substrate surface, from the substrate-coating layer boundary, and from the coating layer. For microhardness measurements, a load of 100 g was applied to each sample for 10 seconds. Mean microhardness values of the test specimens are shown in Table 2.

Table 2. Microhardness measurement results of coatings

AISI 304 substrate		
Coating Thickness	With Bond Coat	Without Bond Coat
150µm	1443 (HV)	1300 (HV)
250µm	1406 (HV)	1216 (HV)
350µm	1171 (HV)	930 (HV)

In the optical microscope and SEM examinations, the substrate material, the substrate material and the bond coat layer transition, the bond coat layer, the bond coat layer and the coating layer transition and the coating layer images were investigated. In addition, the structure of the coating, the relationship between the coating and the substrate surface and the internal structures of the layers have been examined. SEM imaging was performed under high vacuum at 10 kV.

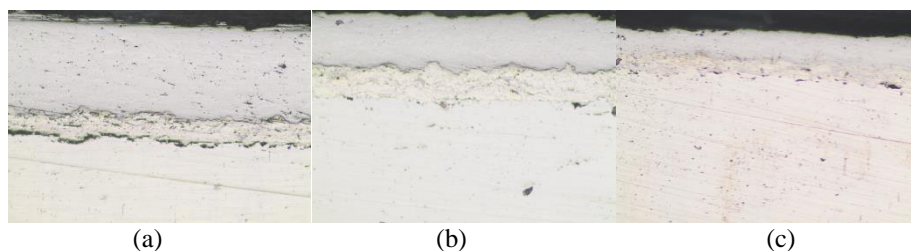


Figure 3.1 Optical microscope images (100X) of coating with NiCr bond coat on AISI 304 stainless steel, a) 150µm coating thickness, b) 250µm coating thickness, c) 350µm coating thickness.

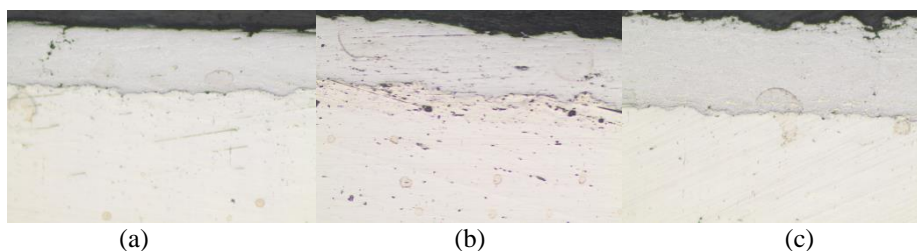


Figure 3.2 Optical microscope images (100X) of coating without NiCr bond coat on AISI 304 stainless steel, a) 150µm coating thickness, b) 250µm coating thickness, c) 350µm coating thickness.

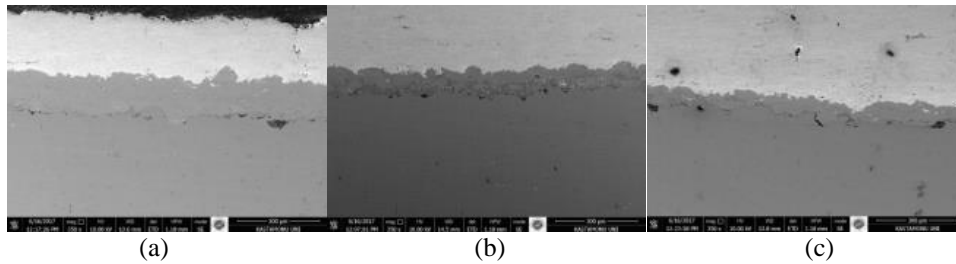


Figure 3.3 SEM images (350X) of coating with NiCr bond coat on AISI 304 stainless steel, a) 150μm coating thickness, b) 250μm coating thickness, c) 350μm coating thickness.

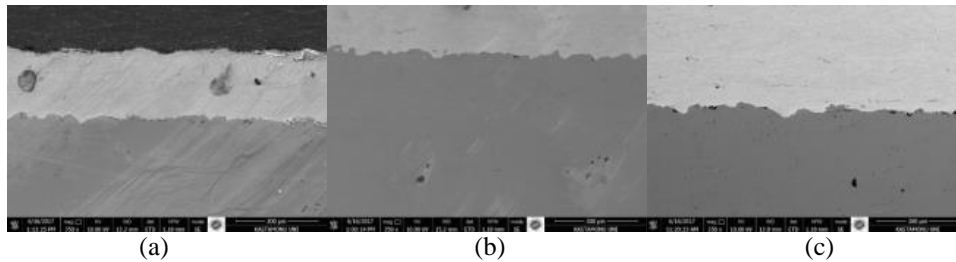


Figure 3.4 SEM images (350X) of coating with NiCr without bond coat on AISI 304 stainless steel, a) 150μm coating thickness, b) 250μm coating thickness, c) 350μm coating thickness.

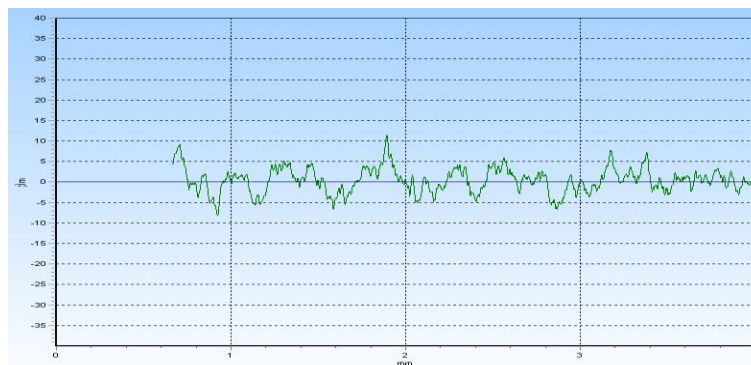


Figure 3.5 Surface roughness measurement results; Ra=4,632 μm of coating with NiCr bond coat on AISI 304 with 150μm thickness



Figure 3.6 Surface roughness measurement results; Ra=4,788μm of coating without NiCr bond coat on AISI 304 with 150μm thickness

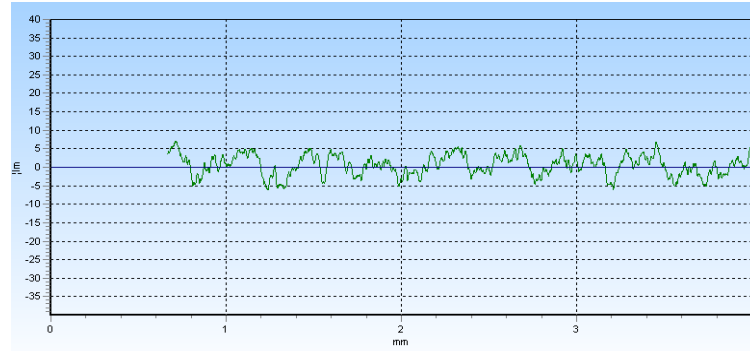


Figure 3.7 Surface roughness measurement results; $R_a=4,681\mu\text{m}$ of coating with NiCr bond coat on AISI 304 with $250\mu\text{m}$ thickness

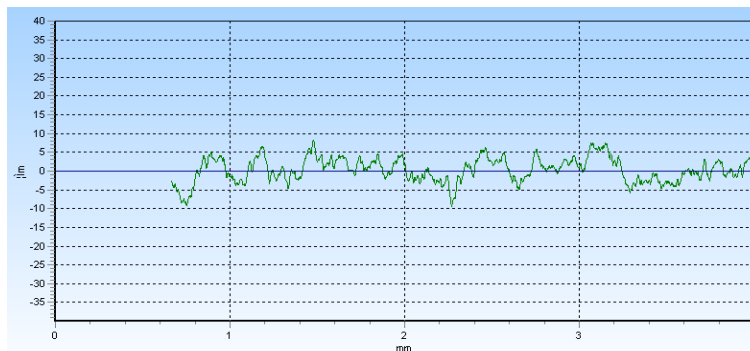


Figure 3.8 Surface roughness measurement results; $R_a=4,959\mu\text{m}$ of coating without NiCr bond coat on AISI 304 with $250\mu\text{m}$ thickness



Figure 3.9. Surface roughness measurement results; $R_a=4,893\mu\text{m}$ of coating with NiCr bond coat on AISI 304 with $350\mu\text{m}$ thickness

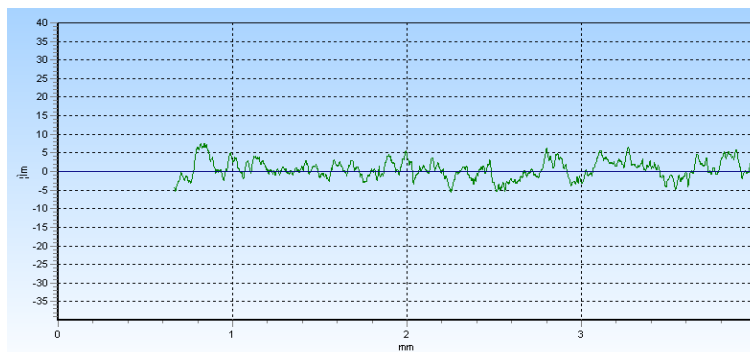


Figure 3.10. Surface roughness measurement results; $R_a=5,221\mu\text{m}$ of coating without NiCr bond coat on AISI 304 with $350\mu\text{m}$ thickness

Table 3. Surface roughness measurement results of coatings

Specimen Number	Coating Thickness (μm)	Bond Coat	R_a (μm)
1	150	with	4,632
2	150	without	4,788
3	250	with	4,681
4	250	without	4,959
5	350	with	4,893
6	350	without	5,221

The nonuse of a bond coat negatively affects the microhardness, surface roughness and adhesion of the coating to the substrate material. The increase in porosity and thermal stresses cause this situation to occur.

At the end of the studies;

According to microhardness results, the increase of coating thickness decreased the mean microhardness values of both with and without bond coat samples. Porosity increase is considered as the reason for this phenomenon.

It was observed that samples with NiCr bond coat have higher microhardness values than the samples without NiCr bond coat with the same coating thickness. It is achieved that the NiCr bond coat layer increases the hardness of the coating.

According to the surface roughness measurement results, it is determined that surface roughness increases as the coating thickness increased. The surface roughness values of the samples with bond coat were found to have a lower surface roughness value than the samples without bond coat with the same coating thickness.

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Investigation of Improvement of Soft Clay by Chemical Additive

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Abstract: In geotechnical engineering soft clay is defined as problematic soils. Lime and cement are used as traditional binders in the treatment of such soils. There are various engineering problems because of light structures to be built on soft soils. Different methods are used to improve soft clay soils and reduce settlement. Stone columns, sand compaction columns, lime-cement columns, embankment and deep mixing methods have been widely used in recent years. Lime and cement are used as traditional binders in the treatment of soft clay soils. In the deep mixing method, the cement and / or lime are injected as a binder in dry and / or liquid form and mixed with soils by means of mixing blade and the columns are manufactured. In this study, sodium hydroxide (NaOH) was used to improve low plasticity clay (CL) in liquid limit form. In experimental study, NaOH (according to dry weight of clay) were added to CL clays in ratios of 1, 3 and 5%. Then, 40% of water in liquid limit value of CL clay, added to mixture and mixing like deep mixing method. The prepared mixture was filled into cylindrical metal molds with 38 mm in diameter and 76 mm in height. Before filling the mixture into the mold, interior of mold was lubricated with a thin film layer to reduce friction. Samples are cured in proper condition (90% humidity and temperature 20 ± 3 °C) subsequently unconfined compressive strength (UCS) were determined at 7, 14 and 28 curing days. The UCS test results of sodium hydroxide added samples in 7, 14 and 28 days were compared with the results of the unconfined compressive strength of CL clay without using sodium hydroxide. Results showed that the UCS improved with increasing of curing time and NaOH ratio. A maximum UCS value of 1055 kPa was obtained in samples with 5% of sodium hydroxide and 28 days of curing.

Keywords: Soft clay, Liquid Limit, Deep Mixing, Unconfined Compressive Strength, Sodium Hydroxide.

1. INTRODUCTION

The deep mixing method is carried out by using special equipment in the field, injecting the binder into the soils with hollow auger and mixing together (Taki and Yang, 1991). The deep mixing is often used in slope stability, filler supports, hydraulic shear walls, liquefaction reduction, excavation support walls, environmental improvement, site strengthening and large volume of soil improvement (Terashi and Kitazume, 2009, 2011).

The deep mixing method (DMM) was developed by Intrusion-Prepakt Inc. in 1950 with the development of mixing in place (MIP) of piles method (FHWA, 2000). Japan and Scandinavian countries have done extensive research and practice on deep mixing in the last fifty years. In Switzerland they used lime columns to improve the soft clay. In recent years, the deep mixing method has been used in the USA for infrastructure, for the resolution of seismic problems, and for environmental improvement (Bruce et al., 1998; Bruce and Bruce, 2003).

Lime and cement are frequently used as binders in the deep mixing method. The effect of these binders on the ground, the effects of water proportions and curing times have been investigated by many researchers (Hartlen and Holm, 1995; Ahnberg, 1996; Porbaha et al., 1998, 2000; Jacobson, 2002; Andromalos and Bahner, 2004; Lorenzo and Bergado, 2004, 2006; Şengör, 2011; Dias et al., 2012). It has been seen that the UCS value increased with the increase of binder material and curing time. Bergado and Lorenzo (2005) in improvement of Bangkok clay by adding 10% - 15% of cement (by dry weight of clay) into the clay and were found the UCS value between 0.3-1.0 MPa (300-1000 kPa).

In the literature there are many studies in improvement of soils by using the deep mixing method with or without of traditional binder (fly ash, silica dust, slag, polyester, guar gum, locust bean gum) (Ahnberg and Holm, 1996; Ahnberg, 2006; Ajorloo, 2010; ve Bagherinia, 2013). Nevertheless, in the literature there are underdeveloped study in improvement of soft clay by using deep mixing method and NaOH as a binder material.

In this study, different ratios of sodium hydroxide (NaOH) were added to CL clay in dry from and liquid consistency of samples were kept in 7, 14 and 28 days of curing time for the purpose of UCS test.

2. MATERIALS AND METHODS

CL Clay: Low plasticity clay (CL) has been used in experimental part of this study. Some index properties of CL clay are given in Table 1.

Sodium Hydroxide: Sodium hydroxide is white, odorless, non-volatile, non-combustible but highly reactive. Heat is generated as a result of violent reaction with water and similar substances (Alshaaer, 2000; Olaniyan, 2008). Some properties of sodium hydroxide are given in Table 2.

Table 1. Index properties of CL clay

	CL Clay
Clay content, <0,002 mm (%)	10
Finer content, <0,075 mm (%)	80
Specific gravity, G _s	2,77
Liquid limit, W _L (%)	40
Plastic limit, W _p (%)	23
Plasticity index, I _p (%)	17
Optimum water content, (%)	15
Maximum dry unit weight, γ _{dmax} (kN/m ³)	18,3
Hydraulic conductivity, k (cm/s)	6,974 x 10 ⁻⁷

Table 2. Chemical properties of sodium hydroxide

	Sodium Hydroxide
Chemical formula	NaOH
Molecular weight	39,9771 g/mol
Melting point	318 °C
Boiling point	1388 °C
pH	11,5-12,5
Density	2,13 g/cm ³
Solubility	Water, ethanol, methanol

In experiment, NaOH was added to clay in the ratio of 1, 3 and 5% according to the dry weight of CL clay and homogenized the mixture. Then 40% of water (liquid limit content of CL clay) added to mixture and mixing for about 10 minutes (150 rpm) on mechanical mixer. The mixture was filled into cylindrical metal molds with a diameter of 38 mm and a height of 76 mm. When the mixture is placed in the mold, it is shot slightly to the edge of the mold by hand to prevent air bubbles. To reduce friction, the inside of the molds are greased to form a thin film layer. Samples were kept in suitable curing conditions (90% moisture and 20±3 °C) and removed from the mold after three days. At the end of the curing times UCS test were carried out on the samples. Sample preparation and curing condition have been done in accordance with the literature (Arasan et al., 2017; Şengör, 2011). Molding of samples and curing condition are shown in Fig 1.



Figure 1. a) Molding of the CL-NaOH mixture, b) samples in curing room.

UCS test were conducted according to ASTM D 2166 (2000). Accordingly, the samples were placed on a 20 tons capacity device (Fig. 2) and fractured at a speed of 0.5 mm / min. The highest pressure value is read from the digital load reading apparatus and the UCS values are calculated from correlation 1.

$$q_u = P_{max} / A_f$$

(1)

Where, P_{max} is the maximum pressure value at break, A_f is the cross-sectional area at break of the sample.



Figure 2. UCS test device.

3.RESULTS AND DISCUSSION

UCS test results: In this study, in order to increase the strength of the soft clay soils, samples were prepared in different ratios of sodium hydroxide according with deep mixing method, and UCS tests were performed for curing times of 7, 14 and 28 days. The results of this experiment of the broken specimens are shown in Fig 3.



Figure 3. Samples of CL clay-5% NaOH (a- 7 days, b- 14 days and c- 28 days).

The UCS-curing time of the CL clay is shown in Fig. 4 and the UCS-curing time-binder ratio relation of the CL clay-NaOH mixture is shown in Fig. 5.

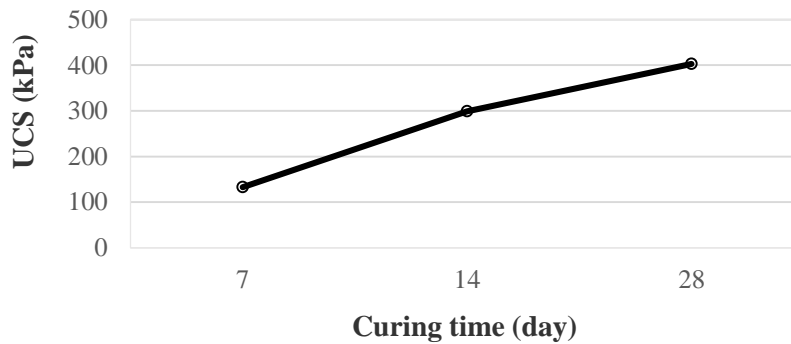


Figure 4. Relation of UCS-curing time (CL clay).

Figure 4. shows that the UCS value of CL clay increases with increasing curing time. The UCS value of CL clay in 7, 14 and 28 days were obtained respectively 133, 299 and 403 kPa.

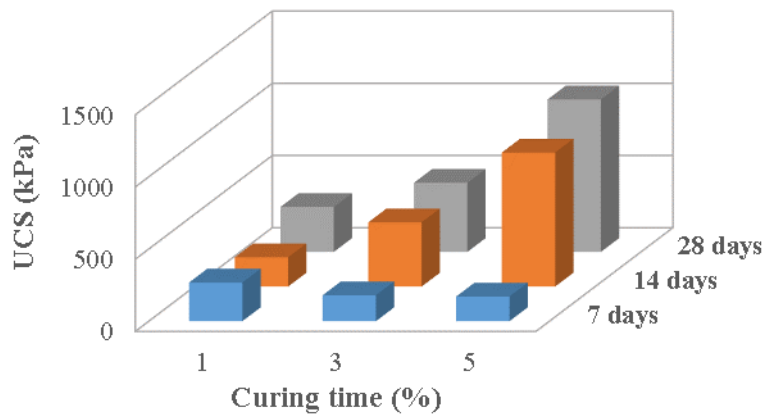


Figure 5. Relation of UCS- binder ratio-curing time (CL clay-NaOH samples).

As it can be seen in Figure 5, the UCS value of all samples prepared with NaOH generally increases with increasing curing time. In 7 days of curing time the UCS value partially decreased with increasing additive (NaOH) ratio, but in 14 and 28 curing days the UCS value were increased. The UCS value of 28 days of sample prepared with 5% NaOH was 1055 kPa. When the UCS value of CL clay compared with this value, strength reached from 403 kPa to 1055 kPa and increase in UCS value about 162% was seen.

- In the literature, it is stated that the UCS value of soil improved by deep mixing is about 0.2-5.0 MPa (200-5000 kPa). For UCS value of cohesive soils and for 28 days of curing, 0.2-2.0 MPa (200-2000 kPa) were obtained (Bruce and Bruce 2003).
- An exothermic reaction has been experienced when the water added to the CL clay-NaOH mixture. It has been determined that the amount of water present in the body of CL clay is reduced due to the temperature generated at the end of the reaction.
- It is suggested to use sodium hydroxide in the treatment of soft clay according to the results of experiment and literature.

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Investigation of Boriding Effect on Tensile Strength for Ti6Al4V Titanium Alloy

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Abstract: In this paper, Ti6Al4V alloy was boronized at 1100 °C for 12, 16 and 20 h. The thickness of borided layers was investigated by scanning electron microscope (SEM). X-ray Diffraction was used to determine the elements of coating. The microhardness from surface was measured by a standard Vickers microhardness tester under 50 g load. The hardness of untreated Ti6Al4V is approximately 330 HV. The hardness value increased 2789 HV after boriding process. The boron diffusion zone was measured to be approximately 200 µm. From obtained results of tensile strength, the yield strength and tensile strength of the untreated Ti6Al4V alloy used as reference is higher than all borided samples. It has been determined that the strength of the borided Ti6Al4V alloy is lower (between 2.7% and 9.6%) than untreated alloy. When boronized Ti6Al4V samples are compared within themselves, the highest yield and tensile strengths were obtained at 1100 °C and 20 h and the lowest yield and tensile strength borided Ti6Al4V samples were obtained at 1100 °C and 12 h. Besides, the percent elongation and percent reduction of area decreased from 16% to 2% and from 44% to 4% respectively after boriding process. These results suggest that boriding reduces the ductility of the titanium alloy.

Keywords: Ti6Al4V, boriding, microstructure, microhardness, tensile strength

1. INTRODUCTION

Titanium (Ti) and its alloys have an excellent combination of the desired material properties, such as high corrosion resistance, high strength, low density, non-magnetism, and excellent biocompatibility. Titanium alloys are known to have low hardness, poor wear resistance and high friction coefficient. Surface modification seems to be the effective way to improve the tribological performance of titanium alloys. Titanium borides are well-known for their high hardness and excellent wear resistance in many tribological systems. These characteristics make boriding an excellent candidate for surface modification of titanium alloys [1-8].

Boriding, also known as boronizing, is thermochemical diffusion based surface hardening process. Purpose of the boriding process, formation of ceramic boride layer which consisted of two phases: TiB and TiB₂ have high hardness and high wear resistance and excellent heat conductivity. The paper presents research results of microstructure, microhardness, yield strength, tensile strength, reduction of area and elongation of Ti6Al4V titanium alloy after boriding process.

2. MATERIALS AND METHODS

Ti6Al4V alloy which widely used in many biomedical applications was boronized in a solid and liquid media at 1100 °C for 12, 16 and 20 h. After boronizing process, specimens were grinded with 100, 240, 400, 800, 1000 and 1200 grids of SiC papers. The section was then polished via a 6 µm diamond paste followed by a 3 µm diamond paste. Finally, 1 µm alumina was applied at the end of the polishing process. After polishing, the samples were etched with Kroll's reagent. The chemical composition of Ti6Al4V alloy is shown in Table 1. The thickness of borided layers was investigated by scanning electron microscope (SEM). X-ray Diffraction was used to determine the elements of coating.

Table 1. Chemical composition of Ti6Al4V alloy (wt. %)

Al	C	H	F	O	N	V	Ti
5,5-6,5	<0,08	<0,015	<0,3	<0,2	<0,05	3,5-4,5	Balance

Microhardness measurements were carried out by Metkon Vickers hardness tester with load of 50 gr and a waiting time of 5 seconds. Three measurements were made for each experiment and their mean values were calculated. Vickers hardness tester is given Figure 1.



Figure 1. Vickers hardness tester

Tensile Tests

Tensile test specimens are prepared in accordance with ISO 6892-1 standard given Figure 2 and tensile testing machine is given Figure 3.

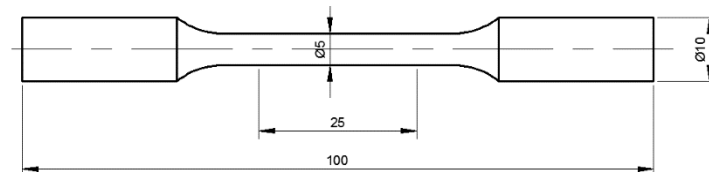


Figure 2. Dimensions of tensile test specimen



Figure 3. Tensile test machine

3.RESULTS AND DISCUSSION

Microstructure of Boronized Ti6Al4V Alloy

Metallographic cross-section of boronized Ti6Al4V alloy and XRD pattern is shown in Fig. 4 [9].The SEM image of borided Ti6Al4V alloy shows that two phase boride layer was produced on Ti6Al4V surface during boriding process. XRD pattern confirmed the presence of TiB and TiB₂ phases on surface of Ti6Al4V alloy. The obtained boride layer had a thickness of approximately 10 μm .

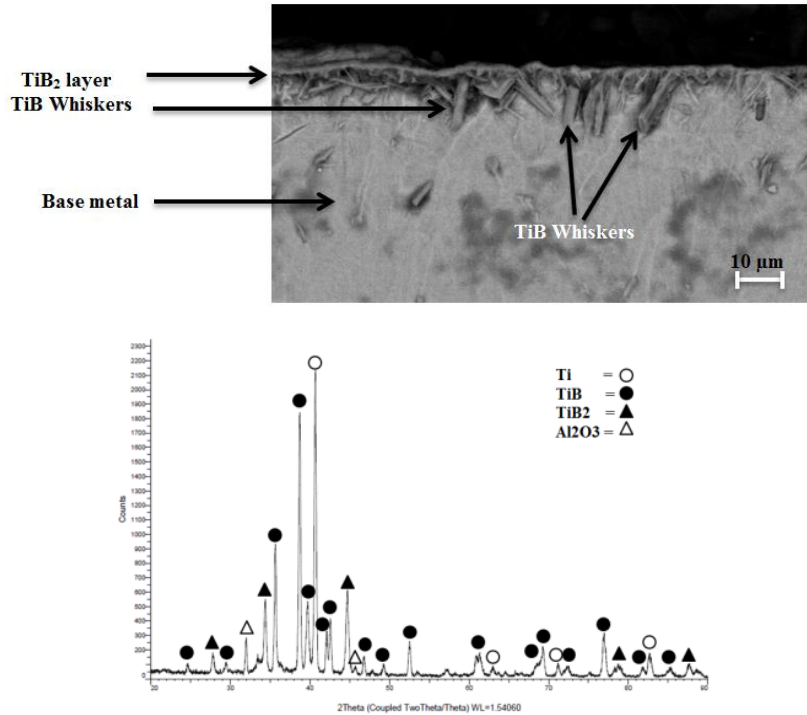


Figure 4. SEM image (a) and XRD pattern (b) of boronized Ti6Al4V alloy

Microhardness Profil of Boronized Ti6Al4V Alloy

The microhardness profile of borided and unborided Ti6Al4V alloy is given Figure 5. The microhardness of untreated Ti6Al4V is approximately 330 HV. The hardness value increased 2789 HV, approximately 8,5 times after boriding process. The boron diffusion zone was measured to be approximately 200 μm as seen Figure 5.

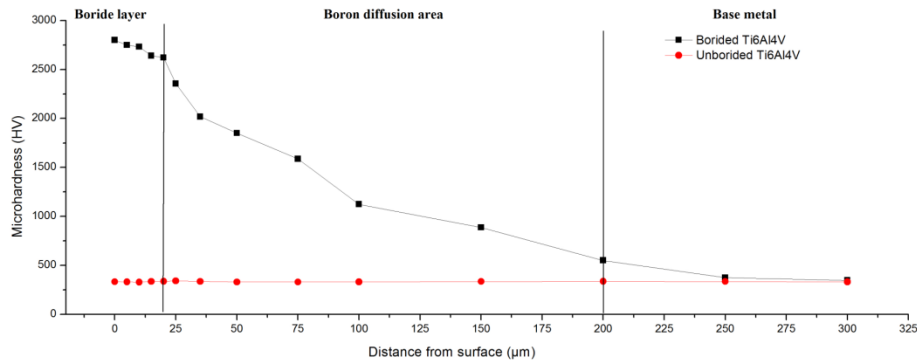


Figure 5. Microhardness profil of borided and unborided Ti6Al4V

Tensile Tests

The yield strength and tensile strength values are calculated from the tensile test graph, the elongation and section contraction values are calculated with the formulas given in Eqs. (1) and (2), respectively.

$$A (\%) = (L_u - L_0) / L_0 \times 100 \quad (1)$$

Where A is percentage elongation, L_u is gauge length at fracture and L_0 is original gauge length.

$$Z (\%) = (S_u - S_0) / S_0 \times 100 \quad (2)$$

Where Z is percentage reduction of area, S_u is cross-sectional area at site of fracture and S_0 is original cross-sectional area. The results of tensile testing and calculated percentage elongation and reduction of area values are given Table 2.

Table 2. Results of tensile testing of borided and unborided Ti6Al4V

Test samples	Yield Strength	Tensile Strength	Elongation	Reduction of Area
	$R_{p0.2}$ (MPa)	R_m (MPa)	A (%)	Z (%)
Ti6Al4V	1080	1131	16	44
Borided Ti6Al4V at 1100 °C for 12 h	980	1022	2	4
Borided Ti6Al4V at 1100 °C for 16 h	1025	1067	2	4
Borided Ti6Al4V at 1100 °C for 20 h	1050	1095	2	4

From obtained results of tensile tests; the yield strength and tensile strength of the untreated Ti6Al4V alloy, used as reference, is higher than all borided samples. It has been determined that the yield strength of the borided Ti6Al4V alloy process is lower (between 2.7% and 9.6%) than untreated alloy. When boronized Ti6Al4V samples are compared within themselves, the highest yield and tensile strengths were obtained at 1100 °C and 20 h and the lowest yield and tensile strength borided Ti6Al4V samples were obtained at 1100 °C and 12 h as seen Table 2. While increasing boriding time, tensile and yield strength values is increasing. Elongation at rupture which was obtained 16% before boriding process, it reduces to 2%. Besides, reduction of area values was also decreased from 44% to 4%. Consequently, boriding process makes Ti6Al4V brittle.

It is known that the boriding process increases the yield strength of the steel by about 10-20%, reduces the tensile strength by about 10-20% [10] and decreases the yield and tensile strengths of the titanium alloys by about 5% [11]. The results of study are consistent with the literature.

Figure 6. and Figure 7 show images of borided and unborided Ti6Al4V alloy after tensile test.

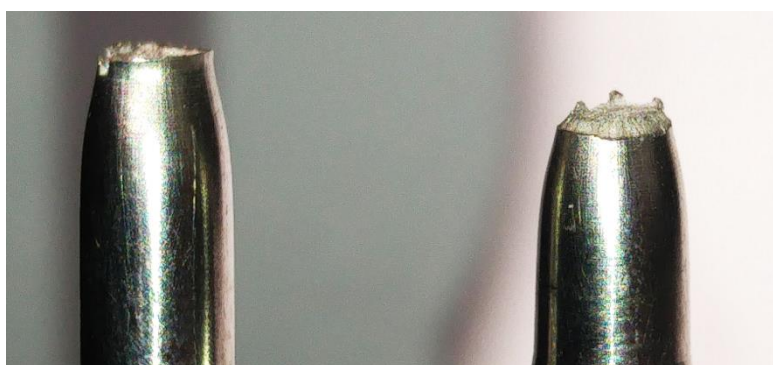


Figure 6. Unborided Ti6Al4V alloy after tensile test

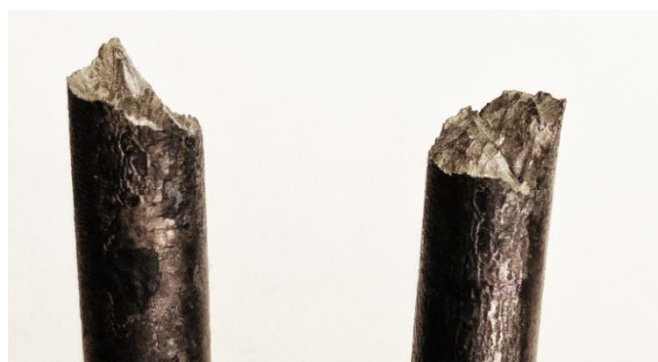


Figure 7. Borided Ti6Al4V alloy after tensile test

When the specimen images given Fig. 6 and Fig. 7 are examined, it is seen that waisting and ductile fracture were occurred in unborided Ti6Al4V (Fig. 6). However, wasting was not observed on borided sample and boriding process cause brittle fracture as seen Fig. 7.

The double phases layer consist of TiB and TiB₂ have high hardness and high wear resistance and excellent heat conductivity were formed at surface of Ti6Al4V alloy by boriding process. The results of the research can be listed as follows;

- Hardness of surface has increased from 330 HV to 2789 HV after boriding process.
- It is understood that boronized Ti6Al4V alloy may be used in tribological systems.
- Boriding process cause decreasing reduction of area values from 44% to 4%.
- It has been determined that the yield strength of the borided Ti6Al4V alloy is lower (between 2.7% and 9.6%) than untreated alloy.
- The percent elongation and percent reduction of area decreased from 16% to 2%.
- Increasing boriding time leads to increasing of tensile and yield strength values.

Acknowledgements

This study was supported by the Scientific Research Department of Pamukkale University.

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The Role of Boride Layers in Impact Energy for Ti6Al4V Titanium Alloy

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Abstract: In this study, Ti6Al4V alloy was boronized at 1100 °C for 12, 16 and 20 h. The thickness of borided layers was investigated by scanning electron microscope (SEM). X-ray Diffraction was used to determine the elements of coating. The microhardness from surface was measured by a standard Vickers microhardness tester under 50 g load. The hardness of untreated Ti6Al4V is approximately 330 HV. The hardness value increased 2789 HV after boriding process. The boron diffusion zone was measured to be approximately 200 µm. From obtained results of impact test, the impact energy of the untreated Ti6Al4V alloy used as reference was obtained 30 Joule. The impact energy of borided Ti6Al4V at 1100 °C for 12, 16 and 20 h were obtained as 32 Joule, 31 Joule and 31 Joule respectively. The significant changes were not observed on impact energy values of the samples. It is known that the boriding process reduces the impact energy in steels. Due to borided layer is very thin, it has been determined that there is no positive or negative effect on impact energy. These results suggest that boriding has no effect on toughness of the titanium alloy.

Keywords: Ti6Al4V, boriding, microstructure, microhardness, impact energy

1. INTRODUCTION

Titanium (Ti) and its alloys have an excellent combination of the desired material properties, such as high corrosion resistance, high strength, low density, non-magnetism, and excellent biocompatibility. Titanium alloys are known to have low hardness, poor wear resistance and high friction coefficient. Surface modification seems to be the effective way to improve the tribological performance of titanium alloys. Titanium borides are well-known for their high hardness and excellent wear resistance in many tribological systems. These characteristics make boriding an excellent candidate for surface modification of titanium alloys [1-8]

Boriding, also known as boronizing, is thermochemical diffusion based surface hardening process. Purpose of the boriding process, formation of ceramic boride layer which consisted of two phases: TiB and TiB₂ have high hardness and high wear resistance and excellent heat conductivity. The paper presents the study results of microstructure, microhardness and impact energy of Ti6Al4V titanium alloy after boriding process.

2. MATERIALS AND METHODS

Ti6Al4V alloy which widely used in many biomedical applications was boronized in a solid and liquid media at 1100 °C for 12, 16 and 20 h. After boronizing process, specimens were grinded with 100, 240, 400, 800, 1000 and 1200 grids of SiC papers. The section was then polished via a 6 µm diamond paste followed by a 3 µm diamond paste. Finally, 1 µm alumina was applied at the end of the polishing process. After polishing, the samples were etched with Kroll's reagent. The chemical composition of Ti6Al4V alloy is shown in Table 1. The thickness of borided layers was investigated by scanning electron microscope (SEM). X-ray Diffraction was used to determine the elements of coating.

Table 1. Chemical composition of Ti6Al4V alloy (wt. %)

Al	C	H	F	O	N	V	Ti
5,5-6,5	<0,08	<0,015	<0,3	<0,2	<0,05	3,5-4,5	Balance

Microhardness measurements were carried out by Metkon Vickers hardness tester with load of 50 gr and a waiting time of 5 seconds. Three measurements were made for each experiment and their mean values were calculated.



Figure 1. Vickers hardness tester

Charpy Notch Impact Test

Charpy impact test samples were prepared according to TS EN ISO 148-1 standard as Charpy V-notch is given Figure 2 and also Charpy impact testing machine is given Figure 3.



Figure 2. Charpy V-notch test sample



Figure 3. Charpy notch impact tester

3.RESULTS AND DISCUSSION

Microstructure of Boronized Ti6Al4V Alloy

Metallographic cross-section of boronized Ti6Al4V alloy and XRD pattern is shown in Fig. 4 [9].The SEM image of borided Ti6Al4V alloy shows that two phase boride layer was produced on Ti6Al4V surface during boriding process. XRD pattern confirmed the presence of TiB and TiB₂ phases on surface of Ti6Al4V alloy. The obtained boride layer had a thickness of approximately 10 µm.

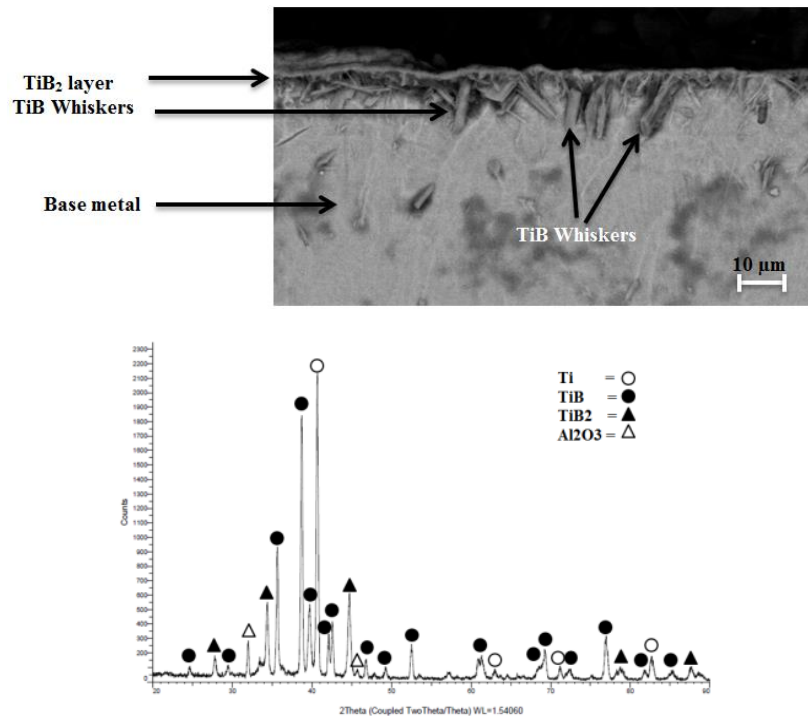


Figure 4. SEM image (a) and XRD pattern (b) of boronized Ti6Al4V alloy

Microhardness Profil of Boronized Ti6Al4V Alloy

The microhardness profile of borided and unborided Ti6Al4V alloy is given Figure 5. The microhardness of untreated Ti6Al4V is approximately 330 HV. The hardness value increased 2789 HV, approximately 8,5 times after boriding process. The boron diffusion zone was measured to be approximately 200 μm as seen Figure 5.

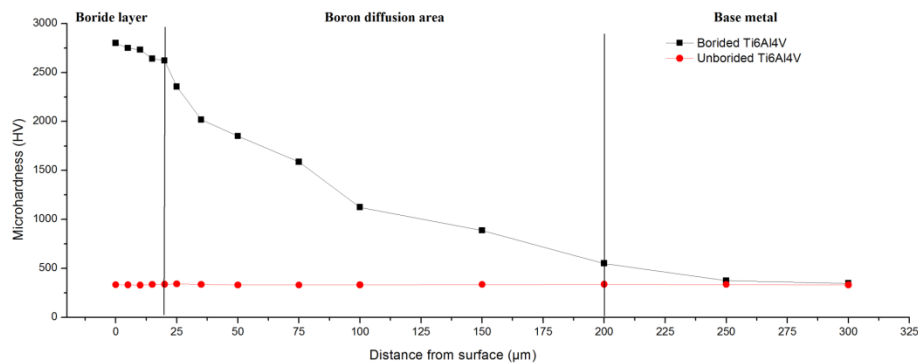


Figure 5. Microhardness profil of borided and unborided Ti6Al4V

Charpy Impact Tests

Charpy notch impact test results to determine the notch impact values of the borided and unborided Ti6Al4V alloy for three different boriding times are given in Table 2 and the surface photographs are given in Figure 6.

Table 2. Results of Charpy Impact Test

Charpy Test Samples	Impact Energy (J)
Ti6Al4V	30
Borided Ti6Al4V at 1100 °C for 12 h	31
Borided Ti6Al4V at 1100 °C for 16 h	31
Borided Ti6Al4V at 1100 °C for 20 h	32

Table 2 shows that the boriding process does not reduce the impact energy values of Ti6Al4V alloy. In addition, boriding process has no significant effect on impact energy for Ti6Al4V. It is known that the boriding process reduces the impact energy in steels [10-11]. Due to borided layer is very thin, it has been determined that boriding process has no positive or negative effect on impact energy. Consequently, the effect of boriding process on impact energy has not been determined for Ti6Al4V.

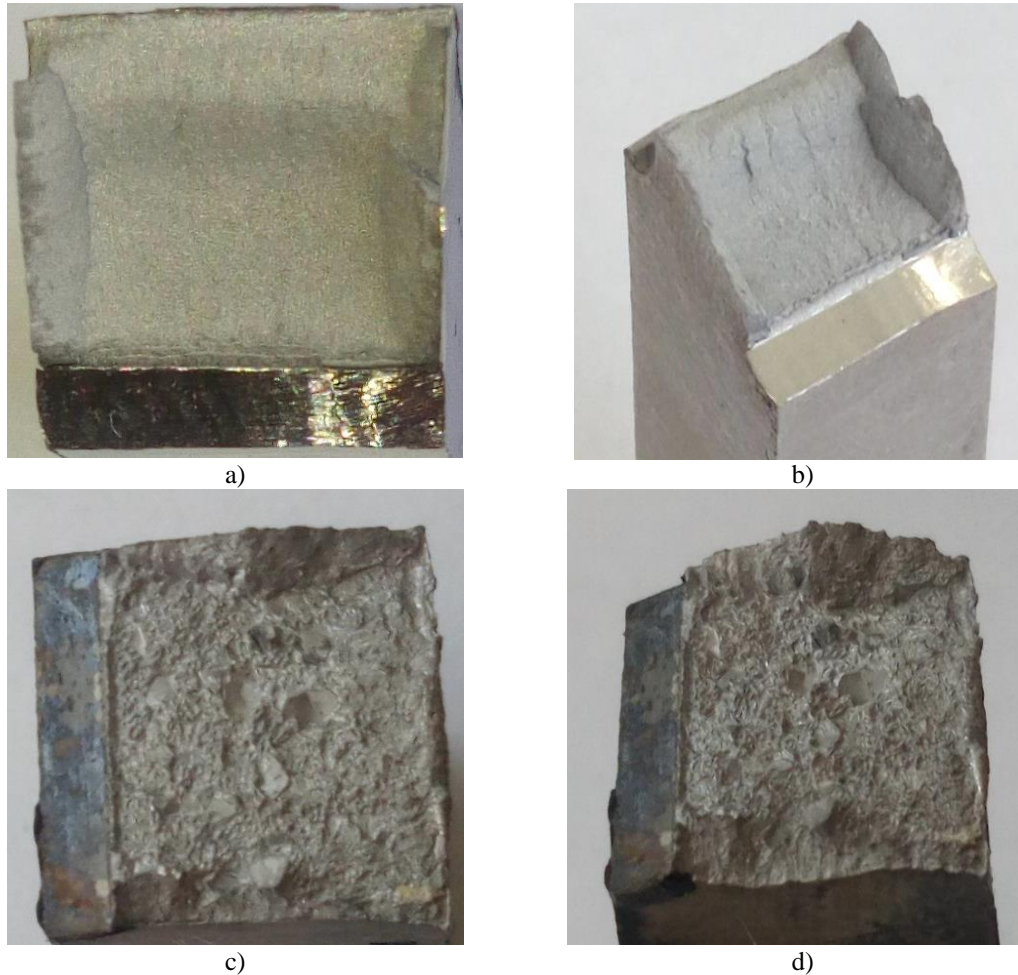


Figure 6. Surface photographs after Charpy Impact Test a), b) Unborided Ti6Al4V alloy c), d) Borided Ti6Al4V at 1100 °C for 20 h

After charpy impact test, unborided Ti6Al4V samples (Fig 6. a, b) were elongated at the edges and fractured in ductile structure, in the case of boronized samples (Fig 6. c, d) the specimens are less elongated at the edges of the fracture zone. However, there are matt colored cavities on the fracture surfaces of the samples.

The double phases layer consist of TiB and TiB₂ have high hardness and high wear resistance and excellent heat conductivity were formed at surface of Ti6Al4V alloy by boriding process. The results of the research can be listed as follows;

- Hardness of surface has increased from 330 HV to 2789 HV after boriding process.
- It is understood that boronized Ti6Al4V alloy may be used in tribological systems.
- Boriding process does not reduce the impact energy values of Ti6Al4V alloy.
- Boriding process has no significant effect on impact energy for Ti6Al4V.
- The effect of boriding process on impact energy has not been determined for Ti6Al4V.

Acknowledgements

This study was supported by the Scientific Research Department of Pamukkale University.

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Hardness Test Investigations of Api 5L X65 Pipe Joints

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Abstract: In this study, the welding performance of natural gas pipes made of API 5L X65 steel material by electric arc welding method was investigated by using Taguchi method. The specimens from the welded joints specified by the Taguchi method were subjected to hardness tests. The data and hardness graphs obtained from the tests showed that similar hardness behaviors. It was determined that hardness values differed according to applied strength of current, welding direction and electrode type. In all hardness data and graphs, the highest hardness values were determined in Heat Affected Zone (HAZ). The lowest values were in base material areas. The hardness values of weld metal were specified between the values of base metal and the HAZ.

Keywords: Hardness, API 5L X65, pipeline, welding, Taguchi.

1. INTRODUCTION

Petroleum and natural gas have an important place in human life and international relations as the most important energy sources. Recent history shows that petroleum and natural gas are not only energy resources, but also have political, economic, cultural and military dimensions, and thus they have a strategic importance (Umbach). It is necessary to move from the sources of petroleum and natural gas which have such economic and strategic importance, to the separation stations and to transport the products from the separation process to the places of use. This transportation carried out with high pressure is made with large diameter steel pipes (Ada et al). It is well known that the easiest and cheapest way to transport petroleum and gas products to distances is to use pipelines. Advanced piping systems transport petroleum products and natural gas in all over the world to consumer from production area. Increasing demand for energy in the world also requires the construction of high-pressure pipelines with high transport capacity (Han et al).

Today, the steels used in the production of natural gas and petroleum line pipes; is produced according to API (American Petroleum Institute) 5L standard. API 5L X65 steels are a high strength and low alloy steel series preferred for pipeline construction (API Spec 5L). In the API 5L standard, the main feature of the materials evaluated in class "X" is to obtain fine-grained ferrite and perlite structures, which have the dominant microstructure, as the result of thermomechanical processes. These materials which are frequently used in high-pressure pipelines, are steels produced by controlled thermomechanical rolling method in which fine-grained acicular ferrite is present intensively (Hashemi, Rakhshkhorshid and Hashemi, Hashemi and Mohammedyani). The numbers on the sides of the X series steels indicate the pressure corresponding to the yield strength of the material. For example, the statement X65 states that the material is a steel X series, and also has a yield strength corresponding to a minimum of 65 kpsi (65,000 psi). The main microalloyed element in API steels is niobium, which is a combination of titanium and vanadium (Nb/V, Nb/Ti, Nb/V/Ti). These combinations affect the yield strength and toughness of the steel positively (Radovic et al, Bajic et al, Bajic and Sijaki). These steels are widely used in pipelines for natural gas and petroleum transportation due to their economical, easy availability and high strength properties (Sangeetha et al, Aksöz et al).

The Taguchi method is used as an alternative approach to ensure that the welding parameters are selected more efficiently and to reduce the time and materials consumed. Basically the Taguchi method is a powerful method for high quality systems. It offers a simple, efficient and systematic approach to optimize cost, quality and performance designs (Çakıroğlu and Acır, Davim). The Taguchi method has been widely used in recent years. This method aims to solve the engineering optimization of a product or process in a three-step approach such as system design, parameter design and tolerance design. The use of classical experimental design methods is not efficient under industrial conditions. As the number of factors affecting the system increase, the number of experiments required increases rapidly, costs increase, and applications become more difficult. In such cases, the application of the Taguchi method, which is a fractional factorial design, becomes more efficient and easier. The Taguchi method can be successfully applied in many cases where it is necessary to decide (Öktem et al).

In this study, the hardness test performances of the joints were investigated by welded connection of steel pipes of X65 quality and API (American Petroleum Institute) 5L standard for petroleum and natural gas pipelines, which was determined by the experimental setup determined by Taguchi method.

2. MATERIALS AND METHODS

This study is an interim study. The basic aim of the main study is to be able to produce real and rational solutions by contributing to industrial applications. It is aimed to determine the source parameters determined by trial and error methods with a systematic model. Taking account of this purpose, it has been tried to choose the process parameters, operating conditions and welding methods used in today's pipeline construction works in factor choosing. In this scope; pipe material used for natural gas and petroleum transportation is subject to plastic deformation caused by external forces such as landslides and dents, it is preferred to use X65 material which has mechanical properties that can resist adverse effects that may arise from the outside. In the welding processes, parameters such as current intensity value, electrode type (Cellulosic and Basic) and welding direction (from down to upwards and from upwards to down) are taken into account. In the experiments, current intensity values were used in the range of 110-140, 120-150, 130-160, 140-170, 150-180, 160-190, 170-200 and 180-210 A, the pipes were connected in two different directions (from down to upwards and from upwards to down) and two different types of electrodes (cellulosic and basic).

Experiments with the Taguchi L16 experimental setup (8 * 2 * 2) were carried out in the light of the determined factors. The factors determined by the Taguchi method were given in Table 1 and the Taguchi L16 experimental setup was given in Table 2.

Table 1. Experiment factors and levels

Symbol	Factors (Welding Parameters)	Levels							
		1	2	3	4	5	6	7	8
A	Current Intensity (A)	110–140	120–150	130-160	140-170	150-180	160-190	170–200	180–210
B	Welding Direction	Bottom to top ↑	Top to bottom ↓						
C	Electrode type	Cellulosic	Basic						

Table 2. Taguchi L16 experiment setup

Experiment Number	-A- (Current Intensity) (Ampere)	-B- (Welding Direction)	-C- (Elektrod Türü)
1	1 (110 – 140)	1 (Bottom to top ↑)	1 (Cellulosic)
2	1 (110 – 140)	2 (Top to bottom↓)	2 (Basic)
3	2 (120 – 150)	1 (Bottom to top ↑)	1 (Cellulosic)
4	2 (120 – 150)	2 (Top to bottom↓)	2 (Basic)
5	3 (130 – 160)	1 (Bottom to top ↑)	1 (Cellulosic)
6	3 (130 – 160)	2 (Top to bottom↓)	2 (Basic)
7	4 (140 – 170)	1 (Bottom to top ↑)	1 (Cellulosic)
8	4 (140 – 170)	2 (Top to bottom↓)	2 (Basic)
9	5 (150 – 180)	1 (Bottom to top ↑)	2 (Basic)
10	5 (150 – 180)	2 (Top to bottom↓)	1 (Cellulosic)
11	6 (160 – 190)	1 (Bottom to top ↑)	2 (Basic)
12	6 (160 – 190)	2 (Top to bottom↓)	1 (Cellulosic)
13	7 (170 – 200)	1 (Bottom to top ↑)	2 (Basic)
14	7 (170 – 200)	2 (Top to bottom↓)	1 (Cellulosic)
15	8 (180 – 210)	1 (Bottom to top ↑)	2 (Basic)
16	8 (180 – 210)	2 (Top to bottom↓)	1 (Cellulosic)

In the experiments, fine grained structure steel is used in API 5L X65 quality with 12.7 mm section thickness given the chemical composition and mechanical properties in Table 3.

Table 3. Chemical composition and mechanical properties of X65 material used in the experiments.

	C	Si	Mn	P	S	Cr	Ni	Mo
Element (%)	0,064	0,29	1,61	0,008	0,0018	0,021	0,001	0,001
	Cu	Al	Ti	V	Nb	N	Fe	C _{Eq}
	0,008	0,035	0,023	0,051	0,052	0,0028	97,83	0,348
Mechanical Properties	Yield Str. (MPa)		Tensile Str. (MPa)		Elongation (min.) (%)		Impact Energy (0°C) (Joule)	
	566		650		34		209	

Cellulosic and basic electrodes are used as additional wires (electrodes). E6010 AWS code electrode with a diameter of 3,25 mm was used in the root pass at the connections made with cellulosic electrode and E8010 AWS code electrode with 4,00 mm diameter was used in the hot pass, intermediate pass and cap pass. Chemical composition and mechanical properties of cellulosic electrodes with E6010 and E8010 codes were given in Tables 4 and 5.

Table 4. Chemical analysis and mechanical properties of AWS/ASME FA.5.1. E6010 cellulosic electrode.

Chemical Analysis of Weld Metal (%)			Mechanical Properties of Weld Metal			
C	Si	Mn	Yield Str. (MPa)	Tensile Str. (MPa)	Elongation (min.) (%)	Impact Energy (0°C) (Joule)
0,10	0,20	0,50	470	530	26	60

Table 5. Chemical analysis and mechanical properties of AWS/ASME FA.5.1. E8010 cellulosic electrode.

Chemical Analysis of Weld Metal (%)				Mechanical Properties of Weld Metal			
C	Si	Mn	Ni	Yield Str. (MPa)	Tensile Str. (MPa)	Elongation (min.) (%)	Impact Energy (-20°C) (Joule)
0,10	0,20	0,80	0,90	500	570	24	60

Electrodes with E9018-D1-H4 AWS codes were used in the connection made with basic electrodes and electrodes with a diameter of 3,25 mm in the root pass and 4,00 mm in the other pass were preferred. Chemical composition and mechanical properties of E9018-D1-H4 AWS code electrode are given in Table 6.

Table 6. Chemical analysis and mechanical properties of AWS A5.5. E9018-D1-H4 basic electrode.

Chemical Analysis of Weld Metal (%)				Mechanical Properties of Weld Metal		
C	Si	Mn	Mo	Yield Str. (N/mm ²)	Tensile Str. (N/mm ²)	Impact Energy (-50 °C) (min) (Joule)
0,075	0,40	1,60	0,45	550	610-780	47

Electric arc welding method which is used intensively in field connections, is preferred as welding method with covered electrode, welding operations were carried out in a redressor type welding machine. In the connection operations, the welding bent geometry and pass sequence were given in Figure 1.

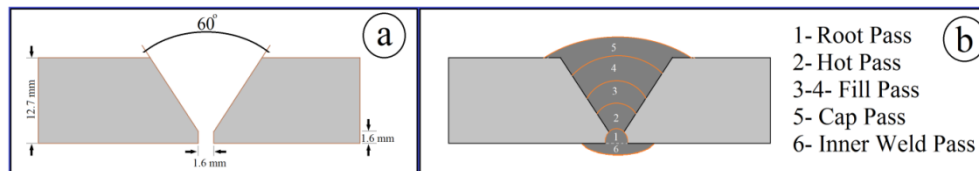


Figure 1. a) Welding groove geometry, b) Pass sequence.

In welded connections, the parts are primarily prepared for welding. API 5L X65 qualify steel pipes of 1.066.8 mm (42 "diameter), 12.7 mm wall thickness produced by submerged arc welding method as spiral is cut 300 mm width with automatic plasma cutter machine. The 30 ° welding bent is opened to the cut pipe and it was prepared for welding operation.

Each experiment was carried out in a from down to upwards and from upwards to down directions (Figure 2) so that half-tubular connection would be achieved, in other words, obtaining two experiments around a full pipe.

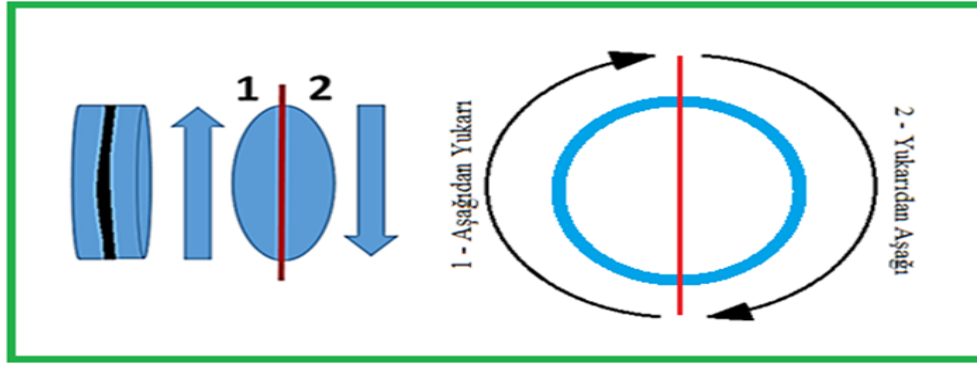


Figure 2. Schematic representation of the welding process

A total of 16 pipe sections were assembled and a total of 16 experiments were carried out as 8 full pipes include 16 half pipes. A photograph of the pipes prepared for welding operation is shown in Figure 3.



Figure 3. Pipes prepared for welding operation.

With the help of the Taguchi method, the most appropriate welding parameters were determined in accordance with L16 ($8 \times 2 \times 2$) as given in Table 2 and the welding operations were selected in accordance with this arrangement, as specified in Table 7, taking into account the cost and time criteria. In the experiments, the root passes were connected at a constant current intensity (100 Amperes) and the current intensity value with hot pass was increased by 10 Amperes by considering the fusion power of the electrode and metal accumulation capacity. At the end of the welding operation, the pipes was subjected to internal welding (6th pass) operation in the cap pass (5th pass) current intensity value. In welded connections, the welding speed was constant and connections were carried out at 120 mm/mins in the root pass rate and 150 mm/mins rate in the other pass. The basic electrodes used in the experiments were dried at 250 - 300 °C for 1 hour without waiting and the cellulosic electrodes were used in the welding operations without drying.

Table 7. Parameters established by Taguchi L16 experiment setup and used in the experiments.

Experiment Number	Welding Direction	Electrode Type	Strength of Current (Ampere)					
			Root Pass	Hot Pass	Fill Passes	Cap Pass	Inner Weld Pass	
			Ø 3,25 mm	Ø 4,0 mm				
			- Pass 1-	-Pass 2-	-Pass 3-	-Pass 4-	-Pass 5-	-Pass 6-
1	Bottom to top ↑	Cellulosic	100	110	120	130	140	140
2	Top to bottom ↓	Basic	100	120	130	140	150	150
3	Bottom to top ↑	Cellulosic	100	130	140	150	160	160
4	Top to bottom ↓	Basic	100	140	150	160	170	170
5	Bottom to top ↑	Cellulosic	100	150	160	170	180	180
6	Top to bottom ↓	Basic	100	160	170	180	190	190
7	Bottom to top ↑	Cellulosic	100	170	180	190	200	200
8	Top to bottom ↓	Basic	100	180	190	200	210	210
9	Bottom to top ↑	Cellulosic	100	190	200	210	220	220
10	Top to bottom ↓	Basic	100	200	210	220	230	230
11	Bottom to top ↑	Cellulosic	100	210	220	230	240	240
12	Top to bottom ↓	Basic	100	220	230	240	250	250
13	Bottom to top ↑	Cellulosic	100	230	240	250	260	260
14	Top to bottom ↓	Basic	100	240	250	260	270	270
15	Bottom to top ↑	Cellulosic	100	250	260	270	280	280
16	Top to bottom ↓	Basic	100	260	270	280	290	290

In accordance with the parameters given in Table 7, welded connections have been performed and pipe connections that welding operation are completed were given in the Figure 4.



Figure 4. Welded pipes

The hardness tests were carried out in accordance with TS EN ISO 9015-1 standard by taking transverse measurements from the midpoint of the section thickness, the base metal, ITAB and weld metal areas as schematically shown in Figure 5. Values obtained by 5 hardness measuring in each region in the measurements performed on both sides of the weld metal (to right and left). The hardness measurements were carried out under the load of 10 kg preferred by the pipe manufacturers by Vickers hardness measurement method.

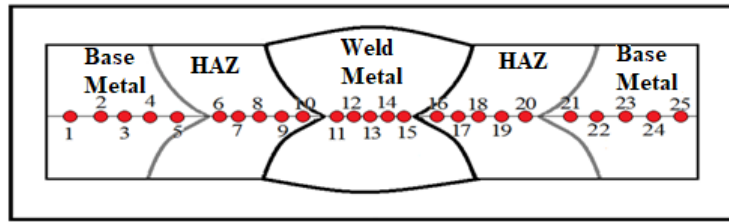


Figure 5. Schematic representation of hardness measurement

Since the position effects play a decisive role in the pipe welding; In the hardness graphs, hardness measurements were taken from 4 different time position regions for each experiment and the results were given in the graphs (Fig 6). Result graphs were created by taken separately by the measurements of the metallographic samples in the experiments from down to upwards, from 6:00 -7:30, 7:30 - 9:00, 9:00 - 10:30 and 10:30 -12:00 clock positions and from upwards to down, 12:00 - 01:30 , 1:30 - 3:00, 03:00 - 04:30 and 04:30 - 06:00 clock positions. 64 pieces hardness samples were taken from the welded pipes (Fig. 7)

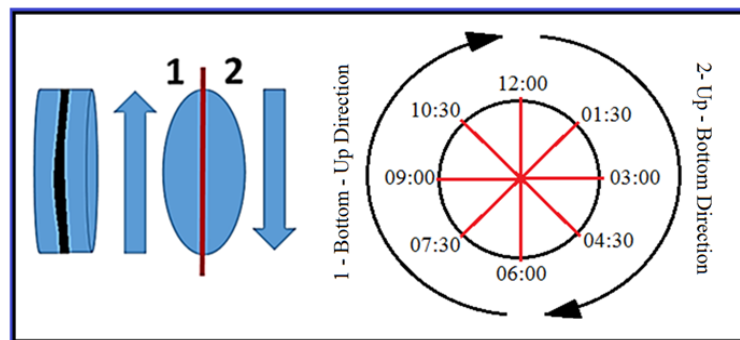


Figure 6. Schematic representation of the zones that hardness samples were taken from



Figure 7. Hardness samples

3.RESULTS AND DISCUSSION

Results

The results of the hardness test performed on the measurement regions and given schematically in Figure 6 were tried to interpreting by groupings made by keeping the welding direction and the electrode type constant. Experiments were grouped in order to examine the effects of parameters on welded connections hardness behavior in further detail. Experiments 1, 3, 5 and 7 performed with cellulosic electrode from down to upward direction and experiments 9, 11, 13 and 15 performed with basic electrode from down to upward direction have been evaluated among themselves depending on the amount of current intensity applied. Likewise, experiments 2, 4, 6 and 8 performed with basic electrode from down to upward direction and experiments 10, 12, 14 and 16 performed with cellulosic electrode from down to upward direction have been also evaluated depending on the amount of current intensity applied. With these evaluations, the effects of welding direction, electrode type, and current intensity amount on the hardness behavior of the connections could be compared in detail.

Experiments carried out with cellulosic electrodes from down to upward:

The microstructure samples obtained from experiments performed with the cellulosic electrode from down to upward are subjected to the hardness test at the measuring points schematically shown in Figure 6. The hardness graphs obtained from Experiments 1, 3, 5 and 7 and carried out from the down to upward with the cellulosic electrode, were given in Figures 8-11.

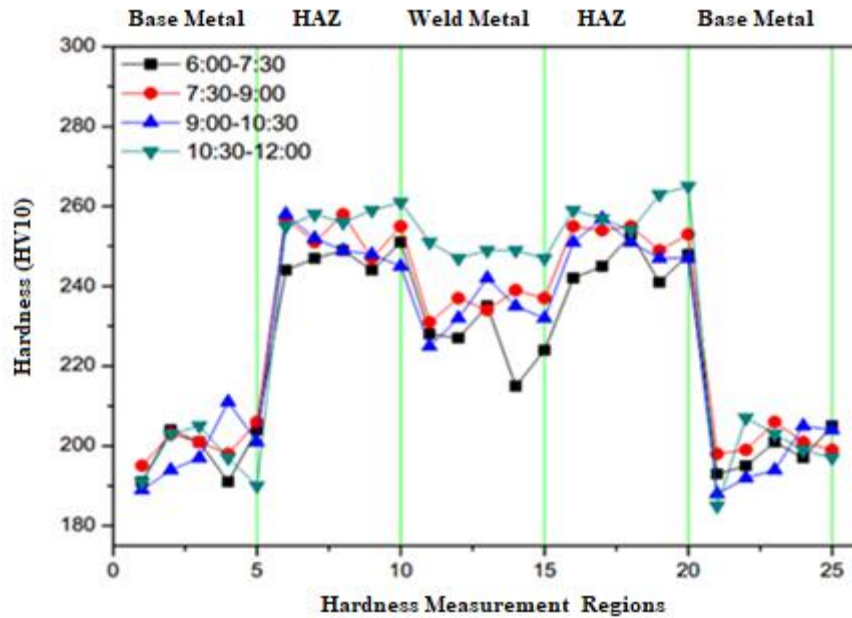


Figure 8. Experiment number 1, DU/C/110-140 A

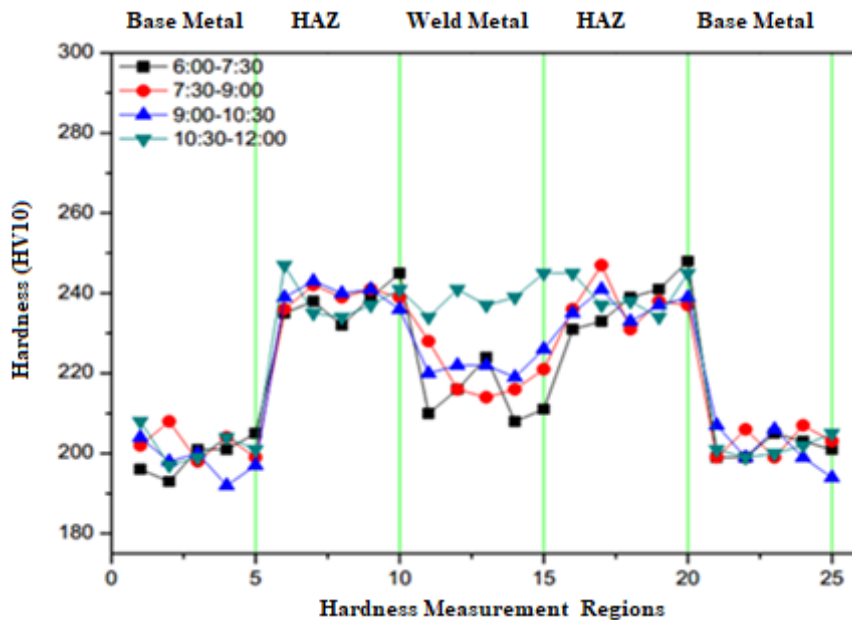


Figure 9. Experiment number 3, DU/C/120-150 A

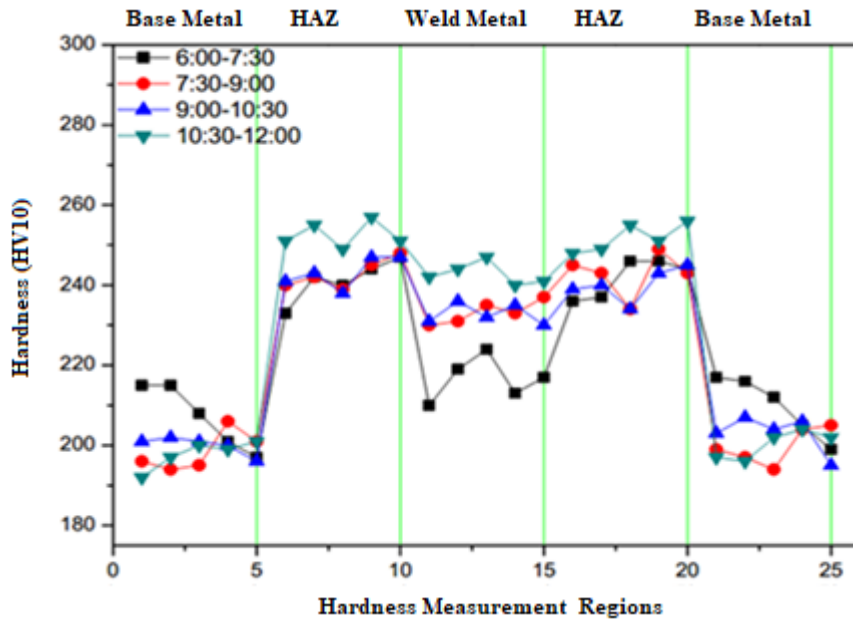


Figure 10. Experiment number 5, DU/C/130-160 A

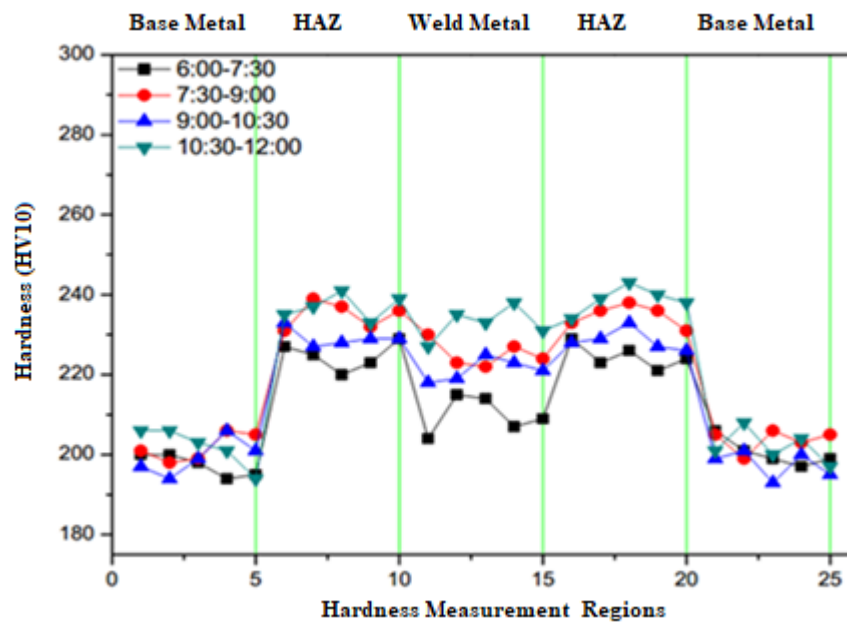


Figure 11. Experiment number 7, DU/C/140-170 A

Experiments carried out with cellulosic electrodes from upward to down:

The hardness results obtained from the experiments 10, 12, 14 and 16 performed with the cellulosic electrode in down to upward direction are as shown in the graphs shown in Figures 12-15.

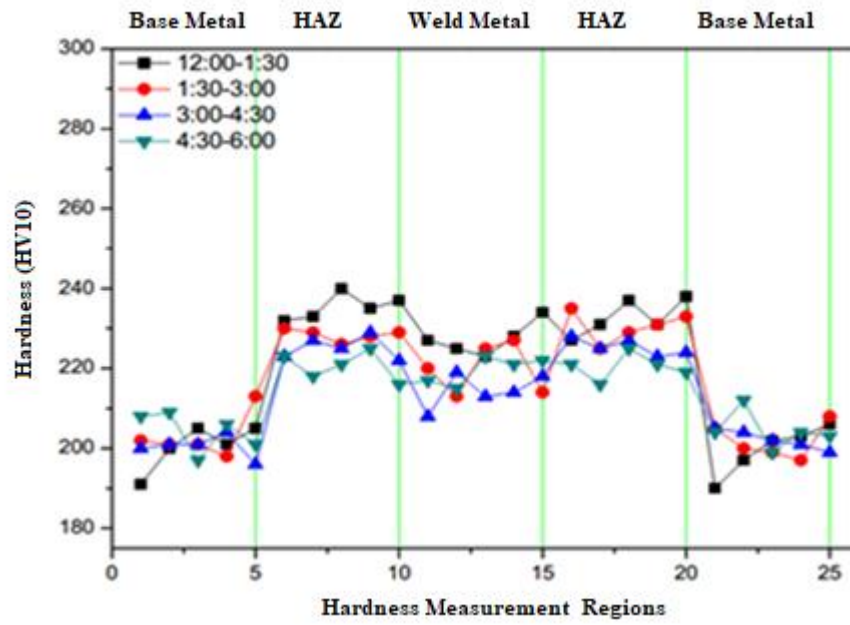


Figure 12. Experiment number 10, UD/C/150-180 A

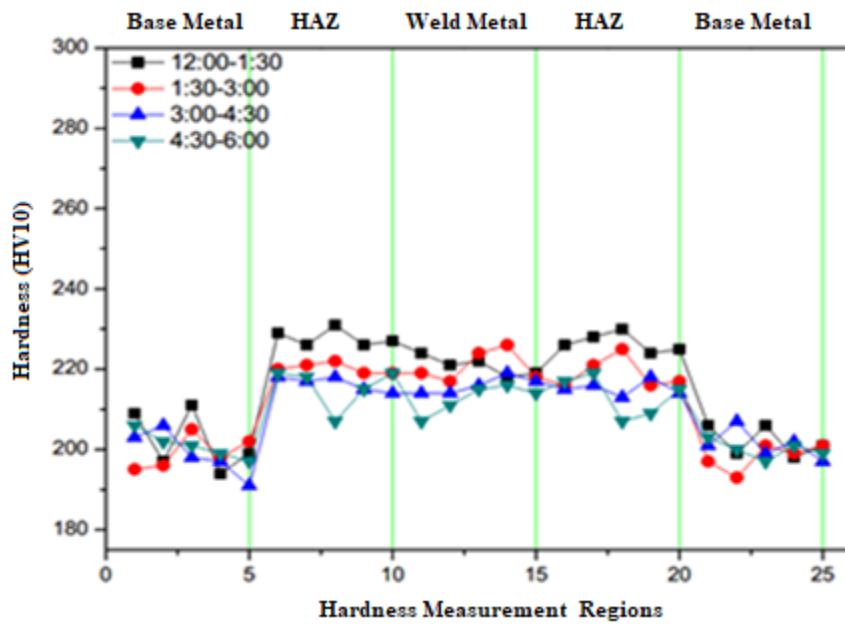


Figure 13. Experiment number 12, UD/C/160-190 A

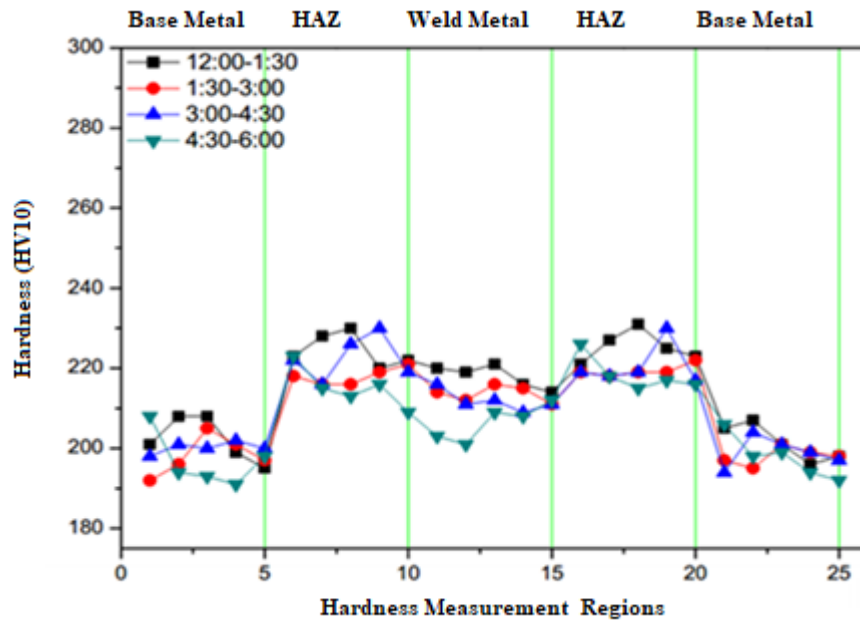


Figure 14. Experiment number 14, UD/C/170-200 A

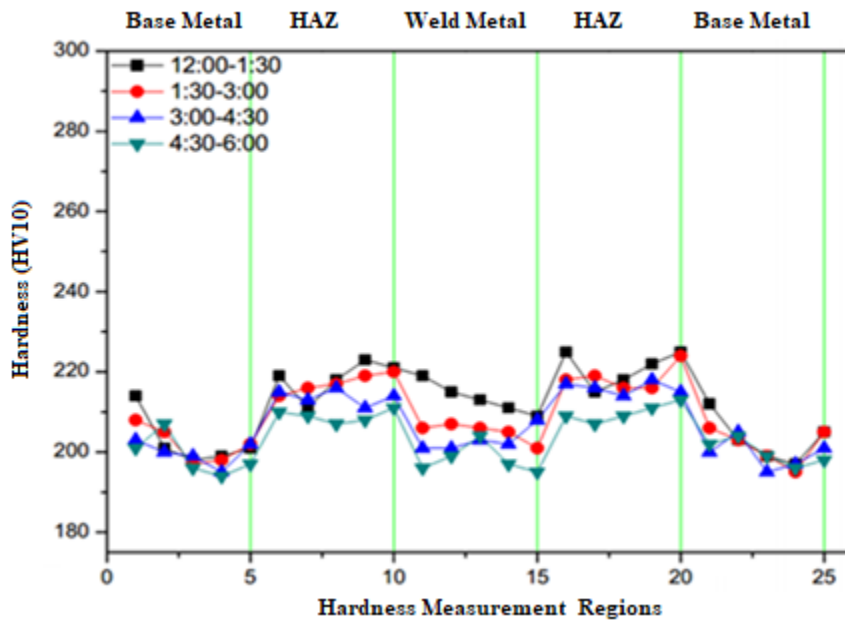


Figure 15. Experiment number 16, UD/C/180-210 A

Experiments carried out with basic electrodes from down to upward:

In the parameters given in Table 7, the hardness graphs obtained from experiments 9, 11, 13 and 15, in which the amount of current intensity is connected with the basic electrode in the down to upward directions, were given in Figures 16-19 respectively.

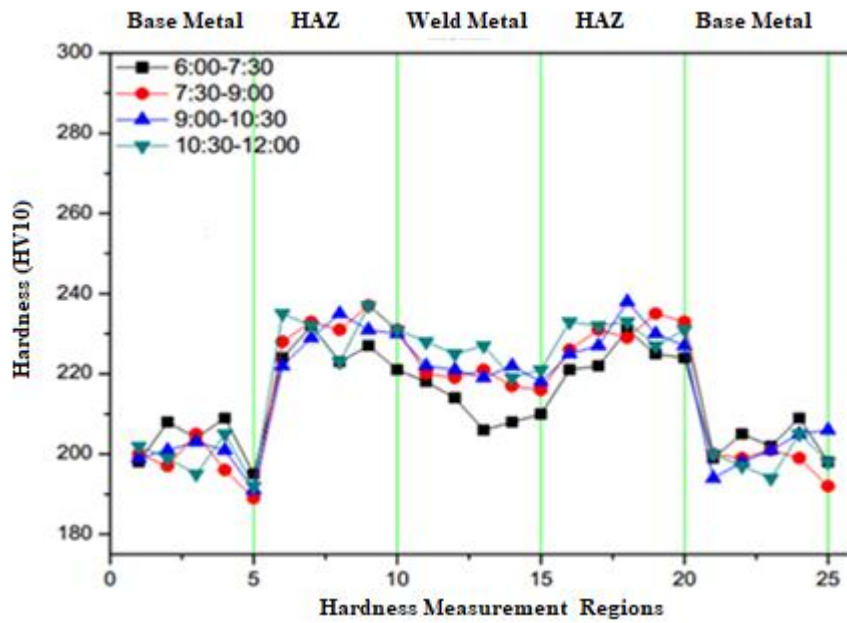


Figure 16. Experiment number 9, DU/B/150-180 A

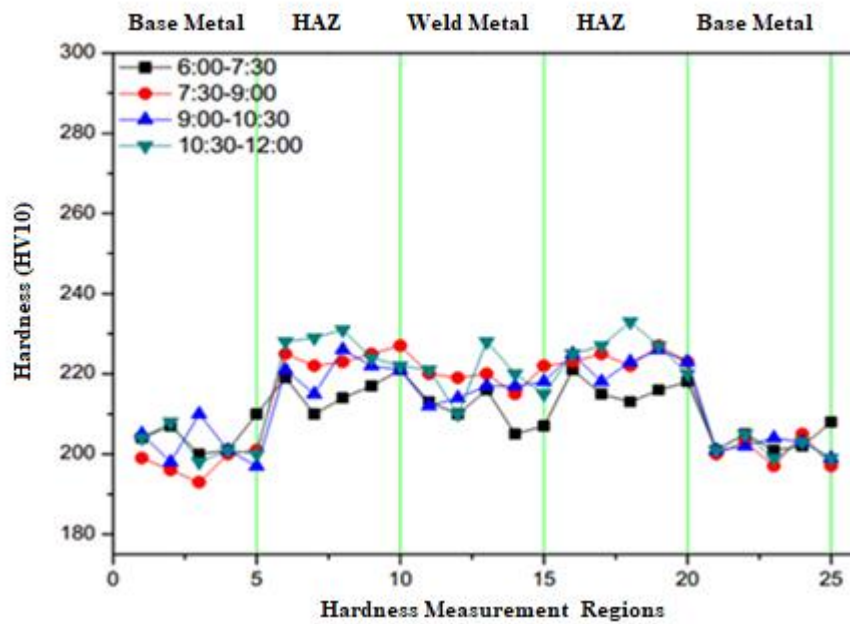


Figure 17. Experiment number 11, DU/B/160-190 A

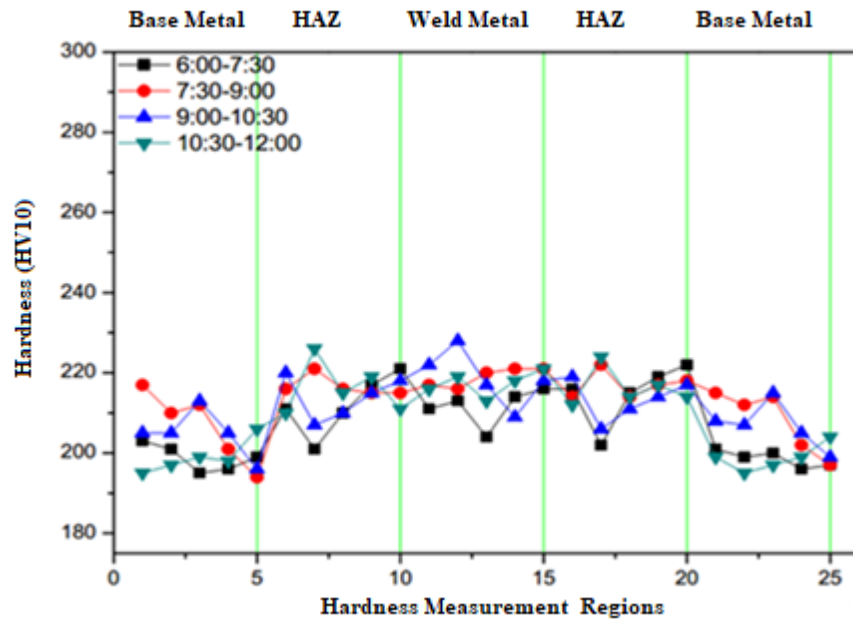


Figure 18. Experiment number 13, DU/B/170-200 A

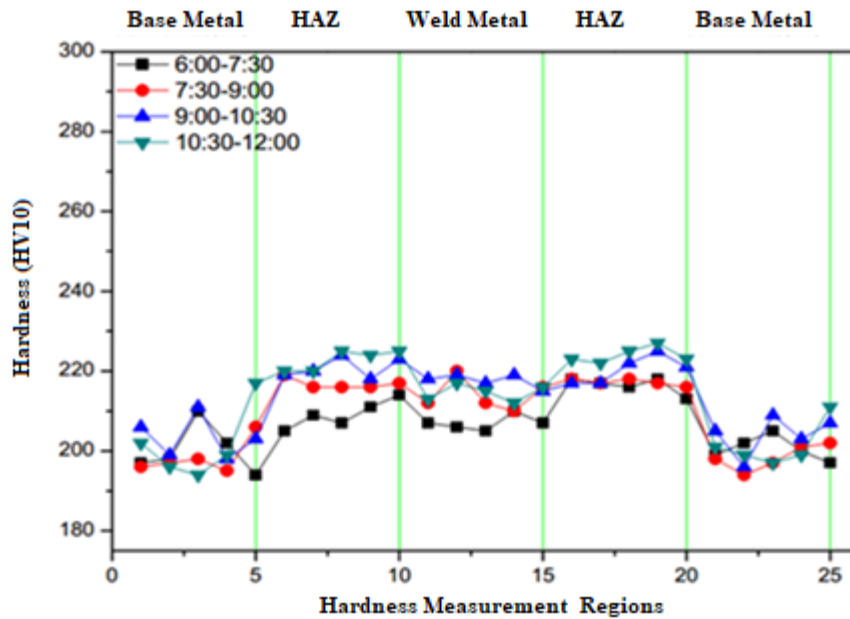


Figure 19. Experiment number 15, DU/B/180-210 A

Experiments carried out with basic electrodes from upward to down:

The hardness graphs obtained from Experiment 2, Experiment 4, Experiment 6 and Experiment 8 performed with the basic electrode upward to down were shown in the following Figures 20 - 23, respectively.

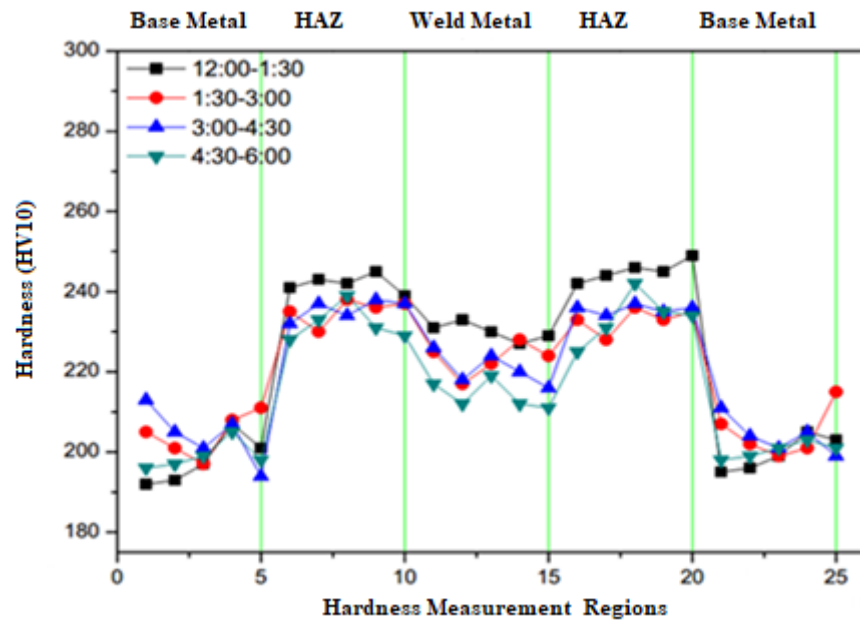


Figure 20. Experiment number 2, UD/B/110-140 A

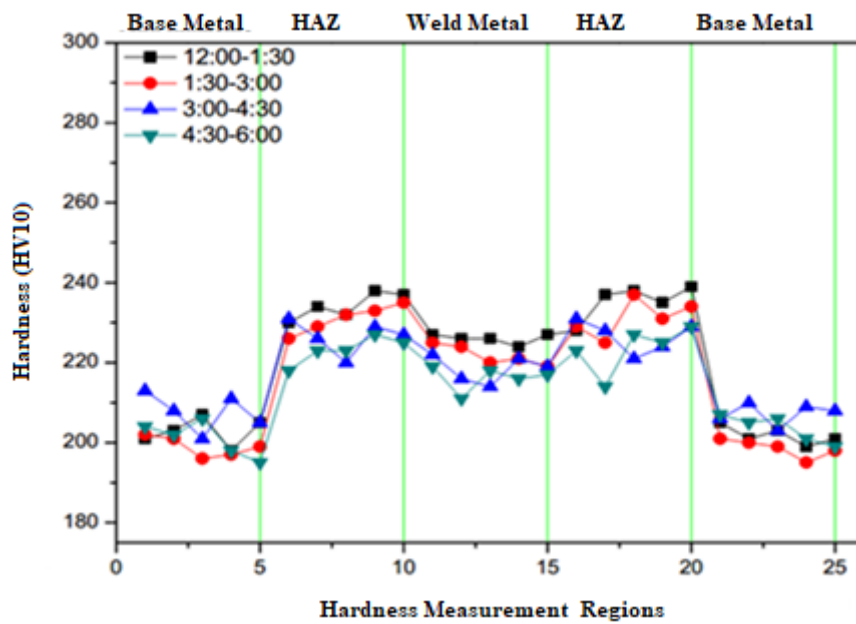


Figure 21. Experiment number 4, UD/B/120-150 A

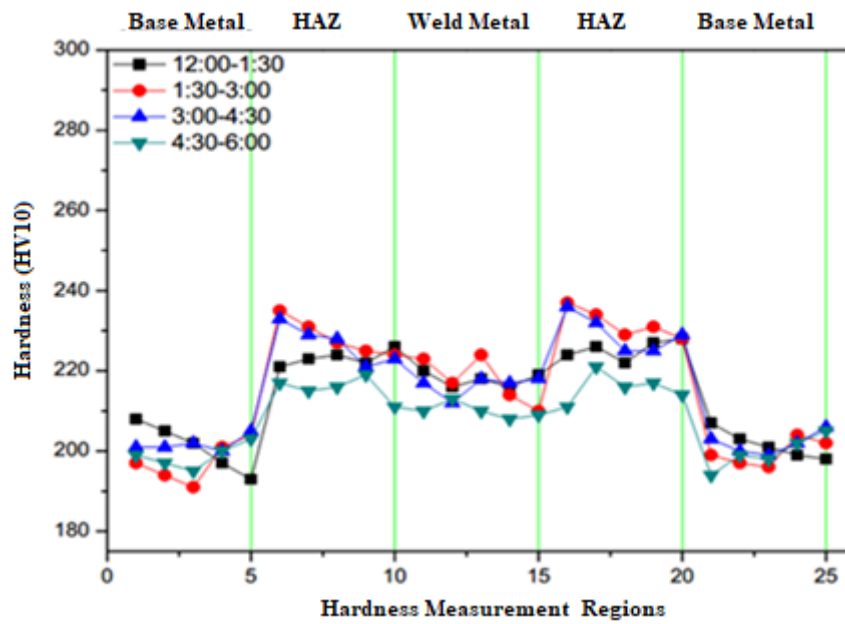


Figure 22. Experiment number 6, UD/B/130-160 A

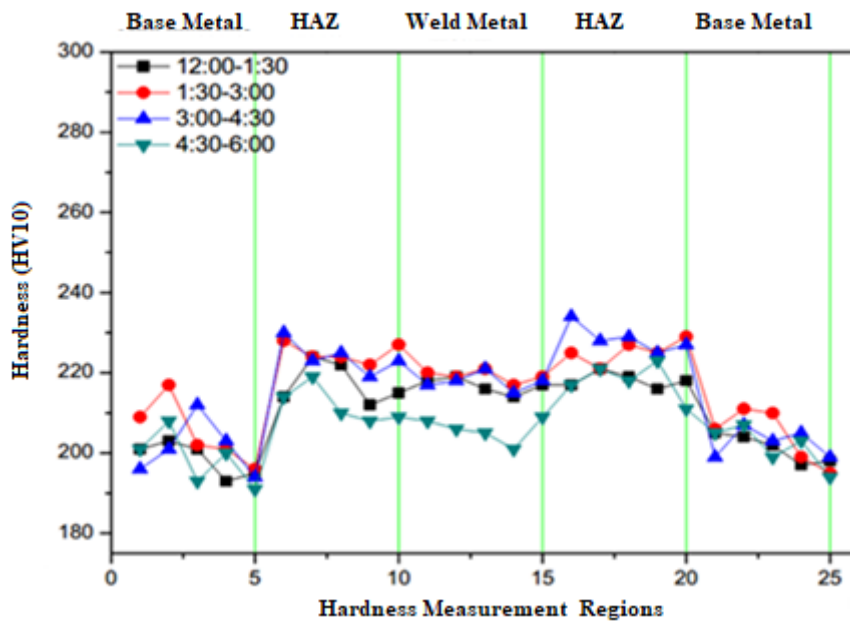


Figure 23. Experiment number 8, UD/B/140-170 A

Discussion

When the hardness graphs were examined, it was observed that the hardness values in main materials had same values in all experiments and about 200 HV and the highest hardness values of ITAB and welding metal were formed in experiment 1, which was connected with the cellulosic electrode with 110- 140 A current range from down to upward direction. In the mentioned experiment, while a value of 252 HV was reached in the ITAB, a hardness value of 236 HV in the weld metal was detected. As the current intensity increased, the hardness values of the other experiments (3, 5 and 7 numbered) performed in the same direction with the cellulosic electrode showed a decrease compared to the number 1 experiment. As noted in previous studies, this is due to an increase in the amount of current intensity and an increase in the heat input to the material. In all experiments, the lowest value of hardness was obtained from number 16 experiment, which was also connected with the cellulosic electrode in the upward to down direction at a current range of 180 - 210 A. In this experiment, a hardness value of 215 HV was measured in ITAB and 205 HV in welding metal.

When the cellulosic electrode and the basic electrode are compared, lower hardness values are generally found in the experiments performed with the basic electrode. Due to the high toughness of the basic electrode, the hardness values are naturally lower. In experiments with basic electrode, the highest hardness value was measured as 236 in the ITAB and 222 HV in the weld metal in the measurements made for the Number 2 Experiment. The lowest measurements were measured as 218 HV for ITAB and 213 HV for weld metal in the Number 15 experiment from down to upward.

When the direction of the weld is examined in the hardness measurements, the hardness values of the experiments performed down to upward were observed as lower due to the effect of the heat input and the hardness values of the experiments performed from the upward to down direction were measured to be relatively higher.

When the hardness measurements are evaluated together with other tests and examinations, there is an integrity between the tests and the examinations. As the heat input applied to the material increases in experiments where the current intensity value is high, the granules are coarser and the ITABs are formed on a larger region. In the microstructure and SEM examinations, the images obtained from the experiments also support this situation. Thus, in experiments where coarse-grains were formed, the strength values of the composites decreased while the percent elongation values increased. Again, experiments with coarse-grained structures due to effect of heat input and cooling rate due to current intensity, lower hardness values were observed than in other experiments with finer grained structures. In the tension and hardness test it was seen that hardness and strength are directly proportional.

The results of this study are as follows:

- When the hardness graphs were examined, the hardness values of the main materials had the same values in all experiments and observed to be about 200 HV. It has been observed that the highest hardness values occurred in the ITAB and the weld metal are formed in the number 1 experiment (252 HV, ITAB - 236 HV, weld metal), which is connected with the cellulosic electrode at 110 - 140 A current range. In all experiments, the lowest value of hardness was obtained from number 16 experiment (215 HV, ITAB – 205 HV weld metal) , which was also connected with the cellulosic electrode in the upward to down direction at a current range of 180 - 210 A.
- A decrease in the hardness values of the experiments performed in the same direction was observed with increasing the current intensity.
- When the cellulosic electrode and the basic electrode are compared, lower hardness values are generally found in the experiments performed with the basic electrode. Due to the high toughness of the basic electrode, the hardness values occurred naturally lower.
- When the direction of the weld is examined in the hardness measurements, the hardness values of the experiments performed down to upward were observed as lower due to the effect of the heat input and cooling rate and the hardness values of the experiments performed from the upward to down direction were measured to be relatively higher.

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Toughness Investigations of Api 5l X65 Pipe Joints

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Abstract: In this study, toughness performance of natural gas pipes made of API 5L X65 steel material by electric arc welding method were investigated. The specimens take from the welded joints specified by the Taguchi method were subjected to Charpy Impact test. The data obtained from the test results were showed that toughness values changed according to applied strength of current, welding direction and electrode type. Because heat input increased and rate of cooling lengthened out, it has been observed that the toughness values increased with high strength of current values. So welding process which made bottom to top direction, effect of the heat input and rate of cooling, higher weld metal toughness values were observed in the tests. The impact resistance of the alkaline electrode were measured higher values than cellulosic electrode.

Keywords: Toughness, API 5L X65, pipeline, welding, Taguchi.

1.INTRODUCTION

Petroleum and natural gas have an important place in human life and international relations as the most important energy sources. Recent history shows that petroleum and natural gas are not only energy resources, but also have political, economic, cultural and military dimensions, and thus they have a strategic importance (Umbach). It is necessary to move from the sources of petroleum and natural gas which have such economic and strategic importance, to the separation stations and to transport the products from the separation process to the places of use. This transportation carried out with high pressure is made with large diameter steel pipes (Ada et al). It is well known that the easiest and cheapest way to transport petroleum and gas products to distances is to use pipelines. Advanced piping systems transport petroleum products and natural gas in all over the world to consumer from production area. Increasing demand for energy in the world also requires the construction of high-pressure pipelines with high transport capacity (Han et al).

Today, the steels used in the production of natural gas and petroleum line pipes; is produced according to API (American Petroleum Institute) 5L standard. API 5L X65 steels are a high strength and low alloy steel series preferred for pipeline construction (API Spec 5L). In the API 5L standard, the main feature of the materials evaluated in class "X" is to obtain fine-grained ferrite and perlite structures, which have the dominant microstructure, as the result of thermomechanical processes. These materials which are frequently used in high-pressure pipelines, are steels produced by controlled thermomechanical rolling method in which fine-grained acicular ferrite is present intensively (Hashemi, Rakhshkhorshid and Hashemi, Hashemi and Mohammedyani). The numbers on the sides of the X series steels indicate the pressure corresponding to the yield strength of the material. For example, the statement X65 states that the material is a steel X series, and also has a yield strength corresponding to a minimum of 65 kpsi (65,000 psi). The main microalloyed element in API steels is niobium, which is a combination of titanium and vanadium (Nb/V, Nb/Ti, Nb/V/Ti). These combinations affect the yield strength and toughness of the steel positively (Radovic et al, Bajic et al, Bajic and Sijaki) . These steels are widely used in pipelines for natural gas and petroleum transportation due to their economical, easy availability and high strength properties (Sangeetha et al, Aksöz et al).

The Taguchi method is used as an alternative approach to ensure that the welding parameters are selected more efficiently and to reduce the time and materials consumed. Basically the Taguchi method is a powerful method for high quality systems. It offers a simple, efficient and systematic approach to optimize cost, quality and performance designs (Çakıroğlu and Acır, Davim). The Taguchi method has been widely used in recent years. This method aims to solve the engineering optimization of a product or process in a three-step approach such as system design, parameter design and tolerance design. The use of classical experimental design methods is not efficient under industrial conditions. As the number of factors affecting the system increase, the number of experiments required increases rapidly, costs increase, and applications become more difficult. In such cases, the application of the Taguchi method, which is a fractional factorial design, becomes more efficient and easier. The Taguchi method can be successfully applied in many cases where it is necessary to decide (Öktem et al).

In this study, the toughness test performances of the joints were investigated by welded connection of steel pipes of X65 quality and API (American Petroleum Institute) 5L standard for oil and natural gas pipelines, which was determined by the experimental setup determined by Taguchi method.

2. MATERIALS AND METHODS

This study is an interim study. The basic aim of the main study is to be able to produce real and rational solutions by contributing to industrial applications. It is aimed to determine the source parameters determined by trial and error methods with a systematic model. Taking account of this purpose, it has been tried to choose the process parameters, operating conditions and welding methods used in today's pipeline construction works in factor choosing. In this scope; pipe material used for natural gas and petroleum transportation is subject to plastic deformation caused by external forces such as landslides and dents, it is preferred to use X65 material which has mechanical properties that can resist adverse effects that may arise from the outside. In the welding processes, parameters such as current intensity value, electrode type (Cellulosic and Basic) and welding direction (from down to upwards and from upwards to down) are taken into account. In the experiments, current intensity values were used in the range of 110-140, 120-150, 130-160, 140-170, 150-180, 160-190, 170-200 and 180-210 A, the pipes were connected in two different directions (from down to upwards and from upwards to down) and two different types of electrodes (cellulosic and basic).

Experiments with the Taguchi L16 experimental setup (8 * 2 * 2) were carried out in the light of the determined factors. The factors determined by the Taguchi method were given in Table 1 and the Taguchi L16 experimental setup was given in Table 2.

Table 1. Experiment factors and levels

Symbol	Factors (Welding Parameters)	Levels							
		1	2	3	4	5	6	7	8
A	Current Intensity (A)	110–140	120–150	130-160	140-170	150-180	160-190	170–200	180–210
B	Welding Direction	Bottom to top ↑	Top to bottom ↓						
C	Electrode type	Cellulosic	Basic						

Table 2. Taguchi L16 experiment setup

Experiment Number	-A- (Current Intensity) (Ampere)	-B- (Welding Direction)	-C- (Elektrod Türü)
1	1 (110 – 140)	1 (Bottom to top ↑)	1 (Cellulosic)
2	1 (110 – 140)	2 (Top to bottom ↓)	2 (Basic)
3	2 (120 – 150)	1 (Bottom to top ↑)	1 (Cellulosic)
4	2 (120 – 150)	2 (Top to bottom ↓)	2 (Basic)
5	3 (130 – 160)	1 (Bottom to top ↑)	1 (Cellulosic)
6	3 (130 – 160)	2 (Top to bottom ↓)	2 (Basic)
7	4 (140 – 170)	1 (Bottom to top ↑)	1 (Cellulosic)
8	4 (140 – 170)	2 (Top to bottom ↓)	2 (Basic)
9	5 (150 – 180)	1 (Bottom to top ↑)	2 (Basic)
10	5 (150 – 180)	2 (Top to bottom ↓)	1 (Cellulosic)
11	6 (160 – 190)	1 (Bottom to top ↑)	2 (Basic)
12	6 (160 – 190)	2 (Top to bottom ↓)	1 (Cellulosic)
13	7 (170 – 200)	1 (Bottom to top ↑)	2 (Basic)
14	7 (170 – 200)	2 (Top to bottom ↓)	1 (Cellulosic)
15	8 (180 – 210)	1 (Bottom to top ↑)	2 (Basic)
16	8 (180 – 210)	2 (Top to bottom ↓)	1 (Cellulosic)

In the experiments, fine grained structure steel is used in API 5L X65 quality with 12.7 mm section thickness given the chemical composition and mechanical properties in Table 3.

Table 3. Chemical composition and mechanical properties of X65 material used in the experiments.

	C	Si	Mn	P	S	Cr	Ni	Mo
Element (%)	0,064	0,29	1,61	0,008	0,0018	0,021	0,001	0,001
	Cu	Al	Ti	V	Nb	N	Fe	C _{Eq}
	0,008	0,035	0,023	0,051	0,052	0,0028	97,83	0,348
Mechanical Properties	Yield Str.		Tensile Str.		Elongation (min.)		Impact Energy (0°C)	
	(MPa)		(MPa)		(%)		(Joule)	
	566		650		34		209	

Cellulosic and basic electrodes are used as additional wires (electrodes). E6010 AWS code electrode with a diameter of 3,25 mm was used in the root pass at the connections made with cellulosic electrode and E8010 AWS code electrode with 4,00 mm diameter was used in the hot pass, intermediate pass and cap pass. Chemical composition and mechanical properties of cellulosic electrodes with E6010 and E8010 codes were given in Tables 4 and 5.

Table 4. Chemical analysis and mechanical properties of AWS/ASME FA.5.1. E6010 cellulosic electrode.

Chemical Analysis of Weld Metal (%)			Mechanical Properties of Weld Metal			
C	Si	Mn	Yield Str. (MPa)	Tensile Str. (MPa)	Elongation (min.) (%)	Impact Energy (0°C) (Joule)
0,10	0,20	0,50	470	530	26	60

Table 5. Chemical analysis and mechanical properties of AWS/ASME FA.5.1. E8010 cellulosic electrode.

Chemical Analysis of Weld Metal (%)				Mechanical Properties of Weld Metal		
C	Si	Mn	Ni	Yield Str. (MPa)	Tensile Str. (MPa)	Impact Energy (-20°C) (Joule)
0,10	0,20	0,80	0,90	500	570	24

Electrodes with E9018-D1-H4 AWS codes were used in the connection made with basic electrodes and electrodes with a diameter of 3,25 mm in the root pass and 4,00 mm in the other pass were preferred. Chemical composition and mechanical properties of E9018-D1-H4 AWS code electrode are given in Table 6.

Table 6. Chemical analysis and mechanical properties of AWS A5.5. E9018-D1-H4 basic electrode.

Chemical Analysis of Weld Metal (%)				Mechanical Properties of Weld Metal		
C	Si	Mn	Mo	Yield Str. (N/mm ²)	Tensile Str. (N/mm ²)	Impact Energy (-50 °C) (min) (Joule)
0,075	0,40	1,60	0,45	550	610-780	47

Electric arc welding method which is used intensively in field connections, is preferred as welding method with covered electrode, welding operations were carried out in a redressor type welding machine. In the connection operations, the welding bent geometry and pass sequence were given in Figure 1.

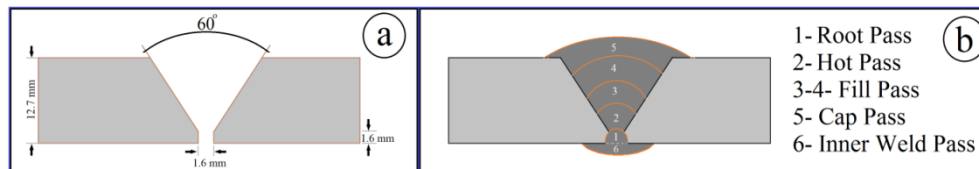


Figure 1. a) Welding groove geometry, b) Pass sequence.

In welded connections, the parts are primarily prepared for welding. API 5L X65 qualify steel pipes of 1.066.8 mm (42 "diameter), 12.7 mm wall thickness produced by submerged arc welding method as spiral is cut 300 mm width with automatic plasma cutter machine. The 30 ° welding bent is opened to the cut pipe and it was prepared for welding operation.

Each experiment was carried out in a from down to upwards and from upwards to down directions (Figure 2) so that half-tubular connection would be achieved, in other words, obtaining two experiments around a full pipe.

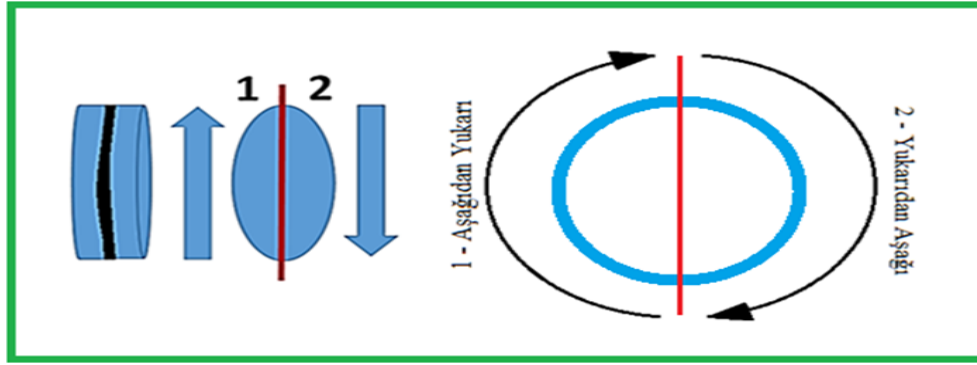


Figure 2. Schematic representation of the welding process

A total of 16 pipe sections were assembled and a total of 16 experiments were carried out as 8 full pipes include 16 half pipes. A photograph of the pipes prepared for welding operation is shown in Figure 3.



Figure 3. Pipes prepared for welding operation.

With the help of the Taguchi method, the most appropriate welding parameters were determined in accordance with L16 ($8 \times 2 \times 2$) as given in Table 2 and the welding operations were selected in accordance with this arrangement, as specified in Table 7, taking into account the cost and time criteria. In the experiments, the root passes were connected at a constant current intensity (100 Amperes) and the current intensity value with hot pass was increased by 10 Amperes by considering the fusion power of the electrode and metal accumulation capacity. At the end of the welding operation, the pipes was subjected to internal welding (6th pass) operation in the cap pass (5th pass) current intensity value. In welded connections, the welding speed was constant and connections were carried out at 120 mm/mins in the root pass rate and 150 mm/mins rate in the other pass. The basic electrodes used in the experiments were dried at 250 - 300 °C for 1 hour without waiting and the cellulosic electrodes were used in the welding operations without drying.

Table 7. Parameters established by Taguchi L16 experiment setup and used in the experiments.

Experiment Number	Welding Direction	Electrode Type	Strength of Current (Ampere)					
			Root Pass	Hot Pass	Fill Passes		Cap Pass	Inner Weld Pass
			Ø 3,25 mm - Pass 1-	Ø 4,0 mm -Pass 2-	-Pass 3-	-Pass 4-	-Pass 5-	-Pass 6-
1	Bottom to top ↑	Cellulosic	100	110	120	130	140	140
2	Top to bottom ↓	Basic	100	120	130	140	150	150
3	Bottom to top ↑	Cellulosic	100	130	140	150	160	160
4	Top to bottom ↓	Basic	100	140	150	160	170	170
5	Bottom to top ↑	Cellulosic	100	150	160	170	180	180
6	Top to bottom ↓	Basic	100	160	170	180	190	190
7	Bottom to top ↑	Cellulosic	100	170	180	190	200	200
8	Top to bottom ↓	Basic	100	180	190	200	210	210
9	Bottom to top ↑	Cellulosic	100	190	200	210	220	220
10	Top to bottom ↓	Basic	100	200	210	220	230	230
11	Bottom to top ↑	Cellulosic	100	210	220	230	240	240
12	Top to bottom ↓	Basic	100	220	230	240	250	250
13	Bottom to top ↑	Cellulosic	100	230	240	250	260	260
14	Top to bottom ↓	Basic	100	240	250	260	270	270
15	Bottom to top ↑	Cellulosic	100	250	260	270	280	280
16	Top to bottom ↓	Basic	100	260	270	280	290	290

In accordance with the parameters given in Table 7, welded connections have been performed and pipe connections that welding operation are completed were given in the Figure 4.



Figure 4. Welded pipes

Charpy impact tests were applied to the samples to control the resistance of the welded connections to toughness. Charpy - impact tests were carried out in accordance with TS EN ISO 148-1. The samples prepared in accordance with Standard were taken as 5 pieces from 4 different regions indicated in Figure 5 for main material and each experiments. A total of 325 charpy - impact test samples taken from 64 regions and main material were prepared within the scope of 16 experiments.

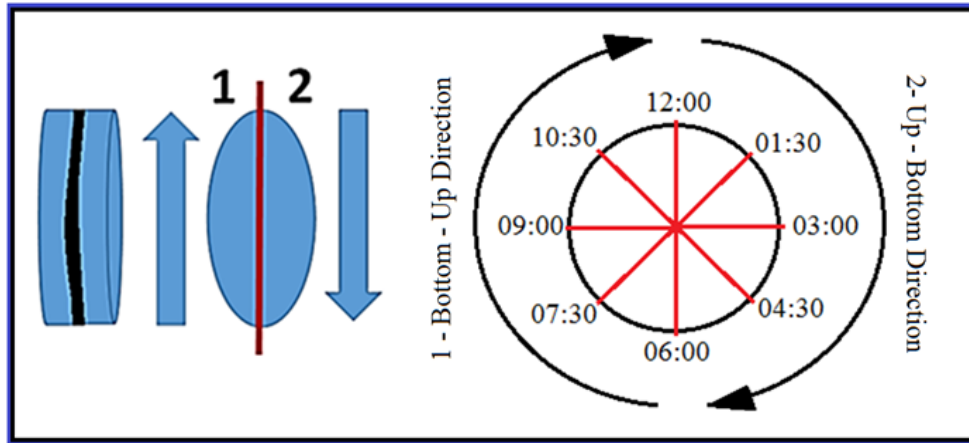


Figure 5. Schematic representation of the sample regions.

A schematic image of the Charpy impact test samples and a photograph of the samples taken according to these measurements are shown in Figures 6 and 7, respectively. Charpy impact tests were realized by Zwick device that its impact rate is 5,23 m/sec. and measures maximum 450 Joule energy and presents in Ankara Factory of Emek Pipe Company. In preparation of the samples welded connection for testing, single-sided "V" charpies are formed in the center of the weld metal and on the cap side of the weld. Thus, the impact strengths of welded connections were determined. Charpy impact tests were carried out at 0 ° C in a cooling fluid at a sensitivity of ± 1 ° C.

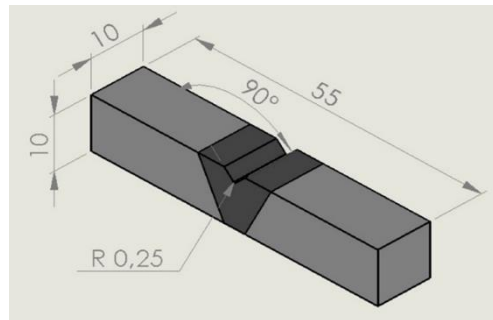


Figure 6. Schematic representation of Charpy Impact test sample.

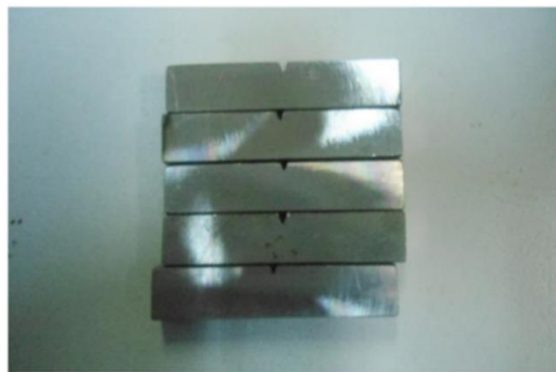


Figure 7. Charpy Impact test sample.

3.RESULTS AND DISCUSSION

Results

Charpy impact test was applied to the samples obtained from the main material and welded materials at 0°C. The results of the main material were given in Table 8.

Table 8. Results of Charpy Impact test of base material.

Region	Sample	Impact Energy 0°C (Joule)
	1	196
	2	228
	3	198
	4	216
	5	206
	Average	209

As a result of the charpy impact test applied with 5 samples to the main material, the base metal average impact strength value was measured as 209 Joule. Test samples of the welded connections carried out under the experimental setup formed with the Taguchi method were prepared so as to center the charpy welded metal center to measure the impact strength of the weld metal. The results of the tests applied to the samples were given in Table 9.

Table 9. Results of Charpy Impact Test of weld joints

Experiment Number	Weld. Direction / Electrode Type / Strength of Current	Clock Position	Impact Energy 0°C (Joule)	Experiment Number	Weld. Direction / Electrode Type / Strength of Current	Clock Position	Impact Energy 0°C (Joule)
1	Down	to 06.00 – 07.30	135	2	Upward to Down	12.00 – 01.30	128
	Upward ↑	07.30 – 09.00	128		↓ / Basic	01.30 – 03.00	129
	Cellulosic	09.00 – 10.30	127		110 – 140 A	03.00 – 04.30	130
	110 – 140 A	10.30 – 12.00	122			04.30 – 06.00	134
		Ortalama	128			Ortalama	130
3	Down	to 06.00 – 07.30	138	4	Upward to Down	12.00 – 01.30	136
	Upward ↑	07.30 – 09.00	136		↓ / Basic	01.30 – 03.00	137
	Cellulosic	09.00 – 10.30	133		120 – 150 A	03.00 – 04.30	138
	120 – 150 A	10.30 – 12.00	128			04.30 – 06.00	140
		Ortalama	134			Ortalama	138
5	Down	to 06.00 – 07.30	142	6	Upward to Down	12.00 – 01.30	137
	Upward ↑	07.30 – 09.00	141		↓ / Basic	01.30 – 03.00	138
	Cellulosic	09.00 – 10.30	139		130 – 160 A	03.00 – 04.30	138
	130 – 160 A	10.30 – 12.00	133			04.30 – 06.00	143
		Ortalama	139			Ortalama	139
7	Down	to 06.00 – 07.30	148	8	Upward to Down	12.00 – 01.30	146
	Upward ↑	07.30 – 09.00	143		↓ / Basic	01.30 – 03.00	147
	Cellulosic	09.00 – 10.30	141		140 – 170 A	03.00 – 04.30	147
	140 – 170 A	10.30 – 12.00	139			04.30 – 06.00	152
		Ortalama	143			Ortalama	148
9	Down	to 06.00 – 07.30	154	10	Upward to Down	12.00 – 01.30	143
	Upward ↑ / Basic	07.30 – 09.00	153		↓ / Cellulosic	01.30 – 03.00	146
	/ 150 –	09.00 – 10.30	148		150 – 180 A	03.00 – 04.30	147
	180 A	10.30 – 12.00	144			04.30 – 06.00	151
		Ortalama	150			Ortalama	147
11	Down	to 06.00 – 07.30	159	12	Upward to Down	12.00 – 01.30	147
	Upward ↑ / Basic	07.30 – 09.00	157		↓ / Cellulosic	01.30 – 03.00	148
	/ 160 –	09.00 – 10.30	153		160 – 190 A	03.00 – 04.30	148
	190 A	10.30 – 12.00	147			04.30 – 06.00	153
		Ortalama	154			Ortalama	149
13	Down	to 06.00 – 07.30	167	14	Upward to Down	12.00 – 01.30	149
	Upward ↑ / Basic	07.30 – 09.00	161		↓ / Cellulosic	01.30 – 03.00	150
	/ 170 –	09.00 – 10.30	159		170 – 200 A	03.00 – 04.30	154
	200 A	10.30 – 12.00	159			04.30 – 06.00	159
		Ortalama	161			Ortalama	153
15	Down	to 06.00 – 07.30	171	16	Upward to Down	12.00 – 01.30	158
	Upward ↑ / Basic	07.30 – 09.00	167		↓ / Cellulosic	01.30 – 03.00	163
	/ 180 –	09.00 – 10.30	167		180 – 210 A	03.00 – 04.30	163
	210 A	10.30 – 12.00	165			04.30 – 06.00	166
		Ortalama	168			Ortalama	162

In order to compare the charpy - impact test results in general, a charpy - impact test general results graph was prepared in Figure 8.

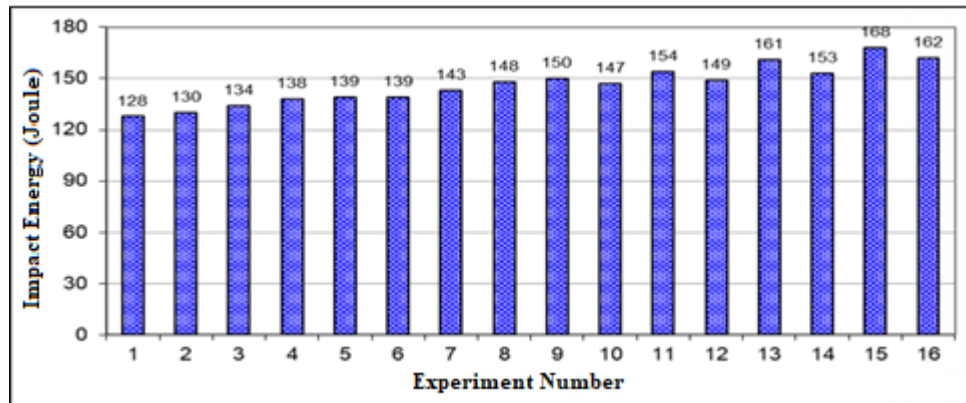


Figure 8. Schematic representation of the results of Charpy Impact Test of all experiments.

Discussion

When the graph in Figure 8 is examined, the highest toughness results in the group-based studies are obtained from the experiments conducted with the basic electrode (numbered 9, 11, 13 and 15) from the down to upwards while the lowest toughness results are obtained from the experiments conducted with the cellulosic electrode from the down to upwards (1, 3, 5 and 7). On the basis of the experiments, the highest impact strength was observed in experiment No. 15 which absorbed 168 Joule energy, while the lowest impact strength was measured in experiment No. 1, which absorbed 128 Joule energy.

It has been observed that the toughness values increase in the experiments with increasing current intensity values. This is related to heat input and cooling rate. As the current intensity values increased, the heat input also increased and the toughness values increased with the heat input increased.

When investigating the direction of welding, higher toughness values were observed due to the effect of heat input and accordingly cooling speed.

Compared to the electrode types, due to chemical properties, the impact resistance of the basic electrode shows higher values, creation of more heat input, and the increase in the cooling time due to the when materials in the electrode cover burnt causes increase in the value of the impact resistance of the cellulosic electrode.

When the results of the impact energy obtained from the charpy - impact tests and the results of hardness are related to each other, it is seen that there is an inversely proportional relation between hardness and toughness. In experiments where high weld metal hardness was measured in the hardness tests, it was determined that the lowest impact energy was measured for charpy-impact tests. Conversely, in experiments where high impact energies were measured, it was found that hardness samples showed low hardness values in the weld metal. The results obtained in the studies support the results obtained in our study [6, 7].

The results of this study are as follows:

- When the results of charpy impact test are examined, the highest toughness results in the group-based studies are obtained from the experiments conducted with the basic electrode (numbered 9, 11, 13 and 15) from the down to upwards while the lowest toughness results are obtained from the experiments conducted with the cellulosic electrode from the down to upwards (1,3,5 and 7). On the basis of the experiments, the highest impact strength was observed in experiment No. 15 which absorbed 168 Joule energy, while the lowest impact strength was measured in experiment No. 1, which absorbed 128 Joule energy.
- It has been observed that the toughness values increase in the experiments with increasing current intensity values. As the current intensity values increased, the heat input also increased and the toughness values increased with the heat input increased.
- When investigating the direction of welding, higher welding metal toughness values were observed due to the effect of heat input and accordingly cooling speed.
- Compared to the electrode types, due to chemical properties, the impact resistance of the basic electrode shows higher values, creation of more heat input, and the increase in the cooling time due to the when materials in the electrode cover burnt causes increase in the value of the impact resistance of the cellulosic electrode.

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A New Technique for Sorting of Metals in Scrap Industry

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Abstract: In recycling sector, reliable, fast and accurate identification of scrap metals is still a challenge which usually causes noticeable financial losses and market insecurity. Most of the companies use traditional methods for sorting of metals such as making an assessment through colour, shape and density. However, incorrect identifications usually take place in conventional techniques, and this results in undesired economic outputs in buying and selling of scrap metals. Commercially available measurement systems are somewhat expensive, hence they are not widely used in recycling sector. In this respect, novel methods are highly required for low-cost, fast and accurate identification of scrap metals. Therefore, a new technique based on thermal conductivity is developed within the scope of this research, and the accuracy of the novel method is justified through different scrap metal samples. The new method can be considered as a successful application of Fourier's heat conduction law. Copper, brass and stainless steel samples are utilised in this study to verify the accuracy of the results. For a reliable and scientific approach, three independent sets of experiments are carried out, and the results are comprehensively assessed in terms of accuracy and consistency. Calibrated scrap test samples are received from a manufacturer with the actual thermal conductivity values given at room temperature prior to starting the experiments. These values are compared with those of other manufacturers in literature, and a very good agreement is observed. Afterwards, the aforesaid samples are mounted inside the propylene body to check the reliability and the accuracy of the novel design through the repeating independent experimental tests. The tests start with the adjustment of electrical power to a certain value about 5 W and the cooling unit is set to 5 °C at the same time. The whole system is left to run, and it is checked from the axial temperature values that whether or not steady-state conditions are achieved. Then, thermal power and axial temperature values across the scrap metal samples are recorded to calculate the thermal conductivity for each sample. Three independent tests are repeated to check the accuracy and reliability of the results for a scientific and realistic approach, and each test consists of four separate experiments. A single test lasts about half an hour and in total, twelve experiments are carried out for each sample. The results indicate that twelve experiments for each sample provide sufficient consistency since there is a very good agreement between the literature data and the experimental results. The samples are selected from three different thermal conductivity ranges to evaluate the response of the novel measurement system to the change in heat conduction ability.

Keywords: Recycling Industry, Scrap Metal, Material Sorting, Thermal Conductivity, Heat Conduction

1. INTRODUCTION

Throughout the last century, the depletion of natural resources as a result of the developing economy, the industry and the growing population on a global scale is obvious. The extraction of virgin ores to produce ferrous and non-ferrous metals can be considered as the main reasons for the depletion of energy resources (Ayres, 1997). Due to the remarkable economic features of the recycling industry, the scrap industry draw attention in recent years. In this context, three Rs (mitigation, reuse and recycling) should be implemented to prevent severely depletion of the natural resources by governments and non-governmental organizations (Melo, 1999). Especially recycling is indispensable process in terms of economic and environmental issues since it is capable of mitigating energy consumption and the amount of scrap metals (Simpson, 2012) (Hatayama, Daigo, Matsuno, & Adachi, 2012). New approaches to recycling process are aimed to waste less energy and time. In this respect, the cost of metal can be decreased to the lowest level by recycling scrap metals (Doonan, Lanoie, & Laplante, 2005).

The recycling process is composed six different categories such as collection, sorting, shredding, physical separation, hydrometallurgical treatment, and smelting. X-ray transmissions, apparent density, and 3D sensing are some of the techniques used for sorting the scrap metals during recycling process (Gaustad, Olivetti, & Kirchain, 2012). Commonly-used techniques have some troubles related to time, cost and reliability as well. A novel method presents that faster, cheaper and more reliable compared to currently available techniques.

Identification and sorting of metals are of rather an importance in scrap industry because incorrect identification and sorting of materials can lead to critical financial issues based on losing time and money. Thermal conductivity of materials is considered as a key solution to identify and sort scrap metals owing to eco-friendly and low-cost features (Chen et al., 2016).

After world war II, there is a growing need for metals such as iron, copper, nickel aluminum in industry. Hereby, new techniques determining the thermal conductivity of scrap materials are developed with many attempts at finding out more reliable and accurate solutions (Min, Blumm, & Lindemann, 2007).

The research is aimed to express fabricating and testing a new system for sorting and identification of scrap metals by using thermal properties of materials.

2. MATERIALS AND METHODS

A novel experimental setup with regard to the thermal conductivity that is used to sorting and identification scrap metals has some advantages like low-cost, eco-friendly, reliable and time-saving compared to conventional approaches. In this system, there are four main parts; propylene body, DC power supply, constant temperature bath and data-logging. 3D sketch and all equipment used in the experiment are depicted in Fig.1.

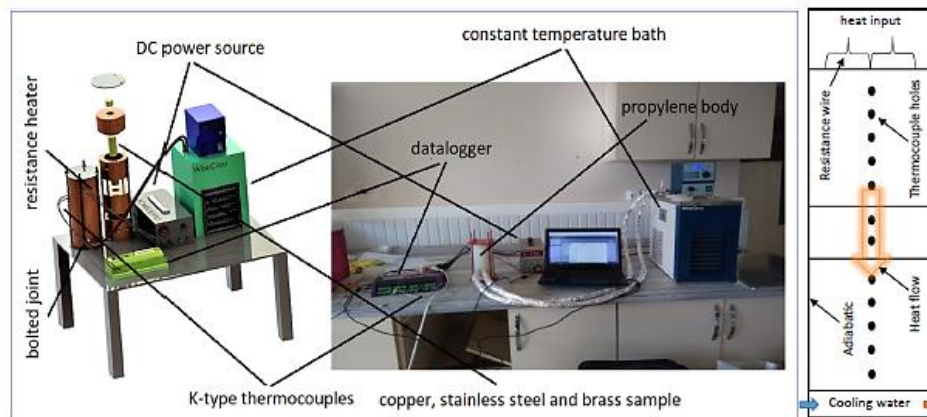


Fig.1. 3D sketch and experimental setup with the measurement systems.

The setup based on Fourier's heat conduction law is to find out the thermal properties of scrap materials. Propylene body is a vital part of the system in which temperature differences occur inside the material. Through the fact that the heat transfer occurs when the temperature difference is available inside the material, a resistance wire unit which is in good contact with the scrap sample at the top is utilised for the hot side, and a direct contact heat exchanger driven by a constant temperature bath which is integrated with the sample at the bottom is considered for the cold side. For a constant value of DC voltage adjusted by a DC power unit, a certain value of DC current flows over the resistance wire which yields a constant electrical power. Since the whole system is well-insulated, radial heat transfer is prevented due to adiabatic boundary condition, and axial heat conduction takes place only across the scrap metal samples. Heat conduction occurs only x direction and inside material, heat generation is not possible to take place. For this reason, following equation is applied;

$$\frac{\partial^2 T}{\partial x^2} = 0 \quad (1)$$

The axial distance affects the temperature and the equation can be redefined as ordinary differential equation form;

$$\frac{d^2 T}{dx^2} = 0 \quad (2)$$

the differential equation can be solved as follows;

$$T(x) = C_1 x + C_2 \quad (3)$$

Three samples made of copper, stainless steel and brass put into the propylene from top to bottom respectively. Highly conductive thermal paste is used to connect the materials each other. In order to mitigate surface resistance effects, the propylene is tightened by applying bolted joints. For copper and brass samples, five different points are designated to measure the axial temperature. As for stainless steel, only two different points are enough to measure the temperature.

Electrical power and the constant temperature bath are fixed at 5W and 5°C respectively during the experiment. Thermal conductivity for samples is calculated with utilizing thermal power and axial temperature through the scrap metals. Overall number of experiments is twelve for each sample. According to the data from the experiments, experimental results accord with the literature data.

3.RESULTS AND DISCUSSION

Results

The conductivity value from first experimental setup for copper are evaluated to be 392.91, 398.69, 396.10 and 408.02 W/mK within thermal power being 4.88, 4.88, 4.88 and 4.48 W respectively. As for the correlation coefficient is measured as 0.94, 0.97, 0.96 and 0.98 respectively. Fig.2 illustrates the first experimental setup for copper samples.

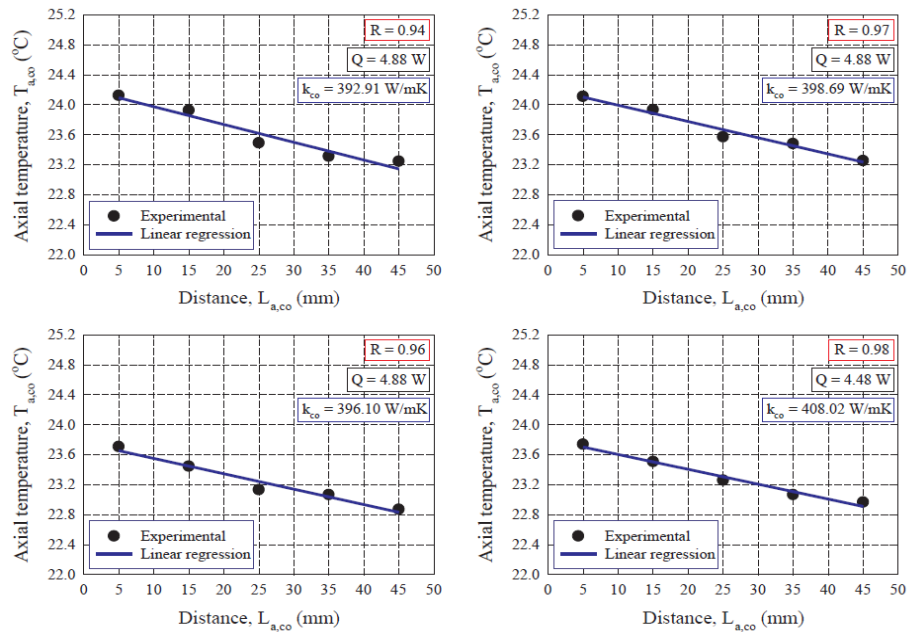


Fig.2. Thermal conductivity values of copper sample from first experimental setup (Cuce et al., 2018).

The conductivity value from first experimental setup for copper are evaluated to be 44.05, 45.86, 44.10 and 43.03 W/mK. As for thermal power is measured to be 3.50, 3.50, 4.00 and 4.00 W respectively. Fig.3 illustrates the first experimental setup for stainless steel samples.

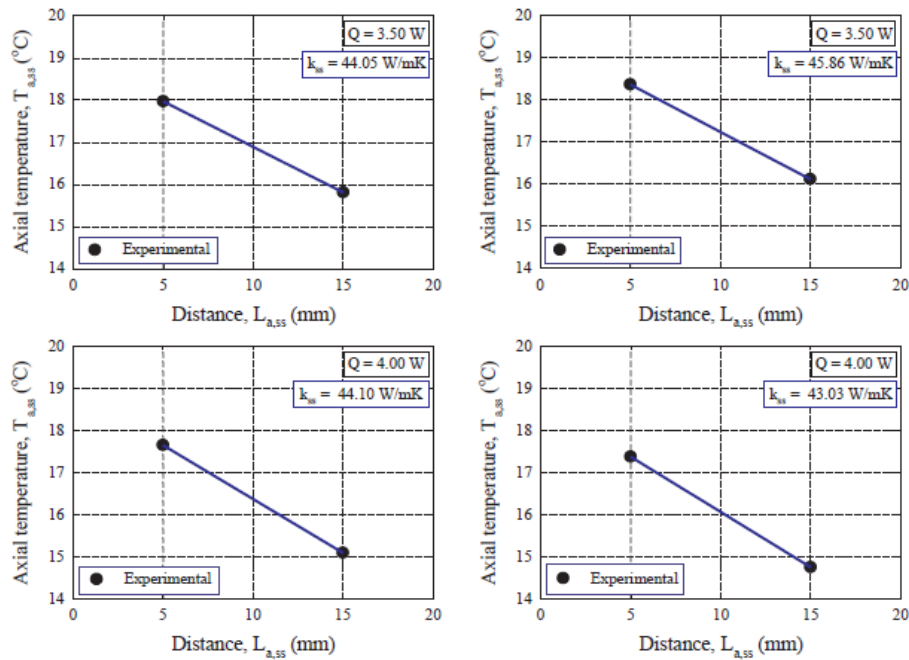


Fig.3. Thermal conductivity of stainless steel sample from first experimental setup (Cuce et al., 2018).

The conductivity value from first experimental setup for brass are evaluated to be 115.45, 106.46, 108.25 and 123.74 W/mK within thermal power being 4.80, 4.80, 4.80 and 4.80 W respectively. As for the correlation coefficient is measured as 0.99, 0.99, 0.99 and 0.99 respectively. Fig.4 illustrates the first experimental setup for brass samples.

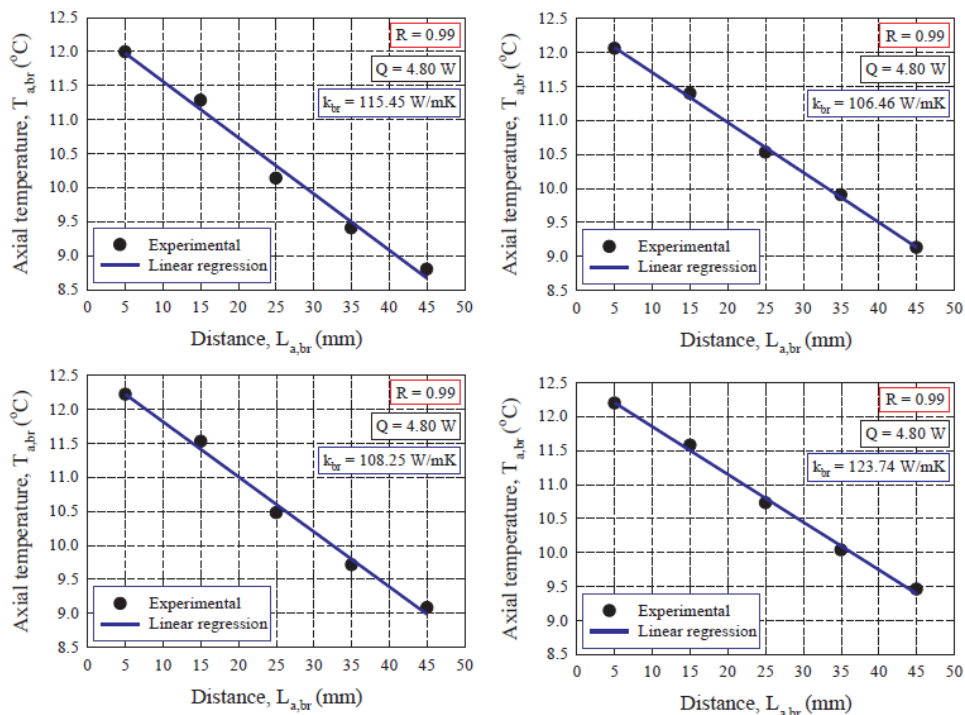


Fig.4. Thermal conductivity of brass sample from first experimental setup (Cuce et al., 2018).

Discussion

Based on results of this experimental research, thermal conductivity values belonging to copper, stainless steel and brass are found to be compatible with the data based on literatures. Examined to errors, the rate of errors in measurements that has little differences can be ignored. The differences are found to be 1.37, 4.46 and 3.31 % for said samples respectively.

Moreover, when used thermal conductivity measurement, thermal conductivity of Bayburt stone extracted from Bayburt/Turkey is measured to be 0.59 W/mK. Compared to previous studies, this finding is firmly accepted to be the reasonable value. This measurement is rather easy to be utilized in the scrap industry. In this respect, financial and time wasting do not take place due to identifying materials accurately when buying and selling scrap materials.

Based on findings that the average thermal conductivity of copper, stainless steel and brass samples is measured to be 397.37, 44.92 and 114.67 W/mK, respectively. Literature data for the said materials is given to be 392.00, 43.00 and 111.00 W/mK, respectively. The results are found to be in very good accordance with each other. Errors in the said measurements are calculated to be 1.37, 4.46 and 3.31%, respectively, which is acceptable. The measurement system which is devised, fabricated and tested within the scope of this research is a successful application of material identification in scrap industry. Sample preparation, analysis and interpretation of the results are easy and can be implemented by any staff after a simple training programme. Most of the companies in scrap industry have their own facilities to develop such a system for fast, accurate, reliable and low-cost sorting of scrap metals

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Effect of Smoke Removal System Flow Rate in Ships on Smoke Control

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Abstract: Today, in line with technological and industrial developments, diversity of commercial products increased. However, with increased competition, firms start to search for new markets. This caused generation of intercontinental distribution and passenger networks. Seaway is preferred for intercontinental transportation as this transportation method is safe and cheap. Therefore, commercial and passenger ship traffic in open seas is constantly increasing. However, this traffic increases probability of negative scenarios. One of these negative cases is the fire on ship. High tonnage load carrying capacity of transport vessels may cause high financial losses in case of fire. Most importantly, with cruise type ships, high number of passengers can be carries across international waters. Fire in such ships may cause loss of life and property. Ship fire can occur due to various reasons including human-based or technical problems. However, engine room has the highest probability for fire on ship. Fire in these rooms may prevent control and movement of the ship and cause high financial damages. If this fire reaches fuel of the ship, the ship may explode, sink, and cause significant loss of life. Therefore, in case of fire in engine room of the ship, different scenarios were numerically investigated. For this purpose, CFD was used to simulate different fan flow. Based on simulation data, it was determined that as fan flow increased, ambient temperature decreased. Additionally, with increased flow, smoke can be contained in specific region inside the room, and safe region volume was increased. This resulted in decrease in CO intensity over time.

Keywords: Smoke and temperature control, Carbon monoxide intensity, Ventilation system, Ship fire.

1.INTRODUCTION

As a result of demands from firms in the industry, as production capacities increased, there is need for raw material and market. These needs in the field of industry are met with raw materials and markets on different continents. In intercontinental transportation, water transportation is preferred due to economic and safe way. As water transportation is preferred, sea traffic in international waterways increases. High tonnage of load carried on ships and accordingly, higher material value causes high monetary loss to firms in case of any negative events. In addition to international freight shipment, passengers are carried with cruise type ships. Any type of unfavourable event in these types of ship may cause numerous people to lose their lives. Most important unfavourable event in ships is fire. An event of fire in engine room of a ship can negatively impact control of the ship and may cause ship accidents. Additionally, if the fire in ship engine room cannot be controlled by educated fire-fighting team, the fire can reach to fuel tank, causes ship to explode, and sink. In literature, there are various studies regarding various closed volume possible fire scenarios. Some of these studies are given below.

Açıkgöz (2012) analysed results of possible fire event by modelling a fire inside LPG storage tanks. For this purpose, with ALOHA package program, an LPG tank was numerically modelled, and harmful factors as a result of possible fire were observed. The results of the study indicated effected area due to fire and explosion caused by fire, and applicable security precautions were presented. Altay (2016) analysed, tunnel fires for different parameters. A fire event in road tunnel was numerically modelled with FDS package program for different vehicle and pool fire scenario. Based on the data, optimum fire control and optimum smoke removal applications were recommended for analysed road tunnel. Berberoğlu (2008) modelled a fire for passenger stations in underground railed transportation systems. In this study, small-scale station model was experimentally prepared. In this station model, for different ventilation speeds, possible fire scenario was experimentally analysed. During experiments, speed and temperature data were collected. For station geometry and fire conditions in the experiment, with HAD program, numerical simulations were completed. As a result, experimental and numerical results were compared and optimum fire control parameters for an underground passenger station were determined.

Bolodian et al. (2017) evaluated a space station as a closed volume and analysed fire extinguishing equipment inside this volume. For this purpose, fundamental design principles and oxygen sufficiency of living sections were analysed for that space station. Working principles of these fire extinguishing systems used in these living sections were calculated under pressure and certain improvement recommendations were presented. Bönücü (2008) analysed fire safety of railroad tunnels with different surface conditions. Round cross-section tunnels were considered, and structural fire resistance of this tunnel type was evaluated. Based on the fire analysis, cross-sectional resistance of the tunnel, material resistance, and tunnel-surface interactions were evaluated and optimum design parameters were determined. Dobrucalı (2013) evaluated exhaust gas propagation in warship in numerical and experimental ways. For this purpose, a warship with 1/100 scale was numerically modelled and simulated. A model with same geometric models was created and with wind tunnel,

experimental results were obtained. Numerical and experimental data obtained as a result were compared and recommendations were presented for improvement of exhaust gas propagation.

Dündar (2009) analysed additional load and strain on steel construction in case of fire in reinforced concrete structures. In this study, with SAP 2000 and SAFIR package programs, time-based analyses of forces in the fire were evaluated. Displacement in steel structure was observed as a result of fire. Based on these analyses, optimum design parameters were determined for steel in reinforced concrete structures by considering fire possibilities. In thesis study of Gökçe (2013), propagation and discharge of exhaust gases in engine rooms in case of gas leak in diesel engine used in ship engine room was analysed. For this purpose, flow of exhaust leak was considered constant, and temperature and carbon monoxide distribution in time in engine room was analysed. Simulations were made for different ventilation speeds. As a result, optimum working parameters to keep carbon monoxide gas in the environment at values that will not affect human health were determined.

As seen above, literature has various studies in possible fire scenarios in road tunnels, metro tunnels, carpark, cinema etc. However, there was no study analysing possible fire case in a ship engine room. But, a fire in ship engine room has the structure to cause serious loss of property and life. Therefore, in this study, a fire case in a ship engine room was considered. For this purpose, numerical simulations were conducted for different fan speeds of a ventilation system.

2. MATERIALS AND METHODS

Analysed ship engine room and position of ventilation system elements inside engine room in this study were schematically represented in Figure 1. Inside the engine room, there were two clean air inputs on right-hand and left-hand sides, and four air outputs on the ceiling positioned with equal distances. Inside the engine room, there were one main machine and three auxiliary machines positioned across the main machine. Fire area was positioned on main machine.

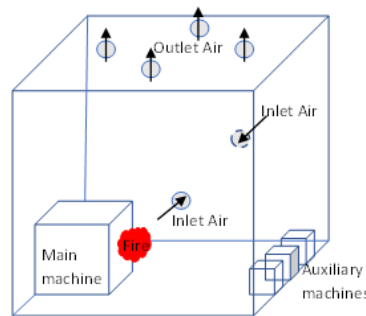


Figure 1. Schematic representation of problem geometry.

Differential Equations

Continuity Equation

$$\frac{\partial \rho}{\partial t} + \nabla \rho u = 0 \quad (1)$$

Momentum Conservation Equation

$$\rho \left[\frac{\partial u}{\partial t} + (u \nabla) u \right] + \nabla p = \rho g + f + \nabla \tau \quad (2)$$

Energy Conservation Equation

$$\frac{\partial}{\partial t} (\rho h) + \nabla \rho h u = \frac{Dp}{Dt} - \nabla q_r + \nabla k \nabla T + \sum_1 \nabla h_1 \rho D_1 \nabla Y_1 \quad (3)$$

Species Conservation Equation

$$\frac{\partial}{\partial t} (\rho Y_1) + \nabla \rho Y_1 u = \nabla (\rho D)_1 \nabla Y_1 + \dot{m}_1^w \quad (4)$$

Boundary Conditions

In designed engine room, area where the fire started was accepted as main machine with diesel engine. A fire case with deflagration as a result of fuel and oil leakage during diesel engine operation was determined as 1000 W/m^2 after literature review [Gökçe, 2013]. During operation, thermal load value of the fire was considered constant, and fan speed were variable as 1,2,3, and 4 m/s. In created engine room, ventilation channel diameter was determined as 1m and ambient temperature of engine room was determined as 45°C .

Validity Check of Numerical Model

In this study, ship engine room was numerically analysed with FDS program. To determine validity of numerical method and obtained results, geometry and limit conditions of Gökçe (2013) were applied without any change. Results obtained from both studies were presented in Figure 2. As seen from the figure, results of both studies were similar. Curves in both studies were compliant and fit. Therefore, validity of numerical methods and analysis in this study were at acceptable level.

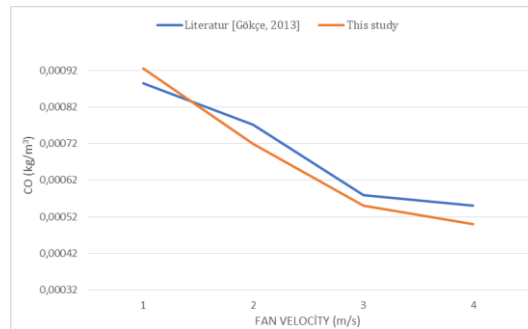


Figure 2. Comparison of results of this study and literature [Gökçe, 2013].

3.RESULTS AND DISCUSSION

In this study, a fire case in ship engine room was analysed numerically for different fire scenarios. For this purpose, numerical simulations were conducted for different fan speeds using FDS. In these analyses, fire size was kept constant and fan speeds were selected as 1 m/s, 2m/s, 3m/s, and 4 m/s. Gas intensity as a result of the fire was investigated instantaneously and created smoke flow structure was observed. For different fan speed of ventilation systems in ship engine room, ambient temperature, carbon dioxide, and carbon monoxide distributions were obtained. Some of the obtained results were presented below.

In case of a fire on main machine inside engine room, distribution of carbon monoxide gas inside engine room was given in Figure 3 with different fan speed. In these figures, distribution of carbon monoxide intensity measured on certain axis determined inside engine room at 360th second after the start of the fire. Carbon monoxide intensity threshold limit within an environment that is considered safe for human health was determined 7×10^{-7} as in literature. Threshold is important to evacuate engine room personnel in case of fire and for fire-fighter team to intervene. When obtained results were evaluated, in case of fan speed 2 m/s and higher, it was determined that carbon monoxide intensity was below threshold level. Therefore, it could be stated that CO intensity of ambient air in considered geometry can be kept at safe level when fan speed is 2 m/s and above.

In Figure 4, carbon dioxide gas distribution inside the engine room was given for different fan speeds. In these figures, distribution of carbon dioxide intensity measured on certain axis determined inside engine room at 360th second after the start of the fire. Life threatening threshold for carbon dioxide intensity inside the environment was determined as 6×10^{-7} in literature. When obtained analysis reports were considered, for fan speed 2 m/s and higher, it was determined that carbon dioxide intensity within environment were below risk limits. Therefore, it could be stated that CO_2 intensity of ambient air in considered geometry can be kept at safe level when fan speed is 2 m/s and above. In case of a fire, this will ease accident victims to evacuate and fire-fighting personnel to intervene the fire.

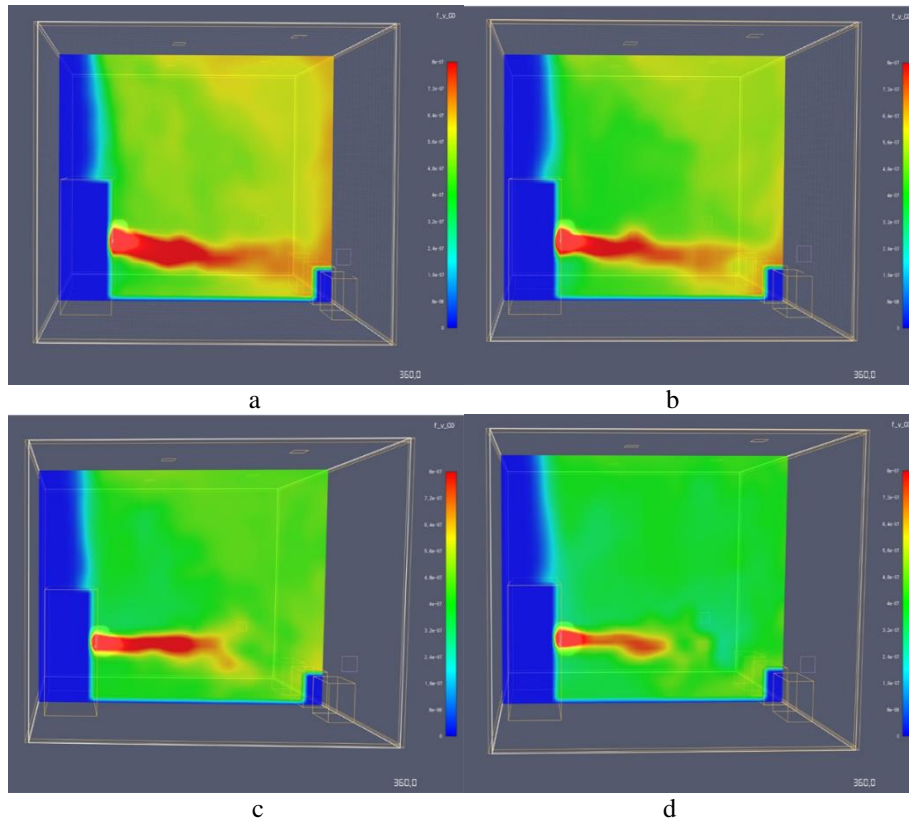


Figure 3. CO distribution for different input fan speeds, a) 1m/s, b) 2m/s c) 3m/s, and d) 4m/s.

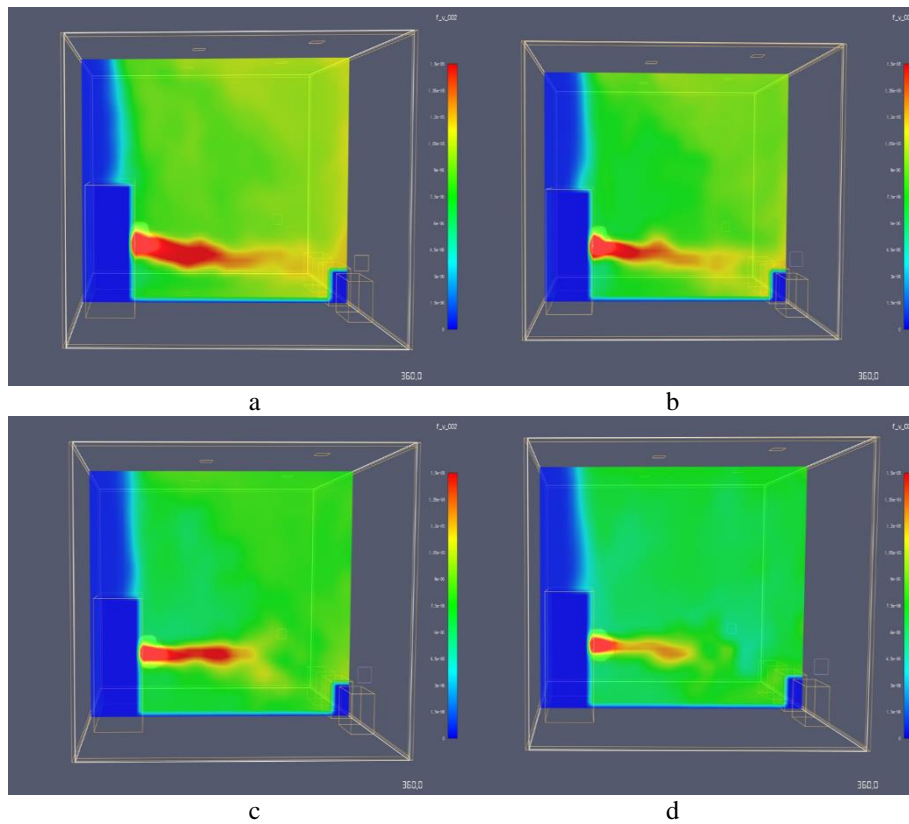


Figure 4. CO₂ distribution for different input fan speeds, a) 1m/s, b) 2m/s c) 3m/s, and d) 4m/s.

A ship fire can have various causes including humans and technical problems. However, the highest possibility for a ship fire is the engine room. Fire in these sections may prevent control and movement of a ship and may cause high monetary losses. Also, if the fire reaches to the fuel of the ship, the ship may explode, sink, and many lives may be lost in this event. Therefore, in this study, a fire case in ship engine room was analysed numerically for different fire scenarios. For this purpose, numerical simulations were conducted for different fan speeds using FDS. In these analyses, fire size was kept constant and fan speeds were selected as 1 m/s, 2 m/s, 3 m/s, and 4 m/s. Gas intensity as a result of the fire was investigated instantaneously and created smoke flow structure was observed. Data obtained from simulation results and data identified as life threatening limits were compared. Based on simulation data, it was determined that as fan flow increased, ambient temperature decreased. Additionally, with increased flow, smoke was captured in certain area of the room and volume of safe region increased. As a result of this effect, CO intensity decreased over time. After the analysis, it was seen that 2 m/s value for ventilation system fan speed was the critical value. Below this limit, carbon monoxide and carbon dioxide intensities in the environment were above the life threatening threshold. Therefore, for secure smoke removal system, it could be said that fan input speed should be more than 2 m/s. Additionally, as fan speed increased, it was observed that ambient temperature values decreased. As a result, when fan speed is more than 2 m/s for ventilation systems in ship engine room, this speed is optimum fan operation speed to evacuate engine room personnel and enable fire-fighter personnel to act easily.

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Effect of Si Content on Machinability of Al-Si Alloys Casted Sand and Metal Moulds

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Abstract: This study investigates the effect of metal and sand moulds casting (solidification or cooling rate) and increase of %Si content in Al-Si (Aluminium-Silicon) cast alloys on mechanical properties and machinability properties. The effect of cooling was analysed by casting the experimental samples in metal and sand moulds. Al-Si cast alloys with varying rates of Silicon (%Si) content (from 2% up to 12%) were used in the study. It was observed that the metal and sand moulds casting (cooling rate) of Al-Si alloys and mechanical properties (hardness and strength) increased depending on the %Si content in the alloy and that cutting forces formed during machining gradually decreased and thus machinability increased. Also noted in the study was the increase in the cooling rate and surface quality (Ra) of alloys (surface roughness value decreased) depending on the rise in %Si amount.

Keywords: Machinability, cutting force, mechanical properties, Al-Si alloys, Surface Roughness

1. INTRODUCTION

Today, aluminium alloys find numerous fields of use in many industries predominantly in automotive, transportation, aviation, and aerospace industries [1-8]. Among the most significant properties of aluminium alloys are as follows: ease of manufacturing, ease of castability, light weight, and ability to improve mechanical properties. Especially their light weight and mechanical properties open to improvement expands the areas of use and their importance in today's industries [2,3,5,6]. Various aluminium alloys occupy a very significant space in lowering environmentally damaging emissions (SO_x, CO₂, and NO_x emissions) and efficient use of energy resources through decreasing weight especially in automotive, transportation, aviation, and aerospace industries [3,5]. For this reason, these alloys are quite an important structural material preferred in the manufacturing of numerous parts used in these sectors [1-6]. Among the important aluminium alloys in this field is Aluminium-Silicon (Al-Si) alloys [6,7]. Therefore, a plethora of researches are carried out on various aluminium alloys [3,6-12].

This study investigates the effect of metal and sand moulds casting (casting condition, cooling rate) and increase of %Si content in Al-Si cast alloys on mechanical properties and machinability properties. Studies that investigate the effect of casting condition and cooling rate and %Si content in alloy in Al-Si aluminium alloys on machinability are quite scarce and insufficient. For this reason, this study investigates the impact of cooling rate on mechanical properties and machinability properties by conducting casting in metal and sand moulds. In addition, the effect of alloy components on mechanical properties and machinability in Al-Si alloys containing %Si at varying degrees were analysed through both casting methods. By analysing the microstructure and mechanical properties of these alloys, the impact of the change in %Si amount on cutting forces, surface roughness (Ra), Flank Build-up (FBU) and chip formation were investigated. In this context, this study bears a unique quality.

2. MATERIALS AND METHODS

Microstructural and Mechanical Properties

Experiment samples used in the study were obtained by casting in sand and metal moulds at the same time. Al-Si alloys containing Si at varying rates (from 2%Si to 12%Si) were used in the study. The effect of casting condition and cooling rate was studied by casting Al-Si alloys with the same alloy components in both sand moulds and metal moulds at the same time. These samples were maintained in sand and metal moulds for the same duration (~30 minutes) (and in same environments, same casting condition).

For obtaining experiment samples, pure aluminium (Al-8E at 99.8% purity) and eutectic Etial 140 alloy with 12.5% Si content (12.5%Si, 0.6%Fe, 0.4%Mn, 0.1%Cu, 0.1%Zn, 0.1%Mg, 0.1%Ni, 0.1%Ti, 0.1%Pb content) were used. Pure Aluminium and Etial 140 purchased from Nova Metal Co., Turkey. Melting procedures were conducted in induction furnace (35 KW Inductotherm). Casting of samples were carried out by casting in sand and metal moulds simultaneously following keeping molten metal for 30 minutes after it reached ~730°C. In sand moulds, mixture was prepared by adding 2.5% sodium silicate (water glass) water clear casting resin in 2.5% silica sand with 90-110 AFS grain size. This sand mixture was fed into mixers for ~30 minutes, and after the mould cavity of the prepared sand was moulded, moulds were obtained by hardening with CO₂ gas. Metal moulds were made from GG25 material. Metal moulds and sand moulds were designed so as to obtain 4 cylindrical samples in each mould following casting the test samples. At the end of casting process, 12 experiment samples were obtained from each mould and Al-Si alloy. Diameter of experiment samples removed from the mould was 25mm and the length was 200mm. In casting Al-Si alloy (eutectic) containing 12% Si,

phosphor bronze (CuSn_5) ppm level (20g in 0.002g/7400g pot) was added in molten alloy for the modification of primer Si crystals that may form due to fast cooling in mould. Mould filling time of casts were established as 8-10 seconds. Chemical components of Al-Si alloy used in the experiment are given in Table 1.

Table 1 Chemical composition of the studied Al-Si alloys.

(Wt %, “Al” refers to Aluminum content and “Si” refers to Silicon content of the alloy).

Al-Si Alloys	Si	Zn	Mn	Cu	Fe	Al
2%Si	2.1	0.02	0.01	0.01	0.04	Rest
4%Si	4.2	0.02	0.01	0.01	0.04	Rest
8%Si	8.1	0.02	0.01	0.01	0.04	Rest
12%Si	11.8	0.02	0.01	0.02	0.05	Rest

In the experimental study, 3 test samples (at 12mm diameter and 10mm thickness) from each Al-Si alloy were prepared to be used in microstructure analyses. Surfaces of these samples were cleaned by sanding (with emery papers ranging from 120 up to 1200 grits). Then, surfaces of these samples were polished by diamond abrasives (6 μm , 3 μm and 1 μm diamond paste, respectively). Surfaces of samples were etched (for 20~25 seconds) with the prepared etching solution (Keller solution 2%HF, 3% HNO_3 , 95% H_2O).

Microstructural surveys were conducted on the metallographic samples by optical microscopy (OM) (LV150 Nikon Eclipse) and scanning electron microscopy (SEM). The hardness values of the samples were determined by the Vickers hardness test (HV) with a load of 10N by using microhardness tester (Shimadzu HMV-2). At least ten hardness measurements were carried out on each sample.

Tensile tests were carried out. Data on the tensile strengths of alloys (Ultimate Tensile Strength-UTS) and elongation % (El%) values were obtained from tensile tests. Samples used in the tensile tests were prepared in compliance with ASTM E 8 M-99 standards. Tensile tests were carried out at room temperature (20°C) (Shimadzu Autograph AGS-J 10 kN Universal Tester). Tensile test data were established by averaging the 7 samples. The strain rate used for tensile testing was $1.1 \times 10^{-3} \text{ s}^{-1}$.

Machining Properties

Machinability tests were conducted on CNC turning lathe (DMG CTX Alpha300). Turning procedures were carried out under dry processing conditions by using Polycrystalline Diamond (PCD) (Taegutec CCGT 120408 FL K10) cutting edge. Data obtained from the study on cutting forces were produced by measuring with a specially designed and manufactured strain-gauge (Fig.1).

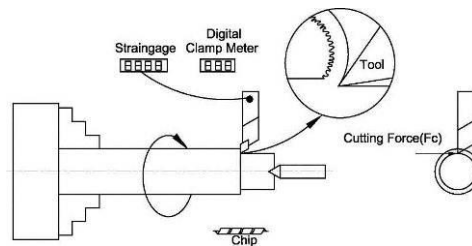


Fig.1 Schematic representation of experimental set-up with strain

In machinability experiments, changes in the cutting forces of Al-Si alloys were measured at varying cutting rates (by keeping chip section fixed). Data on the machinability of alloys were prepared as graphs in accordance with changes in cutting forces. Surfaces of samples taken from casting were cleaned before commencing machinability experiments. Feed rate was kept at a fixed rate (0.10mm.rev⁻¹) in machinability experiments. Data on surface roughness of alloys (R_a - μm) were then obtained (Mitutoyo SJ210). Machining parameters used in the experimental study are given in Table 2. Data formed by changes in cooling rate, alloy properties, and machining parameters were prepared as graphs.

Table 2 Machining parameters and conditions used during the test.

Machining Parameters and Conditions						
Operations	: Turning					
Feed rate (f , mm/rev)	: 0.10 (Constantly)					
Depth of Cut (DoC , mm)	: 0.5					
Cutting Speed (m/min)	: 56, 112, 168					
Cutting & Coolant	: Orthogonal, Dry Cutting					
Workpiece Materials	: Al-Si Alloys (from 2% to 12% Si)					
Cutting Tool	: Taegutec CCGT 120408 FL K10					
	α	γ	λ	ε	κ	r_ε
	7°	5°	0°	80°	50°	mm

3.RESULTS AND DISCUSSION

Microstructural and Mechanical Properties

Microstructure images of Al-Si alloys used in the experimental study are given in Fig.2(a-d). When analysed Fig.2(a-d), it was observed that silicon was dispersed, became evident/increased in microstructure due to increase in %Si content in alloy and to cooling rate (Fig.2d). Microstructure images obtained in this study are in concordance with the literature [1,13].

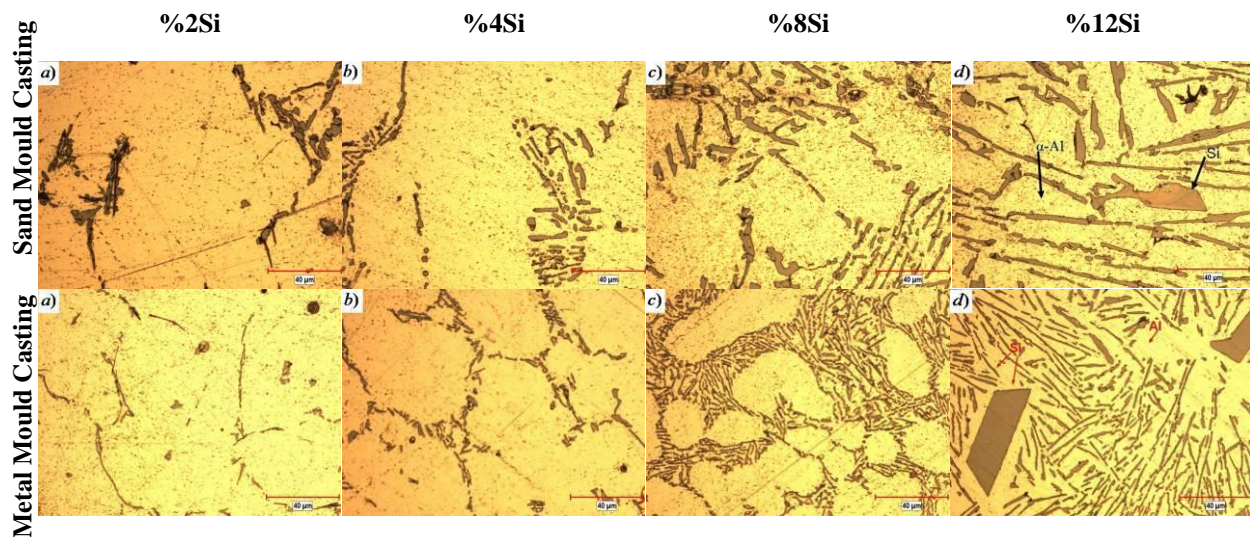


Fig.2 (a-d) Optical Micrographs (OM 50x) of (a)2%Si, (b)4%Si, (c)8%Si, (d) 12%Si Al-Si alloys

Data on mechanical properties of Al-Si alloys used in the experiment (hardness (Fig.3) and strength (Fig.4)) are shown. When checked the hardness values of analysed alloys (Fig.3), it was observed that the hardness of alloys removed from the metal mould was higher (compared to sand mould). Hardness values of alloys ranged in a gradually increasing order beginning from Al-Si containing 2%Si up to Al-Si with 12%Si content (Fig.3) (Similar was observed in both moulds). Higher hardness of samples from the metal mould (compared to sand moulds) shows the effect of cooling rate on hardness (Fig.3). It is possible to note that the hardness of Al-Si alloys increase depending on the rise in cooling rate (Fig.3). In addition, the hardness of alloys increased (sequentially) depending on the rise in %Si amount in alloy. The reason for this is believed to stem from the effect of Si observed/found in microstructure depending on the increase in %Si.

While the lowest hardness value (in both moulds) was obtained from Al-Si alloy containing 2%Si, the highest hardness value was received from alloy containing 12% Si (Fig.3). Hardness of alloy containing 12%Si was observed to increase (compared to alloy containing 2%Si) (~65% in sand mould and metal mould) depending on the rise in Si amount in alloy. It is similar in both moulds. In experiment samples removed from sand mould, while the lowest hardness value was obtained from Al-Si alloy containing 2%Si as 39.5 HV₁₀, the highest hardness value was taken from Al-Si alloy containing 12%Si as 59.9 HV₁₀. In experiment samples removed from metal mould, while the lowest hardness value was obtained

from Al-Si alloy containing 2%Si as 45.8 HV₁₀, the highest hardness value was taken from Al-Si alloy containing 12%Si as 68.8 HV₁₀ (Fig.3).

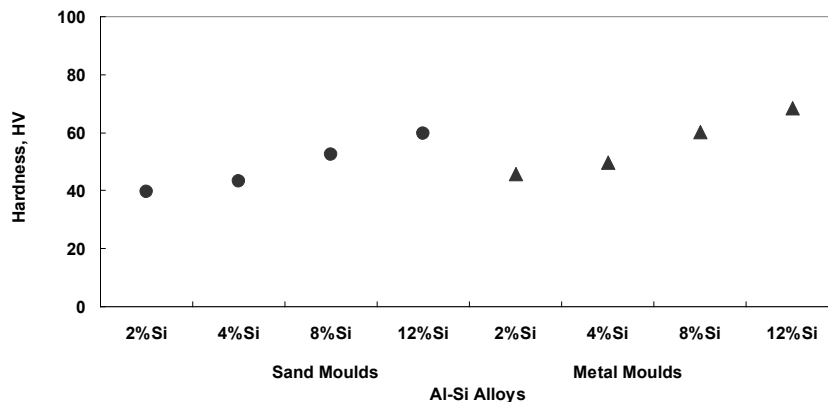


Fig.3 Hardness (HV) of Al-Si alloys

Data obtained from tensile tests in the experimental study are given in graph form in Fig.4a-b. As can be observed from the graph, UTS values increased parallel to the rise in the cooling rate of Al-Si alloys and the rise in %Si content in alloy. On the other hand, %El was observed to decrease. UTS values of samples from metal mould were higher (compared to samples from sand mould) (Fig.4a).

While the lowest UTS value (in both moulds) was obtained from Al-Si alloy containing 2%Si, the highest hardness value was received from alloy containing 12% Si (Fig.4a). When checked the %El values, the highest %El value (in both moulds) was obtained from Al-Si alloy containing 2%Si (Fig.4b). The lowest %El values were observed in alloys containing 12% Si (in both moulds). While the lowest UTS value was established as 118.7 MPa in Al-Si alloy containing 2%Si in experiment samples removed from sand mould, the highest UTS value was obtained from Al-Si alloy containing 12%Si as 139.3MPa (Fig.4a). Similarly, while the lowest UTS value was established as 139.7MPa in Al-Si alloy containing 2%Si in experiment samples removed from metal mould, the highest UTS value was obtained from Al-Si alloy containing 12%Si as 145.9MPa (Fig.4a).

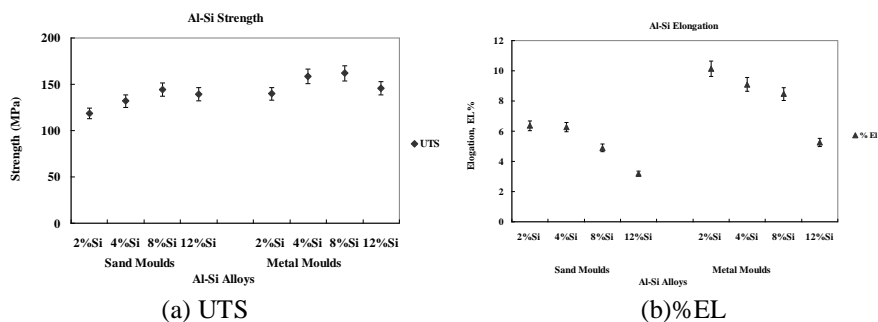


Fig.4 Tensile Tests of Al-Si alloys (a) UTS and (b) EL%

Machining Properties

In the machinability study, data on cutting forces of Al-Si alloys were obtained (by keeping chip section fixed) at varying cutting speeds (Fig.5.). In the experimental study, cutting forces were observed to decrease due to the increase in cooling rate (Fig.5). From this point of view, the fact that cutting forces of samples from metal mould (compared to samples from sand mould) manifested the positive effect of cooling rate on machinability.

It was also observed that there was a drop in cutting forces due to the increase in %Si content in alloy (in both moulds) (Fig.5). In experiments, while the highest cutting force values (in both moulds) were established in Al-Si alloy containing 2%Si, the lowest cutting force value was obtained from Al-Si alloy containing 12%Si (Fig.5). From this viewpoint, the fact that cutting forces drop due to the increase in %Si content in alloy (in both moulds) shows the effect of Si in alloy. Depending on the Si amount in alloy, it may be noted that silicon observed in microstructure becoming evident/increasing

facilitated the chip breaks [13-18], thus had a decreasing effect on cutting forces. Therefore, machinability of alloys was improved.

In addition, cutting forces manifested a decrease in experiments (in both moulds) due to the rise in cutting speed. Cutting forces showed a decreasing range in all cutting speeds beginning from Al-Si alloy containing 2%Si down to the alloy containing 12% alloy (Fig.5). The reason for cutting forces being higher at lower cutting speeds was believed to be due to chip build-up as a result of dislocation deposit at lower cutting speeds (deformation hardening/work hardening) [15-20].

In samples from sand mould, while the cutting force value was measured as 45.1N in Al-Si alloy containing 2%Si at the lowest cutting speed (at 56m/min), it was established as 29.5N in Al alloy containing 12%Si. Following the increase in cutting speed (rise to 168 m/min), cutting force was measured as 38.2N in Al-Si alloy containing 2%Si and as 21.5N in Al-Si alloy containing 12%Si. Accordingly, machinability of alloy containing 12%Si is higher (compared to alloy containing 2%Si).

In samples from metal mould, while the cutting force value was measured as 34.7N in Al-Si alloy containing 2%Si at the lowest cutting speed (at 56m/min), it was established as 22.9N in Al-Si alloy containing 12%Si. Following the increase in cutting speed (rise to 168 m/min), cutting force was measured as 24.5N in Al-Si alloy containing 2%Si and as 17.8N in Al-Si alloy containing 12%Si. Accordingly, machinability of alloy containing 12%Si is higher (compared to alloy containing 2%Si). In the study, it may be noted from data obtained in this phase that cutting forces decreased and machinability increased due to rise in Si amount in Al-Si alloy and cooling rate.

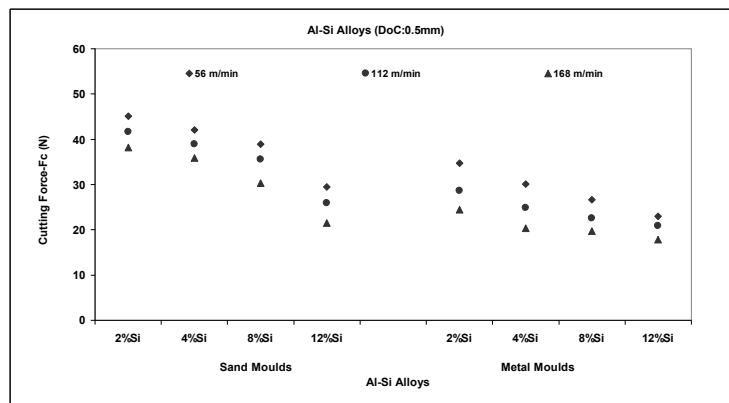


Fig.5 Relationship between cutting forces and Al-Si alloy compositions (*DoC:0.5 mm, f:0.10 mm/rev*).

Data on surface roughness (*Ra*) values of alloys used in the experiment is given in Fig.6. Surface roughness values of alloys from metal mould were observed as lower (surface with higher sensitivity). Surface roughness values ranged from alloy containing 2%Si down to Al-Si alloy containing 12%Si manifesting a decrease. From this viewpoint, a drop was observed in surface roughness values (surfaces with higher sensitivity were obtained) in Al-Si alloys due to increase in Si content in alloy and to increase in cooling rate and cutting speed (from %2Si to %12Si).

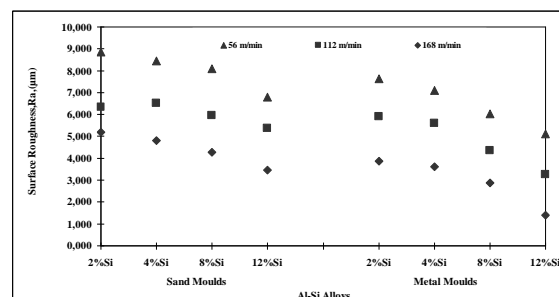


Fig.6 Relationship between surface roughness and cutting speeds of Al-Si alloys (*DoC:0.5 mm, f:0.10 mm/rev*).

When analysed the chips formed during the machining of samples in the study (Fig.7), chip formation was observed to change due to increases in cooling rate, %Si content in alloy, and to rise in cutting speed. It may be noted that the rise in

Si content and cooling rate in Al-Si alloys had an effect on chip lengths being shorter. From this point of view, Si found in microstructure has an impact on chip formation due to a rise in %Si content of alloy and cooling rate.

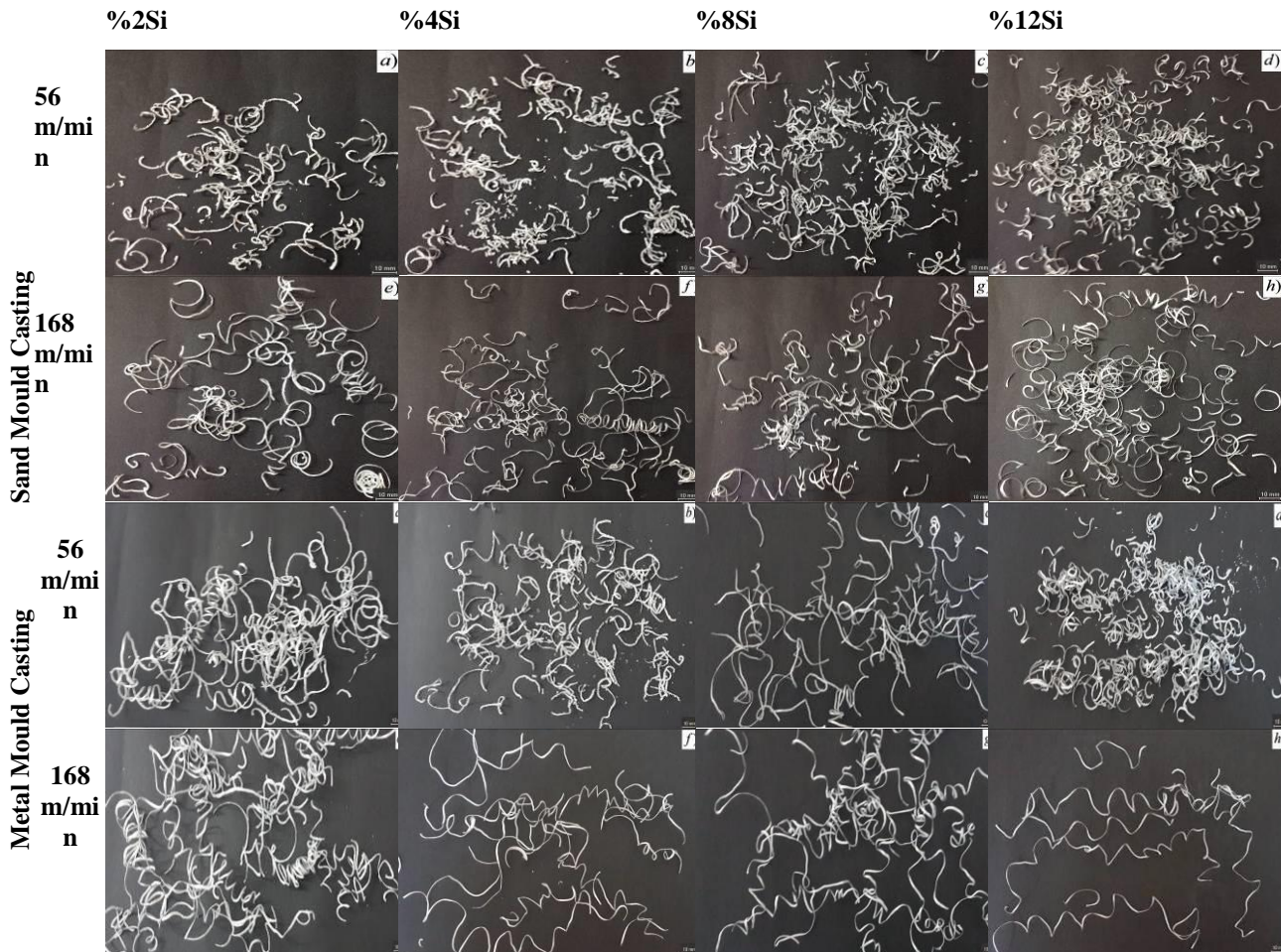


Fig.7(a-h) Chip formation of Al-Si alloys (V_c :56-168 m/min, DoC:0.5 mm, f:0.10 mm/rev)

Images on cutting edged surfaces used in the experiment are shown in Fig.8. Depending on the increase in %Si content in alloy and on cooling rate, FBU was observed to form on the cutting edge from the broader surface toward the narrower surface of the edge (Fig.8). Similar occurs with the increase in cutting speed. Flank Build-up (FBU) formation was observed on cutting edge surfaces between the work piece and cutting edge surface due to dry adhesion (Fig.8). The said build-up (FBU) was found to occur more on the cutting edge of Al-Si alloy containing 2%Si and to spread on yield surfaces to a wider area (Fig.8a). It was also observed in the alloy containing 12%Si that flank build-up (FBU) was less; however, wear occurred further to the edge and deeper (Fig.8h).

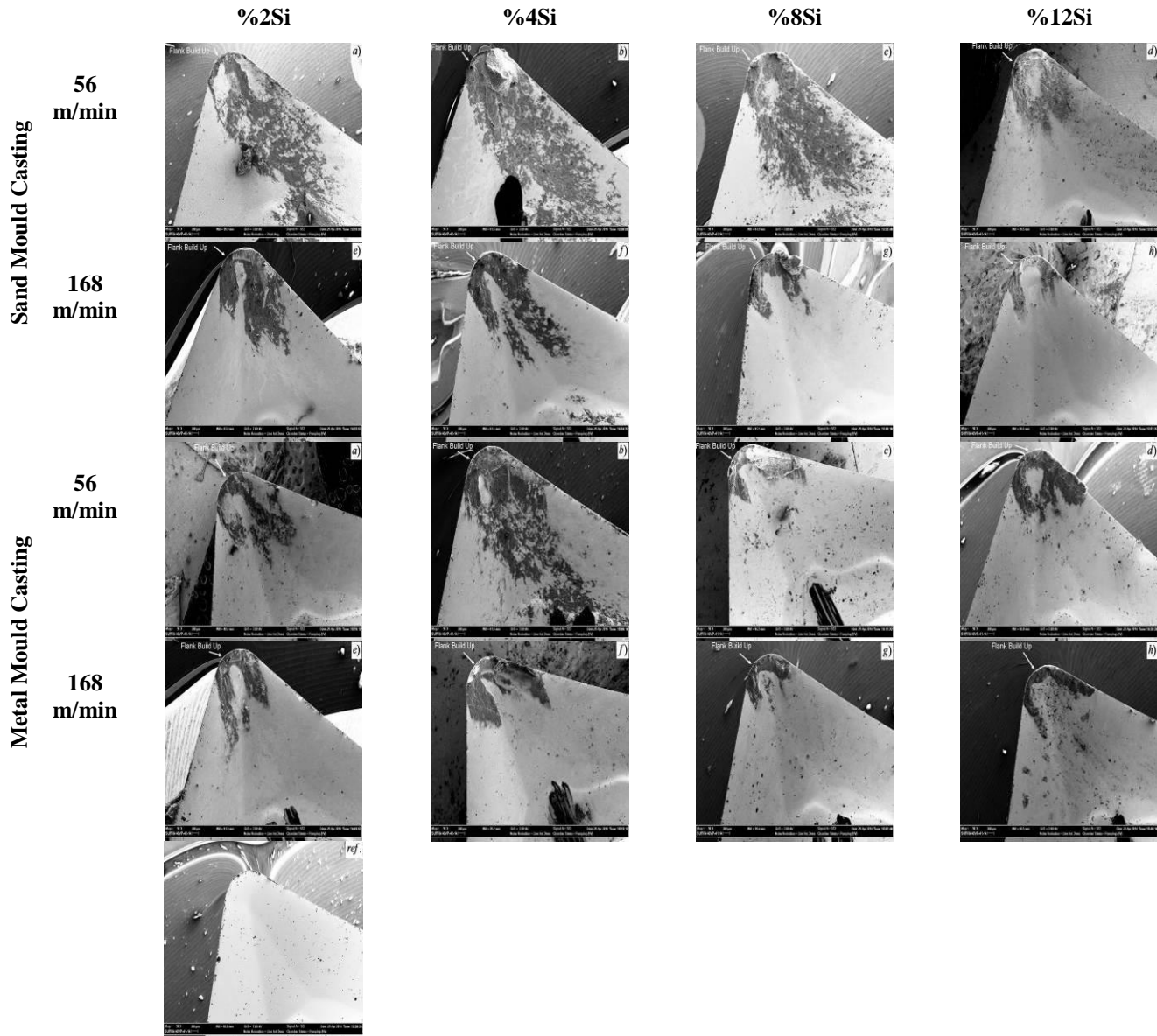


Fig.8 (a-h) SEM image of cutting tool tip used for machining of Al-Si alloys (V_c :56-168m/min, DoC :0.5 mm, f :0.10 mm/rev)

In the experimental study, mechanical properties and machinability of Al-Si alloys were observed to improve due to increases in the %Si content and cooling rate in Al-Si alloys (Fig.4-6). Thanks to the rise in %Si in alloy, it was established that chip breaks were facilitated and that this manifested an impact in the form of decreasing cutting forces. The fact that lower cutting forces occurring especially in Al-Si alloy containing 12%Si shows that Si in the structure have a positive impact on machinability. Lower cutting forces in samples removed from metal moulds manifest the effect of cooling rate. It may be noted that cutting forces decrease (machinability increases) due to a rise in cooling rate.

Cutting forces were observed as higher (in both moulds) at lower cutting speeds. It may be argued that the reason for cutting forces being higher at lower cutting speeds as a result of dislocation deposit at lower cutting speeds (deformation hardening/work hardening) [15-17] and that cutting forces rose as a result of chips built-up (FBU) and adherence on cutting edge due to local heating from friction. From this point of view, Si presence in Al-Si alloys (increase in %Si amount) had an impact in the form of dropping cutting forces, and as a result, machinability increased. It was observed in the study that increases in cooling rate and in Si content in Al-Si alloys positively affected mechanical properties and machinability properties of the alloy. Data from the previous sections of the study (Fig.2) support the mechanical test

results (Fig.3-4) and data obtained from the machinability section (Fig.5-8). Data obtained from the study complies with the literature [1-11].

The below results were acquired from the experimental study;

- In Al-Si alloys, cutting forces (F_c) formed in experiment samples from the metal mould were lower (compared to samples from sand mould). Rise in the cooling was observed to have an impact in the form of lowering the cutting forces. Therefore, machinability of alloys was improved.
- Machinability of alloys increased parallel to the rise in the %Si content in Al-Si alloys (cutting forces decreased). It was observed that the rise in %Si amount in alloy (Si found in microstructure becoming evident/increasing) had an impact in the form of lowering the cutting forces.
- Mechanical properties of alloys (Hardness and UTS) were observed to increase due to the rise in the %Si content in Al-Si alloys. On the other hand, %El decreased. The rise in the %Si content in alloy (Si found in microstructure becoming evident) had an impact in the form of increasing mechanical properties (Hardness and UTS).
- Cutting forces were observed as higher (in both moulds) at lower cutting speeds. A drop was observed in cutting forces due to rising cutting speeds.
- Surface roughness (R_a) values were observed as decreased (finer surfaces) being inversely proportional to the rise in the %Si amount in alloy. Surface roughness values were observed as higher at lower cutting speeds (rougher surfaces were formed). Lowest surface roughness values were obtained from samples from metal moulds.
- Rise in the %Si amount in alloy was observed to have an impact on chip formation. Chips were established to form at shorter lengths due to increases in %Si amount in alloy and in cutting speed. Chips were observed to form at shorter lengths due to the effect of %Si in Al-Si alloy with higher hardness (containing 12%Si). Chips were formed at longer lengths in 2%Si alloy.
- Rises in cooling and %Si content were observed to affect Flank Build-up (FBU) formation on cutting tool edge. It was established that FBU spread on the cutting edge surface, and that the FBU formation was higher in Al-Si alloy containing 2%Si with higher ductility.

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A Numerical Investigation of Impact Resistance of Sandwich Structure Subjected to Spherical Impactor Using Finite Element Method

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Abstract: Sandwich structures are often preferred for engineering applications requiring high stiffness with low structural weight. The impact resistance of the sandwich structures under the impact load is largely influenced by shape and dimensional parameters. In this study, impact resistance performance of the aluminium corrugated core sandwich structures subjected to spherical impact loading are discussed. The trapezoid profile was selected as the core geometry. The influence of dimensional parameters such as wall thickness, lateral wall angle, core height and the face sheet thickness of sandwich structure on its impact performance parameters such as indentation depth, peak force, and absorbed energy were studied by using the finite element method (FEM) software. Experimental parameters for different dimensional parameter values were determined by using optimization techniques and geometric models were created accordingly. The Response Surface Method (RSM) was applied to optimize the dimensional parameter values that will exhibit the best impact performance. Results show that the dimensional parameters have an effect on its impact performance of sandwich structure. In particular, increased face sheet thickness was increased energy absorbing capacity of the sandwich structure.

Keywords: Sandwich structure, finite element method, response surface method, optimization, impact analysis.

1. INTRODUCTION

Sandwich structures are often preferred in areas such as space, automotive, shipping and defence industry due to their light weight as well as high impact resistance (Lu and Yu, 2003; Hutchinson and Xue, 2005; Li et al., 2017). Sandwich structures frequently encounter many adverse conditions such as vehicle striking, bird striking, explosion and water impact during the life of the product (Heimbs, 2011; Meo et al., 2005; Zhu et al., 2009; Dharmasena et al., 2009). In similar cases; it is important to protect the integrity of the structures to ensure human and equipment safety. Sandwich structures consist of hard and thin face sheet and a relatively thick and light core. The face sheets are generally selected from materials resistant to stretching and twisting, while the core is selected from light and low density materials (Kılıçaslan, 2014). Sandwich structures play an important role in preserving structural integrity against adverse situations.

The mechanical performance of sandwich structure is largely influenced by the core structure (Hou et al., 2013). The core must show resistance to external loads which may cause the panel to bend and crush. Sandwich structures are generally divided into four groups according to their core geometry: corrugated, foam, honeycomb and lattice. Core materials are selected from balsa, metal sheets and composite polymers (Mohammed et al., 2014). Each core type has different advantages and is chosen according to their usage area. The corrugated sandwich constructions are light and exhibit high energy absorbing performance at the same time. (Fleck, 2004). Cores of corrugated sandwich structures are produced by sheet metal forming method in different geometries, such as square, triangular, circular and trapezoidal. Corrugated core geometry is often preferred as it is both easy to manufacture and costly compared to other core structures. Corrugated core geometry is often preferred because of its ease of manufacture and low cost (Kılıçaslan, 2014).

The face sheet and core thickness and the dimensions of the core geometry directly affect the impact resistance performance of the sandwich structure (Zhang et al., 2014). Therefore; it is important to optimize the sandwich geometry to increase the impact resistance performance (Hou et al., 2013) and there are studies in the literature for this purpose. Some of these are summarized below:

Liang et al. (2001), were optimized dimensional parameters such as corrugated angle, core pitch length, face sheet thickness, core thickness and core length of the metallic sandwich panels with corrugated core form against the blast load. The Feasible Direction Method (FDM) combined with the Backtrack Program Method (BPM) was used for optimization. The obtained results was shown that the core length, corrugated angle and core thickness are the most important parameters for core and face sheet thickness, and core pitch length thickness is the most important parameter for face sheet layer. Li et al. (2017) was investigated the dynamic response of sandwich panels with corrugated trapezoidal core under the influence of projectile. The projectile that subjected on the sandwich panels was made of aluminium foam. Nylon mass was attached to the back of the bullet to increase the effect of the bullet. Typical deformation modes of two different sandwich panel configurations were investigated as experimentally and numerically. Experimental and numerical result showed that the corrugated sandwich structure with smaller core height produce larger deformation than the sandwich structure with larger core height. Zhang et al. (2011); was investigated of crushing behaviour of sandwich

structures with corrugated core of type V, U, X and Y under quasi-static loading conditions as experimentally and numerically. Quasi-static compression tests were carried out at a loading rate of 0.16 mm/s and numerical analyses were carried out at a speed of 2 m/s. Experimental and numerical analysis results show that all core geometries outside the Y-framed corrugated structure have excellent crushing performance. It was stated that the core walls of Y-framed corrugated structures are deformed by bending, and that the sandwich structure with V geometrically corrugated core has the highest impact strength and energy absorbing capacity. Hou et al. (2013) was investigated the relationship between crashworthiness and structural properties of sandwich structure with trapezoidal and triangular core geometries in case of loading with low speed local impact and planar impact. Experimental tests and simulation studies for different levels of dimensional parameters such as top face sheet thickness, bottom face sheet thickness, core height, length and width were investigated by using multidimensional optimization method and how the dimensional changes of these parameters affected the absorbing energy, peak force and deformation. Aluminium is used as face sheet and core material. The amount of absorbed energy, peak force and deformation of the prepared specimens by the research were determined under low speed crushing load (2 mm/min). Experiments were repeated with the finite element method and the results were consistent with experimental studies. As a result of the tests; was determined that core cell geometry has a relatively small effect on low-speed local impact loading, but has significant effects on planar impact loading when the thickness of the face sheet, core height and core density are kept constant. Rejab and Cantwell (2013); was investigated the compressive behaviour as numerically and experimentally of three different triangular corrugated sandwich structures produced using aluminium, carbon fibre reinforced polymer and glass fibre reinforced polymer. The thickness of the cell walls and the number of core cells of the sandwich structures have determined the effect on general deformation and local collapse behaviour of the structure. They found that the buckling in the cell walls caused the damage to the corrugated sandwich structures to begin and the on-going loads to break the cell walls and to separate them on the adhesion surfaces.

In this study, the impact resistance performance of sandwich structures with corrugated core subjected to a spherical and rigid geometry impactor was investigated by the finite element method as numerically using Abaqus 6.13 software. The effects of the dimensional parameters (core height, wall thickness, lateral wall angle and face sheet thickness) of the single layer sandwich structure with trapezoidal core geometry on the impact resistance performance criteria (absorbed energy, peak force and indentation depth) were determined.

Sandwich Structure Impact Resistance Performance

Sandwich structures was absorbed by the plastic deformation of the kinetic energy generated during impact loading. The amount of absorbed energy by the sandwich structures, maximum peak load and indentation depth is used to determine the impact resistance performance of sandwich structure. The amount of absorbed impact energy was show how much the impact energy is reduced after plastic deformation. The amount of damped energy is expected to be high. The maximum peak value is the name given to the highest force that occurs in the first moments of deformation and is formed in the same axis as the impact force. This force is expected to be low because the higher the force, the more sudden the shock will occur. The depth of indentation shows the amount of deformation in the structure after impact. This value should be low so that the integrity of the sandwich structure does not deteriorate.

Effects of dimensional parameters of sandwich structure on impact resistance performance was given below:

- The face sheet thickness of sandwich structure affects the weight of the structure and the resistance to bending and deformation,
- The core lateral wall angle is important for holding the impact load in the vertical axis and this provides the controlled deformation of the sandwich structure core,
- As a result of the impact load plastic deformation occurs in the sandwich structure core and most of the impact energy is absorbed at this stage. Higher core wall thickness provides more plastic deformation,
- It affects the weight of the core height structure, but at the same time it is important in terms of mountability.

For this reason it is important determining the effect of geometric properties of sandwich structure on impact resistance performance and optimize the dimensional parameter values to obtain the best impact resistance performance.

2. MATERIALS AND METHODS

Trapezoidal geometry was chosen for corrugated sandwich structure core in this study. The dimensional parameters (wall thickness (A), core height (B), face sheet thickness (C) and lateral wall angle (D)) and the fixed edge length of the core form is 5 mm of the sandwich structure that modelled for the analysis studies were given in Figure 1a for a single cell. The depth of the sandwich structure is 30 mm (Figure 1b).

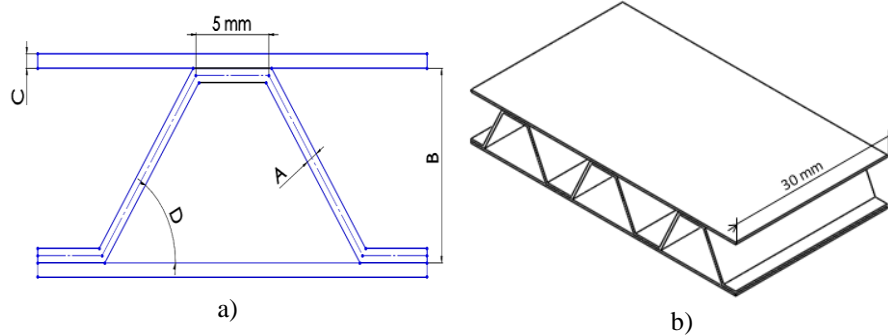


Figure 1. Dimensional parameters of sandwich structures

Dimensions at different levels were selected for each parameter to determine the impact of sandwich structure of impact resistance performance (Table 1). Using these dimensions the L16 experiment was designed with the Orthogonal Design method (Table 2).

Table 1. Levels of Dimensional Parameters

	A (mm)	B (mm)	C (mm)	D (°)
Level 1	0.3	8	0.3	55
Level 2	0.5	10	0.5	60
Level 3	0.7	12	0.7	65
Level 4	1		1	

Table 2. L16 Orthogonal Experimental Design

Model No	A (mm)	B (mm)	C (mm)	D (°)	Model No	A (mm)	B (mm)	C (mm)	D (°)
1	0.3	8	0.3	55	9	1	8	1	60
2	0.7	12	0.3	65	10	0.3	12	0.7	60
3	1	8	0.3	55	11	0.5	12	1	55
4	0.5	10	0.3	60	12	0.5	8	0.5	65
5	0.5	8	0.7	55	13	0.7	8	0.7	55
6	1	12	0.5	55	14	0.7	8	0.5	60
7	0.7	10	1	55	15	1	10	0.7	65
8	0.3	8	1	65	16	0.3	10	0.5	55

Sandwich structures were modelled using 3D design software for the specified dimensional parameter values and Aluminium 2024 was selected as the face sheet and core material. Abaqus 6.13 software was used to impact analysis the sandwich structure models using the finite element method. Material properties; Poisson's Ratio (PR) 0.3, density (RO) 2780 kg/m³ and elasticity modulus (E) 70.6 GPa was defined in the finite element software. Face sheets and core were modelled shell element (S4R) with 4 nodes having 5 integration points. Finite element dimensions for deformation area of core, face sheets and core were specified as 0.5 mm, 1 and 1 mm respectively. A perfect bonding between the core and face sheets was assumed.

The sandwich structure was fixed on a rigid surface with zero degree of freedom and subjected to quasi-static impact loading in vertical direction. The spherical impactor applied on the sandwich structure was modelled as a rigid surface, with 0.5 kg mass and 1 m/s impact velocity (Figure 2).

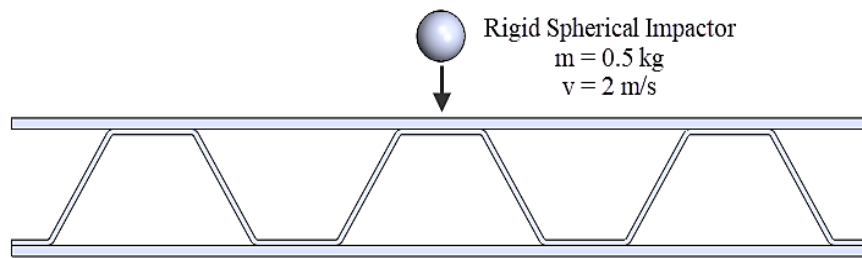


Figure 2. Impact analysis scenario

Static and dynamic coefficients of friction were specified respectively as 0.3 and 0.2. “General Contact” algorithm was defined for contact of rigid surfaces with the sandwich structure and the possible contact of core walls with each other.

3.RESULTS AND DISCUSSION

Results

Impact analysis of the generated numerical model was carried out and the results were calculated (Table 3).

Table 3. Results of impact analysis

Model No	Peak Force (N)	Indentation Depth (mm)	Absorbed Energy (Joule)
1	405.327	3.0377	0.989
2	1567.94	0.924	0.963
3	2003.03	0.821	1.016
4	937.312	1.429	1.008
5	1036.39	1.09	0.952
6	1989.9	0.74	0.99
7	1698.95	0.588	0.881
8	678.675	1.366	0.823
9	1935.56	0.477	0.694
10	427.715	2.931	0.932
11	1049.35	0.815	0.754
12	1103.76	1.154	0.939
13	1031.36	0.773	0.844
14	1643.49	0.91	0.932
15	2059.31	0.609	0.832
16	389.487	3.067	0.957

In the sandwich structure model (Model No:1) occurred Von mises stress distribution during loading was given Figure 3. In addition, the deformations occurring in two different sandwich structure models (Model No 16 and 9) with minimum and maximum indentation depths are shown in Figure 4 and 5, respectively.

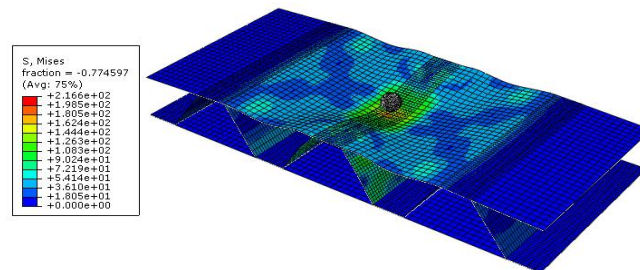


Figure 3. Von Mises Stress Distribution on Sandwich Structure (Model No:1)

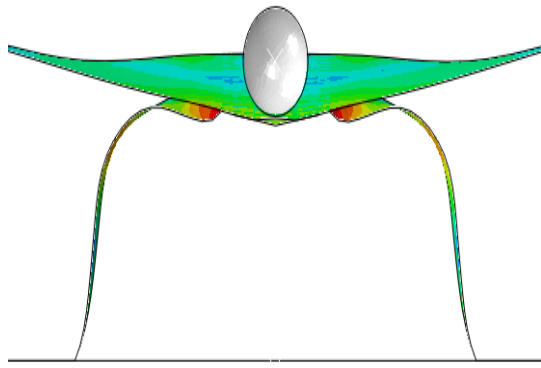


Figure 4. Model with Maximum Indentation Depth
(No: 16)

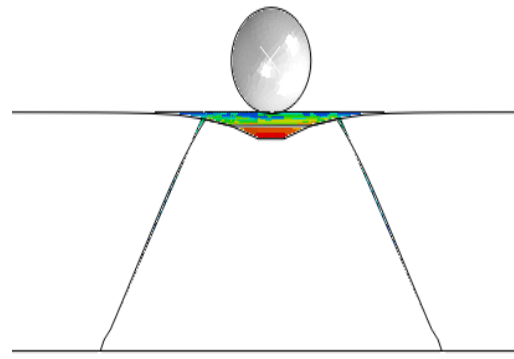


Figure 5. Model with Minimum Indentation Depth
(No: 9)

Optimization of Dimensional Parameters

Response Surface Method; calculates the statistical correlation between the input parameters and the output parameters and determine the input values necessary for obtaining optimum output values. In this study; the Response Surface Method was used to determine the dimensional parameter values that would provide the best impact resistance performance. The dimensional parameter values of each model determined by the experiment design were used as input parameters and the impact resistance performance values obtained as the analysis result are used as output parameters. The success of the optimum values were determined as a result of the optimization to meet the desired performance criteria is also statistically calculated. The values obtained after the optimization are given in Figure 6.

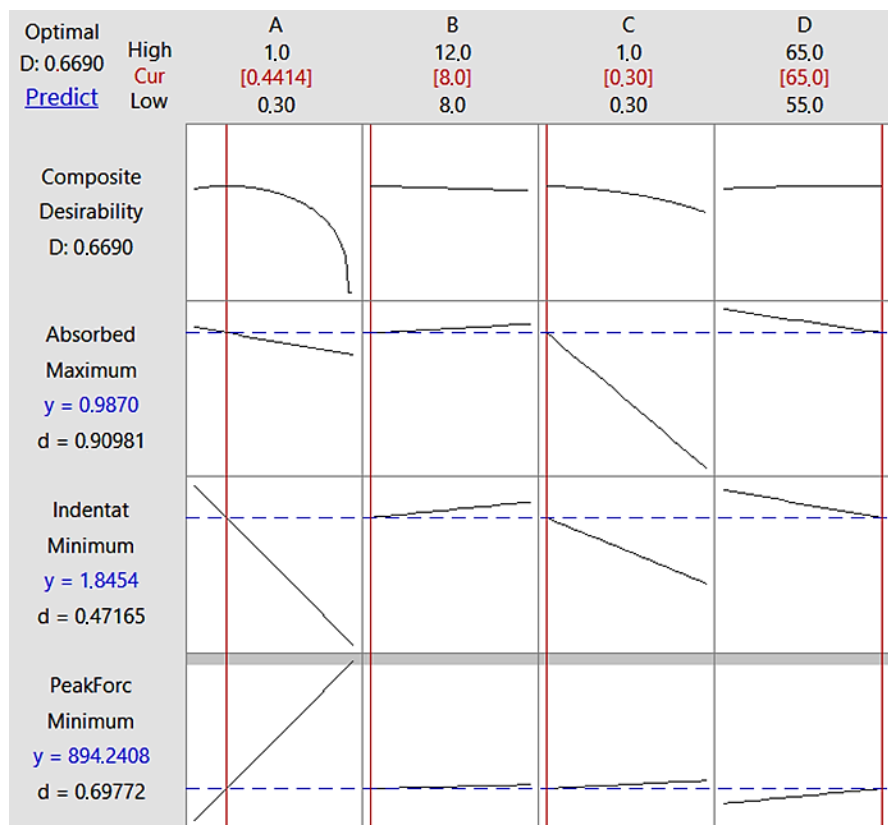


Figure 6. Dimensional parameter values providing optimum impact resistance performance

As a result of optimization; the input parameters required under specified impact conditions for maximum absorbed energy, minimum indentation depth and minimum peak force were given in Table 4 and Table 5. The individual Desirability (d) for each output parameter and the Composite Desirability (D) for all of the output values were calculated.

Individual Desirability (d) indicates the success of the input parameters to meet the output parameters. Composite Desirability value was calculated as 0.6690.

Table 4. Input parameters and values

Input Parameters	Input Values
A	0.441
B	8
C	0.3
D	65

Table 5. Output parameters and values

Output Parameters	Output Values	Target	Individual desirability (d)
Absorbed Energy	0.987 Joule	Maximum	0.909
Indentation Depth	1.845 mm	Minimum	0.471
Peak Force	894.240 N	Minimum	0.697

This value is; the optimization result indicates that the optimum values were determined about 67% of the success rates in meeting the desired performance criteria. Also, the individual Desirability values were calculated to be about 90% for the amount of damped energy, about 47% for the indentation depth and about 70% for the peak force value.

The results of the analysis show that the geometric properties of sandwich structures have an impact on impact resistance performance. Optimization techniques have been used to achieve sandwich design that will increase impact resistance. The Reaction Surface method allows for the optimization of multiple effect parameters at the same time. The Composite Desirability value was calculated as approximately 67% and this value has shown that optimization is successful.

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A Model Study for Tekirdag Rural Tourism Project: Ucmakdere (Sarkoy/Tekirdag)

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Abstract: Tourism has today focused much on tourism forms and products that are nature- and human-friendly and contributes to the economy. There is a trend towards diversification in tourism and evaluation of tourist attractions to meet the increasing demands for various reasons. In this regard, efforts have been made to diversify tourism products and services and to detect tourist attractions in order to put destinations with high attractiveness and competitiveness on the market. Thus, there is a need for pilot and inventory studies for the efficiency of tourism activities. Additionally, the increased importance of diversification in the tourism market, the intense competition, and changing demands and needs have led to the emergence of alternative tourism types. Rural tourism has become one of the popular tourism types that have emerged due to changing tourism trends and tourist profiles. This type of tourism considered a tool in rural development is of growing importance in the national and international tourism market. The purpose of this study is to present data on the planning of Ayraşıl/Ucmakdere tourism area that will be put into operation within the scope of Tekirdag Rural Tourism Project. It is anticipated that this area primarily designed for recreation and tourism purposes will be initiated within the scope of Turkey's Strategic Vision 2023 and hold a major place in the Thracian Cultural Corridor. The study method supported by field research and observations were centered on the idea of compiling an inventory for the determination and selection of tourism supply resources. Additionally, visits were made to relevant institutions and organizations working on the project and interviews were held especially with village headmen and locals. The study found that this area, which is rich in tourist attractions, lacks accessibility and accommodation facilities. Based on the study results, it seems to be more appropriate to enlarge this tourism area originally designed to cover a total area of 51 hectares considering the recent trend towards the diversification of tourism products.

Keywords: Rural Tourism, Tekirdag Rural Tourism Project, Tourism supply resources, inventory checking, Tekirdag.

1.INTRODUCTION

In recent years, the tourism industry has been improving through tourism types and touristic products that are respectful to the nature, sensitive to humans, and beneficial to the economy. Tourism is diversified and tourist attractions are utilized now in order to meet the demands that are increasing due to various reasons (Emekli, 2008). In this sense, activities are carried out in order to diversify tourism and extend it over time and space, and efforts are made to determine tourism attractions and identify those that will be prioritized or to put those with high competitive power on the market. Therefore, both inventory works and pilot area practices are needed so that tourism activities can be productive. Furthermore, the increasing competition and changing demands/needs in the tourism market, where touristic product diversification gains importance each passing day, have caused alternative tourism types to emerge (Emekli, 2006). Rural tourism is one of the popular tourism types that have emerged due to the changing understanding of tourism and tourist profile. Seen as a tool for rural development, this tourism type is becoming increasingly important both in Turkey and in the world tourism market (Ozsahin and Kaymaz, 2014). This study aims to share findings regarding the planning of the Ayraşıl/Ucmakdere tourism region aimed to be put into service as part of Tekirdag Rural Tourism Project. It is expected that this area, which is designed basically for recreation and tourism purposes, shall come into operation as part of the 2023 Turkey Tourism Strategy and hold an important position within the Thracian Culture Corridor.

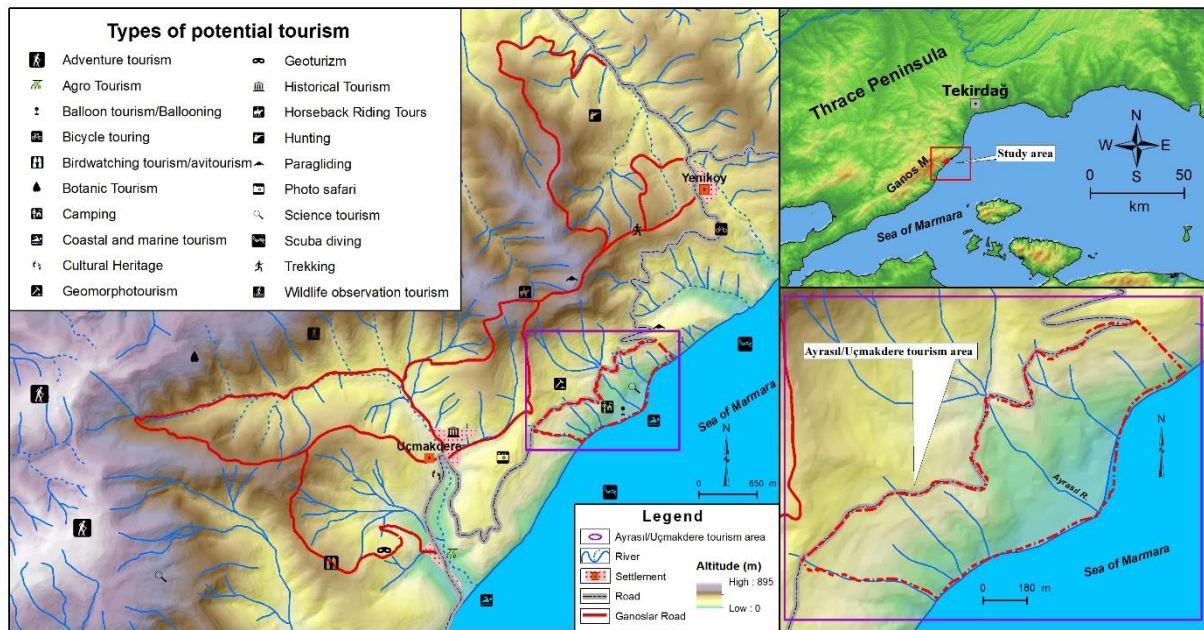


Figure 1. Location map and types of potential tourism map of the study area

2.MATERIALS AND METHODS

The research method, which was supported by observation based on direct field study, was mostly designed with the aim of taking inventory in order to determine or select supply sources of tourism. Furthermore, the relevant institutions and organizations working on this matter were visited and especially village headmen and public were interviewed.

3.RESULTS AND DISCUSSION

The Ayrasil site in the northeast of Uçmakdere neighborhood in Sarkoy district is an important place that may yield positive results if planned properly in terms of inhabitability and tourism activities. This area is located near both Istanbul and the Istanbul-Canakkale highway transit route, and it is richer than the nearby areas in terms of natural and cultural resource values. As a result, the area can be used for one-day activities or transit tourism activities. Therefore, it would be advantageous to introduce it into the tourism industry.

However, the main objective of the practices must be determined as surveying the natural environment qualities of the place properly and making sure that the activities do not harm the ecosystem. It must be kept in mind that achieving this may produce favorable results. That is because the natural environment is the basic element of the tourism attraction in this area. Therefore, the order of the natural environment must not be disrupted during the practices.

The area where the Ayrasil site is located, especially the delta area formed by the Ayrasil river, is at a critical location for the ecosystem. This key location possesses qualities of both sea and stream ecosystems. For this reason, both stream and sea ecosystems, particularly the delta ecosystem, must be protected in the planning. In other words, the delta area must not be zoned for construction. Instead, this area (the delta area) must be utilized in a way that does not cause a lot of pressure. For instance, it can be used for various kinds of sportive activities.

Choosing parts that are close to the sides of the delta for construction of the facilities in the area would be a more accurate choice. However, landslide, rockfall, and earthquake risks in the area must be taken into account during and after construction in these parts. For this reason, attention must be paid to ensure that the facilities do not have too many stores and are constructed within the bedrock. In addition, a retaining wall or steel meshes can be used to prevent landslide and rockfall risks at the sides with higher slopes in the part of the area close to the land. Planting activities can be carried out on sides without vegetation in these parts.

Another guiding factor for achieving the desired objectives in the area is transportation. The roads in this area, where land transportation is not very active, can be made more favorable. However, this may cost a lot. On the other hand, another way can be using sea transportation to bring those who will use the area. This way can be preferred especially for tourists that will be brought in bulks. This can be achieved in a more convenient and economical way with a suitable ferry departing from Tekirdag port. Furthermore, tourists can be allowed to view the area from the sea in this way.

Also, increasing tourism alternatives in tourism planning done in the area may yield highly positive results regarding multipurpose usage of the field. People coming to the field may be engaged in various tourism activities such as hiking, paragliding, local or cultural tours (For example, the Ucmakdere neighborhood) instead of being stuck in there. This way, the relevant area and its surroundings may be utilized much more thanks to integrated tourism.

The Ayrasil site and its immediate surroundings have a high potential in terms of tourism activities. However, an accurate and scientific planning process is needed in the area under the guidance of experts in order to use this potential efficiently. A highly suitable and long-termed tourism advantage will be caught in this way. The following suggestions can be made for activities necessary in the area;

- 1) Firstly, an inventory must be taken regarding the natural and cultural tourism resource values of the area and its immediate surroundings and those that will be used in tourism must be determined.
- 2) The boutique hotel planned for the area must be completed as soon as possible.
- 3) Particularly ecotourism activities must be developed in order to manage the tourism resource values in the field in a sustainable manner and to accommodate them to the demands of the visitors and the local community.
- 4) Some local culture motives in the area (the residence architecture of the Old Greek houses, natural colors and sounds, etc.) must be turned into touristic products.
- 5) Transit tourism activities must be given priority considering that the area is on the road.
- 6) This area is expected to draw visitors mainly from Istanbul due to its general location, so efforts must be made for this purpose in the area.
- 7) Materials that have the characteristics of touristic products in the area (sage tea, savory, linden, chestnut, etc.) must be turned into brands.
- 8) Awareness raising activities such as advertisement, poster, and introductory film aimed at promotion and marketing of the tourism characteristics of the area must be prepared.
- 9) A website suitable for the glory of the area must be prepared, and the tourist attractions and touristic products of the area must be introduced in this website.
- 10) Furthermore, the human-culture-place relationship must be examined in terms of tourism during these suggested activities and the resource values of the area must be passed on to the future without any disruption by means of sustainable approaches.

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Investigation of the Sufficiency of the Clarification Tanks Used in the Concrete Plant Wastewater Treatment

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Abstract: As a result of the rapid development in the construction sector and the need for ready mixed concrete, ready mixed concrete production facilities have been increased and an important production potential has been reached. Despite the considerable water consumption in the ready-mixed concrete production process, there is no waste water discharge from this process which is closed-circuit operated. However, as a result of the washing of vehicles and equipment used during production and transport of the produced concrete, significant waste water is generated. This washing process aiming to clean concrete wastes is used in concrete production process or washing of vehicles and equipments again after the wastewater formed is treated in clarification tanks. In this study, the sufficiency of clarification pools used in the treatment of waste water in ready mixed concrete production facilities and the reusability of waste waters in ready mixed concrete production process were examined. In line with this aim, waste water samples were taken from concrete production plants in different sizes located in Marmara region of Turkey and analyses were conducted in line with the required parameters in pollution control regulations (Table 7.5) applied in Turkey. The analysis is performed on the desired parameters accordingly. One, two or three compartment clarification tanks are used in the facilities surveyed. Analyzes made demonstrate that although the results obtained in all the clarification tanks studied are different, they are below the limit values given in WPCR 7.5. According to the results in the clarification tank with the highest values: The value of the suspended solids; initial value: 636 mg / L and final value: 92 mg / L, the pH values; initial value: 10.15 and final value: 8.96, the color values; initial value: 29.3 (Pt - Co) and final value: 24.3 (Pt - Co), the oil and grease values; initial value: 18 mg / L and final value: 10 mg / L. These values demonstrate that treatment process was successful and that the clarification tank could be used effectively.

Keywords: wastewater treatment, treatment efficiency, wastewater from concrete plant, clarification tank

1. INTRODUCTION

The most used material in the construction sector is concrete (Xuan et al. 2016). In the past, the concrete was prepared by mixing the necessary materials in the construction areas, but now it is produced in ready-mixed concrete production plants. Ready-mixed concrete has reached a significant level of production due to the fact that it can be produced in appropriate quality standards and quantity, easy to use, saves time and labor (Sealey et al. 2001). However, the high amount of production caused an increase in the waste generated from ready-mixed concrete production. Waste from ready-mixed concrete production, remaining in the production process or in transport vehicles ready-mixed concrete residues, wastewater and wastewater treatment sludge after washing of vehicles and plant area (Ferriz-Papi, 2014). Ready-mixed concrete residues and wastewater treatment sludges usually sent to waste storage and disposal sites. There are many studies suggested in the literature for the recycling of these wastes (Asadollahfardi et al. 2015, Ferriz-Papi, 2014, Sealey et al. 2001).

There is a significant amount of water use and wastewater generation in ready-mixed concrete production plants. But, unlike many other production sectors, waste water production in ready-mixed concrete production is not directly caused by the process. The reason for this is that the process used is closed circuit and the water used in production does not come out (Garrett, 1999). The main source of wastewater is washing of concrete transport vehicles (Figure 1). After transportation, the concrete transportation vehicles come to the washing area, the washing process is carried out and the wastewater from the washing process reaches the treatment unit. The water produced by the washing of the factory area and the rainwater are added to the waste water (Asadollahfardi et al. 2015).

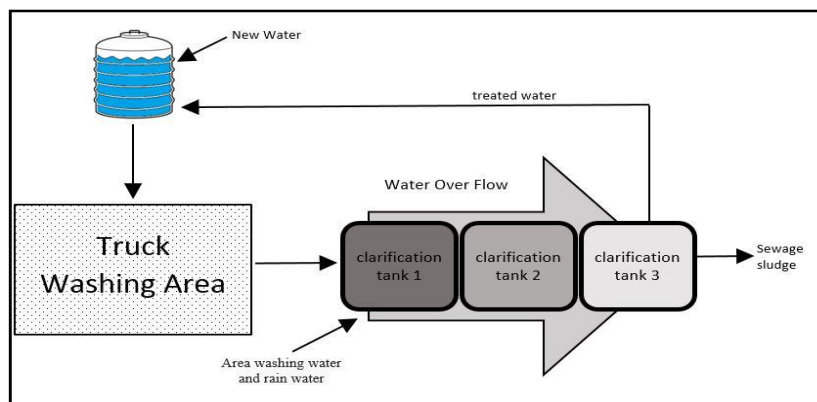


Figure 1. Wastewater generation and treatment in ready-mixed concrete facilities

Generally, clarification tanks are used for waste water treatment in ready-mixed concrete production plants. These tanks can be one, two or three stages depending on the water to be treated (Sealey et al. 2001). The main purpose of the treatment with clarification tanks is the precipitation of suspended solids in the wastewater and the reduction of pH. The wastewater treated in these tanks is re-used in the process or vehicle washing. In case of need new water supply is provided as much as the system needs. However, after the waste water treatment process, the water to be used in the process must be at the specific water quality standards (EN 1008).

In this study, the sufficiency of the clarification tanks used in the treatment of wastewater in the ready - mixed concrete production plants and the reusability of treated waste waters in the ready - mixed concrete production process and washing of the transportation vehicles were examined.

2.MATERIALS AND METHODS

Waste water samples were taken from concrete production plants in different sizes located in Marmara region of Turkey and analyses were conducted in line with the required parameters in pollution control regulations (Table 7.5) applied in Turkey. The analysis is performed on the desired parameters accordingly. One, two or three stage clarification tanks are used in the concrete production plants surveyed (Figure 2).



Figure 2. Clarification tanks in ready-mixed concrete production plants

Analyzes made demonstrate that although the results obtained in all the clarification tanks studied are different. Water pollution control regulations (WPCR) implemented in Turkey (table 7.5) of the desired parameters to suspended solids (Standard Method Number : SM 2540 D; standard method for the examination of water and wastewater. Total suspended solids dried 103-105 °C); pH (Standard Method Number : SM 4500 H+ B; standard method for the examination of water and wastewater. electrometric method) , color (Standard Method Number : SM 2120 C; Standard method for the examination of water and wastewater), oil and grease (Standard Method Number : SM 5520 D; standard method for the examination of water and wastewater. oil and grease, soxhlet extraction method), Cr^{+6} (Standard Method Number : SM 3500 Cr B; standard method for the examination of water and wastewater. hexavalent chromium, colorimetric methods) parameters were examined (APHA. Standard methods,2017). All analyses within the scope of this study were three replicated and results were provided as the average of three replications.

3.RESULTS AND DISCUSSION

According to the results of the study, the results obtained in all the clarification tanks examined showed that although the results obtained were different, they were below the limit values given in the water pollution control regulations (WPCR).

Analysis results of wastewater in one stage clarification tank and comparison with 2 hours composite sample values of WPCR has given Table 1. According of this results, the value of the suspended solids; initial: 636.4 mg/l and final: 92.8 mg/l, the pH values; initial: 10.15 and final: 8.96, the color values; initial: 29.3 (Pt - Co) and final: 24.3 (Pt - Co), the oil and grease values; initial: 18 mg/l and final: <10 mg/l was found.

Table 1. Analysis results of wastewater in one stage clarification tank and comparison with 2 hours composite sample values of WPCR-Table 7.5

Analyzed Parameters	Clarification tank input	Clarification tank output	WPCR Table 7.5 values
Suspended Solid	636.4 (mg/l)	92.8 (mg/l)	100 (mg/l)
pH	10.15	8.96	6-9
Color	29.3 (Pt - Co)	24.3 (Pt - Co)	280 (Pt - Co)
Oil and Grease	18.2 (mg/l)	<10 (mg/l)	10 (mg/l)
Cr ⁺⁶	<0.05 (mg/l)	<0.05 (mg/l)	0.3 (mg/l)

Results of Two-stage clarification tank has provided Table 2. This results have showed that, the value of the suspended solids; initial: 745.3 mg/l and final: 83.9 mg/l, the pH values; initial: 10.03 and final: 8.76, the color values; initial: 32.9 (Pt - Co) and final: 22.5 (Pt - Co), the oil and grease values; initial: 14.6 mg/l and final: <10 mg/l.

Table 2. Analysis results of wastewater in Two-stages clarification tank and comparison with 2 hours composite sample values of WPCR-Table 7.5

Analyzed Parameters	Clarification tank input	Clarification tank output	WPCR Table 7.5 values
Suspended Solid	745.3 (mg/l)	83.9 (mg/l)	100 (mg/l)
pH	10.03	8.76	6-9
Color	32.9 (Pt - Co)	22.5 (Pt - Co)	280 (Pt - Co)
Oil and Grease	14.6 (mg/l)	<10 (mg/l)	10 (mg/l)
Cr ⁺⁶	<0.05 (mg/l)	<0.05 (mg/l)	0.3 (mg/l)

In Three-stage clarification tank, the value of the suspended solids; initial: 721.4 mg/l and final: 68.7 mg/l, the pH values; initial: 9.96 and final: 8.44, the color values; initial: 30.6 (Pt - Co) and final: 19.2 (Pt - Co), the oil and grease values; initial: 11.8 mg/l and final: <10 mg/l.

Table 3. Analysis results of wastewater in Three-stages clarification tank and comparison with 2 hours composite sample values of WPCR-Table 7.5

Analyzed Parameters	Clarification tank input	Clarification tank output	WPCR Table 7.5 values
Suspended Solid	721.4 (mg/l)	68.7 (mg/l)	100 (mg/l)
pH	9.96	8.44	6-9
Color	30.6 (Pt - Co)	19.2 (Pt - Co)	280 (Pt - Co)
Oil and Grease	11.8 (mg/l)	<10 (mg/l)	10 (mg/l)
Cr ⁺⁶	<0.05 (mg/l)	<0.05 (mg/l)	0.3 (mg/l)

Waste water from the production of ready-mixed concrete is usually caused by the washing of concrete mixers and equipment. These values demonstrate that treatment process was successful and that the precipitation tank could be used effectively. However, It can be said that the number of stages of the clarification tank used and thus the increase of the precipitation time increases the treatment efficiency. Furthermore, it was understood according to the results obtained by comparison with the TS EN 1008 concrete mixed water standards that the usage of treated wastewater in concrete production does not have any negative effects on the concrete quality or the used process.

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Effect of Fungicide on Pollen Germination in Cherry (*Prunus avium* L.) Plant in-Vitro Conditions

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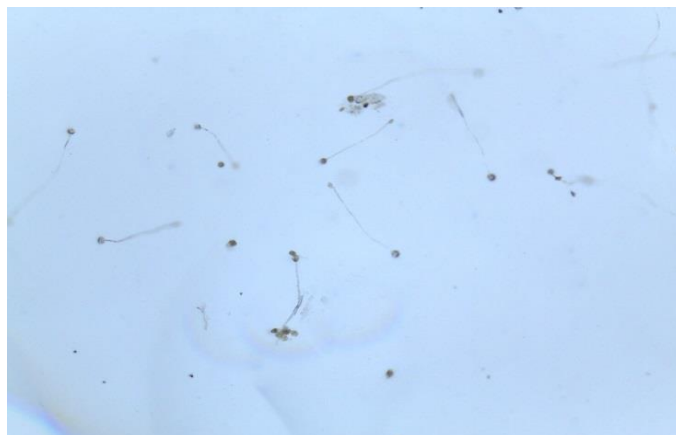
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Abstract: Fruit set is the result of pollination, which occurs in the plant's flower and is a biological mechanism. In this study, the effects of pollen germination on the cherry plant of Calcium Hydroxide + Copper II Sulphate, which is used to inhibit the formation of fungi in plants, are discussed in in vitro conditions. The pollen obtained from the flowers of *Prunus* varieties was directly cultivated in 2% agar, 10% sucrose medium. Calcium Hydroxide + Copper II Sulfate was added to the medium in various ratios in the two experimental groups and the germination and development of pollen tubules were observed in the light microscope. Pollen tubing decreased with the presence of the rate of fungicide in the medium.

Keywords: Pollution, Environment, Pollen germination, Cherry, Fungicide Treatment

1. INTRODUCTION

Cherry in terms of production Turkey is located in the first place in the world (480-748 tons (İkici & Bolat 2015)). Changes in the cherry flowering period can have a negative impact on flower quality and pollination (Zhang and Whiting 2012). For this reason pollinators and bloom overlap with pollinizers are important (Afik et al., 2008; Imani et al., 2013). Fruit production is a large group of plant-based agricultural products. In order to increase productivity in agricultural activities, various chemical treatment methods are one of the basic applications. In the world, agrochemical production is 3 million tons, fungicides constitute 19% of them. In Turkey, the EU and the use of pesticides at levels lower than the world average, the environment of pesticide use, threats to human health and natural balance in terms of the agenda is advantageous considering. However, application errors made by the manufacturer in the use of agrochemicals can turn this advantage into a disadvantage (Arslan & Çiçekgil 2018). Fruit set is the result of pollination, which occurs in the plant's flower and is a biological mechanism. Fertilization requires that the pollen grain grow a tube that penetrates the style until it encounters the ovary (Picture 1). The pollen grain germinates after it adheres to the stigma of a carpel.



Picture 1. Germinated pollen of Cherry.

While the beneficial crops are aimed to be obtained, the other side is aimed at increasing the crop by combating harmful species such as insects, weeds and fungi. To this end, unconsciously used chemicals affect ecosystems and organisms in various forms. In this study, the effects of pollen germination on the cherry plant of Calcium Hydroxide + Copper II Sulphate, which is used to inhibit the formation of fungi in plants, are discussed in in vitro conditions.

2. MATERIALS AND METHODS

The pollen obtained from the flowers of *Prunus* varieties was directly cultivated in 2% agar, 10% sucrose medium. Two test groups and control group were established by adding Calcium Hydroxide + Copper II Sulfate to 2% agar, 10% sucrose medium. For the pollen tube germination was expected at 35 °C for three days. The plates were observed in the light microscope. The pollen grain was considered to have germinated when the length of the germinated pollen tube was equal to or longer than the diameter of the pollen. (Kakani et al., 2002). Percentage pollen germination was calculated using the formula:

% Pollen germination= Number of germinated pollen / Total number of pollen x100

3.RESULTS AND DISCUSSION

Pollen tubing decreased with the presence of the rate of fungicide in the medium (Table 1). According to the control group, the tube formation was significantly reduced in the experimental groups. Germination was least in the group with the highest fungicide.

Table 1. Pollen germination rates

Medium	Pollen Germination %
Control	75.30
8.5Agar/1.5 Fungicide	27.50
8 Agar/2 Fungicide	13.86

The high viability and germination abilities of the pollen grains in the plants are crucial for successful fertilization and hence fruitfulness. The investigations on the effects of environmental pollution on pollen germination are limited . It was reported that very few reports exist on efficacy and timing against of fungi in cherry (Børve&Stensvand, 2006). It was found in this study; The optimal timing of fungicidal applications in sweet cherry is early green fruit stage. Time to treat with fungicide is important for fruit set. Our research is based on the right timing. Zhang et al. (2018) investigated the role of temperature on stigma receptivity and ovule viability in four sweet cherry cultivars that exhibit variability in productivity and fertility. They observations suggest high air temperatures during bloom decrease fruit set of many sweet cherry cultivars. Environmental conditions are affecting pollination.

The chemicals that are used affect not only the ecological problems but also the biological mechanisms that occur in living things. Depending on the presence of Calcium Hydroxide + Copper II Sulfate used to inhibit fungal germination pollen tubing has been affected at different levels of germination. In order to ensure fruit formation and increase of crops, these types of chemical applications should not be exposed in plants that have opened flowers and flowering continues, pollen germination time should be taken into consideration. This study, will be useful for breeding programs based on pollination to produce seeds and to investigate environmental pollution.

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The Ecological Assessment of Derivative Industrial Forestry Product Via Bio-Assay Test

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Abstract: The biomonitoring has gained extreme importance in environmental assessment of consumer end use commercials. The production of material as well as conservation of environment should be taken into account in terms of health hazards, habitat & flora and surrounding environment. Meanwhile the test system relaying on living organism increases awareness environmental impacts. The consumption of furniture in modern society has gained an acceleration in increasing portions of various chipboards rather than lumber. Since the wastes of furniture industry can be easily burned for household and other purposes, their recycling processes have not been considered immensely. In the study, before the pyrolysis of the chipboards and wood powders as a recycling process, the basic thermal analysis was realized. First of all, the glass transition temperatures (T_g) and melting and crystallization temperatures (T_m & T_c) were determined by differential scanning calorimetry (DSC) and differential thermal analysis (DTA). In addition to these, in order to determine basic mass loss of material with temperature, the thermal gravimetric analysis (TGA) were made. These wastes were inverses in tap water the 50g of each wastes were inverses in 1L of tap water for 3 days. Than these mixtures were simply filtered and the liquid parts were collected in erlenmeyer for *Allium cepa* test. By inspection of these temperature values, pyrolysis temperatures were determined. And the pyrolysis of the materials was accomplished and the liquid products were collected. These liquid products will be tested also for further studies and will be compared with previous liquid results. By this way the assessment of pyrolysis process effectiveness for conservation of environment will be determined. It is understood that the pyrolysis process may affect the hazardous nature of these materials. Here just the root length of onion bulbs for the liquids obtained from immersion and the results will be compared for the liquids obtained from pyrolysed chipboards and wood dust. By this way, the mitigation of environmental impact of these waste materials was evaluated by the mitotic index and chromosomal aberration. This study can become frontiers study and inspire smart resolution of environmental problems.

Keywords: Chipboards, wood powder, pyrolysis, *Allium cepa*, pollution, biomonitoring

1.INTRODUCTION

Technological and scientific developments aim both social welfare and trigger competitions between countries. This let to various ways of production that neglects environmental impacts and human health. Various chemical and biological agents have been used in all industry for the production, distribution and consumption stages of fabrics without considering environmental impact (Pimiento, 2014). Therefore, it is compulsory to find and develop new techniques and methods which are effective and easily to handle. The biomonitoring method comes fort first in the ultimate analysis of threshold level (Rai, 2016; Aboal et al., 2004).

The observations of plant growth are the well-known method in the determination of environmental conditions. The *Allium cepa* (onion) stem cells are the most common plant which can be used as a bio indicator for this purpose (Pekol et al., 2012). The division and multiplication of meristematic root cells under the exposure supply important knowledge. Because it is known that the effect in the mammalian cells is the same as that in the onion stem cells (Xu et al., 2017).

The aim of this study is to determine environmental impact of furniture wastes as virgin and as well as processed. The liquids obtained by weathering of these wastes and the liquids from their pyrolysis were considered for environmental assessment (Aydinli&Caglar, 2010). Here just the liquids obtain from virgin materials were applied to *Allium cepa* test system. And as a basic criterion for eco toxicological assessment the root lengths have been measured and compared with control top water group. And for further studies chromosomal aberration will also be determined and all studies will be repeated for pyrolysis liquids. In this state, this study provides a more effective, easy, fast and economical detection of chemical and biological exposure, which has an important place in occupational health and safety.

2.MATERIALS AND METHODS

MDF, Chipboard and wood powders were collected from local furniture industries and stored in bags for experimental studies. The amounts of 50 g taken separately from each sample were kept in 1 L of water for 3 days. As a result of this time, it was filtered and prepared for the experiments. Experimental sets were prepared separately after 1 day of seeding in pure water (5 bubble each sample). Root lengths were monitored for 3 days at room temperature and compared with control group. The liquid products obtained by conducting the pyrolysis experiments of these three materials were prepared for the *Allium cepa* test.

3.RESULTS AND DISCUSSION

The onion stem cells are similar to mammalian cells in terms of the counter reactions to toxic compounds. The division and multiplication of onion meristematic cells are deviated and chromosomal aberration will occur. This will cause at the end inhibited root growth and short root lengths. In this circumstances, root lengths become the basic criteria for toxicity apart from chromosomal aberration which needs detailed cytogenetic techniques for analysis.

Results

The onion root growths and comparative root lengths obtained from immersion liquids from furniture wastes and control group were given in figures 1, 2 & 3. It can be clearly seen that the control groups have normal root growth and have 2-3 times longer root lengths. In other comparison, if the experimental groups (MDF, LDF and wood powder) are compared in series, the situation is similar for MDF and LDF, and highly differentiated for wood powder. That is the root lengths for wood powder is the shortest and which is shorter than MDF and LDF.

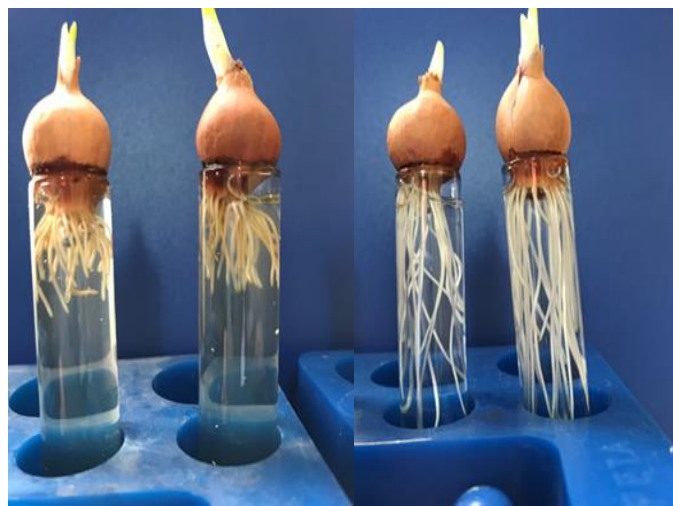


Figure 1. MDF & control

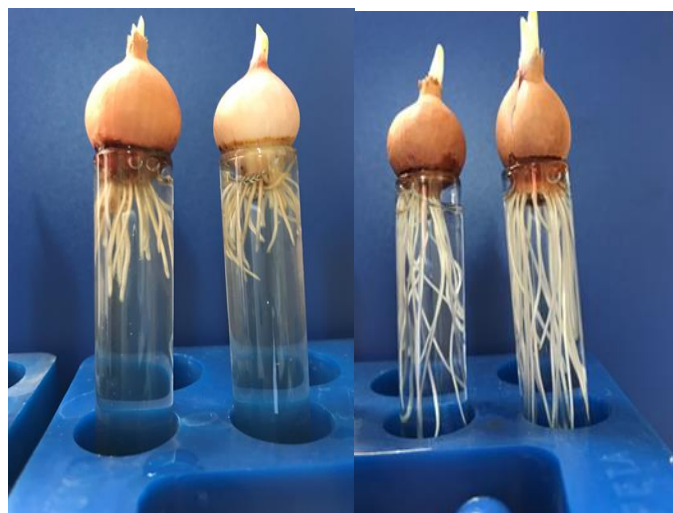


Figure 2. Chipboard & control

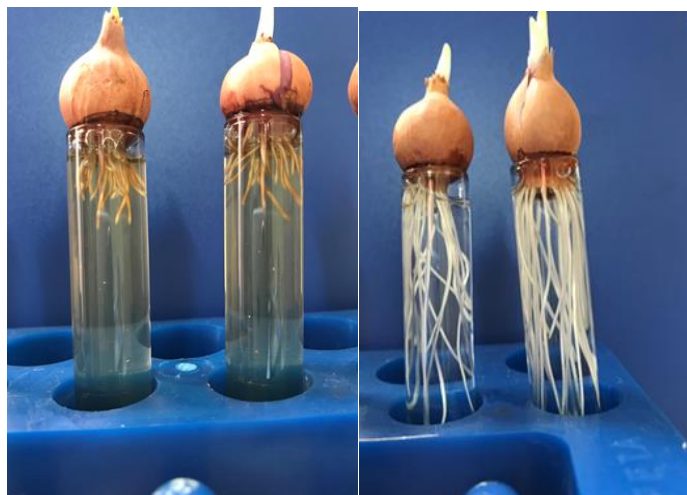


Figure 3. Wood powder & control

Discussion

Normally, the MDF and LDF contains additives, fillers and catalyst which can be assumed to be more ecotoxic. However, the processing for the production of these chipboards convert them to somehow more environmentally friendly material.

This study shows that the processing of natural materials sometimes converts the including toxicities into more environmentally safe compounds. As shown the longer root lengths for MDF and LDF than wood powders.

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Comparison of Vrs and Fkp Techniques in Different Application Fields

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Abstract: The satellites are recorded by a receiver of satellite signals in the positioning system. The time elapsed between the moment that the data (*code and phase measurements*) collected at the receiver are transmitted from the satellite and the moment the signal is recorded at the receiver is measured very precisely. This time is multiplied by the propagation speed of the signal to determine the distance between the satellite and the receiver. This process is also performed by transmitting the reference station data or the calculated corrections in real time to any receiver (*GPRS, satellite, internet, mobile phone, etc.*). However, the positional accuracy achievable in this method is limited by the increasing systematic effects due to the distance from the stationary station. A fixed GNSS system (*Network-RTK / CORS*) has emerged with the idea of establishing multiple fixed stations to reduce these limitations. Thanks to the CORS system, the dependence on a single reference station has been lifted, allowing for the atmospheric modeling of a specific region by taking advantage of the data from a large number of reference stations. In this study, P1 point of the forested area and P2 point of the built area were determined as application areas. At these points, measurements were made using both VRS and FKP techniques for 2 days. These measurements were then compared against standard deviations and average values. As a result of these comparisons, the standard deviation of Δy according to CORS-VRS technique is 1.7 cm, mean value is 2.8 cm; the standard deviation of Δx is 2.1 cm and the mean value is 1.5 cm; the standard deviation of Δh is 6.4 cm and the average value is 6.6 cm. Standard deviation of Δy according to CORS-FKP technique is 2.8 cm and average 2 cm; the standard deviation of Δx is 4.5 cm and the average value is 4.9 cm and the standard deviation of Δh is 4.3 cm and the average is 4.6 cm. As a result of comparison, the Δy and Δx values of the CORS-VRS technique give better positional accuracy than the CORS-FKP technique. However, in CORS-FKP technique, Δh value better positional accuracy than CORS-VRS technique was obtained. When these results are evaluated in general, it should be remembered that reflection effect (multipath) is high in forested and structured areas and satellite number and satellite geometry negatively affects position accuracy.

Keywords: CORS, VRS, FKP, Forestland, Built-Up Areas

1.INTRODUCTION

In the classical RTK technique, raw measurement and correction information is transmitted between a single reference station and a single rover. However, measurement and calculation methods of network structure are used in geodetic measurements. Repeated observations are made at many points in the network structure. After that, network balancing is done with error free measures, statistical analyzes are used to eliminate coarse errors, systematic effects are better modeled, and high accuracy and reliable coordinates are obtained. This dominance of geodetic networks has also been reflected in GNSS observations over time. It has arisen from the idea of establishing a large number of reference stations to remove the weak sides of the classical RTK technique and to ensure that this technique yields more reliable and accurate results. It has become possible to model errors such as trajectory errors, atmospheric effects, etc. using data from the reference stations around the wanderer. Thus, the dependence on a single reference station has remained intact, and the concept of a large number of reference stations has evolved. The accuracy achieved with the real time kinematic GNSS (RTK GNSS) method limits the increasing systematic effects due to the distance from the stationary station. In order to avoid these limitations, the idea of establishing multiple stations has been put forward. As a result of implementing this idea and using the experience gained, the concept of fixed GPS / GNSS (Global Positioning System / Global Navigation Satellite System) networks (Net-RTK) has emerged. Today, real-time applications (cadastral metering, machine control systems, vehicle tracking and navigation, agriculture, etc.) have made these networks active. In addition to archiving and calculating data in active GPS / GNSS networks, location correction information is also broadcasted in real time to users via any communication.

Typically, the maximum distance between a base station and rover GNSS set up is around 10 - 15 km. This is due to the effect of the atmosphere on the GNSS signals as they travel from the satellite to a GNSS receiver. With the establishment of a network of CORS, the distance between the base and the rover can be extended.

The CORS can be spaced around 100 km apart and using at least 3 of these CORS, the atmospheric effects can be modeled and corrected for, yielding level of cm, mm position solution required by so many industries.

In RTK network applications, the methods used to send corrections to users provide modeling of observation space. Data transfer methods used to model observation space and used in CORS are examined under three main headings. But we have been working on VRS and FKP techniques in this application [1, 2].

Field Correction Parameter Method (FKP)

The FKP (Flachen Correlation Parameter) method was developed by German SAPOS (SAteellite POSitioning). The corrections are made according to the gradient (angular) method, which allows the traveling receiver to interpolate. This includes linear ionosphere parameters and geometric corrections in RTCM format (message-59). The FKP parameters are published for a wide range of reference stations. The reference station data is collected and analyzed in the main system. Published data include observations of reference stations, including ionospheric effect. The traveling receiver solves the initial integer ambiguity (fast) with these parameters, performing classical GZK with reference observations. Very high size data transfer is required [1].

Virtual Reference Stations Method (VRS / VBS)

Virtual reference station (VRS) technique, also known as Virtual Base Station (VBS), is a long-used concept in GNSS measurement [1]. VRS is a Network-RTK / CORS approach developed by Trimble Terrasat using the linear interpolation method [3]. The principle of the VRS method is an imaginary station on which no instruments are installed and is only a few meters away from the transceiver. The observations for the VRS point are constructed using the data of the reference stations in the vicinity, and the observation is made by setting up tools at the VRS point [1].

A virtual reference station is then created from this information to be a few metres away from the initial position of the rover. The rover interprets this data as in the same manner as if it were from a single and real reference station. As the rover moves, then VRS is static. If the rover moves considerably as to effect the quality of corrections, then a new VRS needs to be created in its place [4].

2. MATERIALS AND METHODS

In this application, it is desirable to compare these two techniques by making measurements at the points determined in the forested and structured areas using the reference stations correction techniques CORS (VRS / FKP) which are continuously observing.

A region in Kayseri province was selected as the application region. There is also a point in an area where the trees are dense and a point where the structured areas are located. The photograph belonging to this region is shown in Fig. 1.

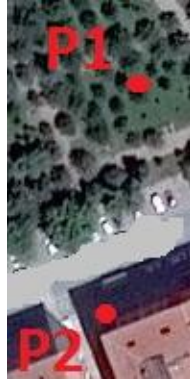


Fig. 1 . Çalışma Alanı

These points were measured for 2 days using VRS and FKP techniques and GNSS receiver. It is emphasized that open spaces should be preferred in GNSS measurements. However, study areas can have different conditions. Signal reflection error and PDOP values in forested and structured areas adversely affect positioning [5].

Measurements were made for 2 days using VRS and FKP techniques. In a wooded area in built up areas P1 point determined using GNSS receiver with VRS and the FKP, 10 made epoch measuring technique to the point P2 (with 1 sec) and the average of these values was taken.

Coordinates obtained from these measurements were recorded. The differences of the obtained coordinates are taken and the differences of Δx , Δy and Δh are calculated. Graphs of calculated coordinate differences are plotted.

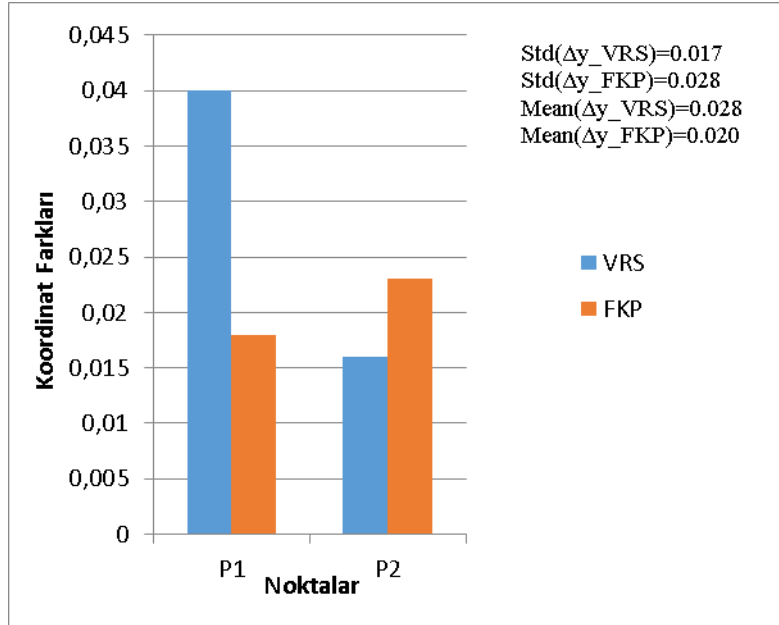


Fig. 2. Δy Koordinat Farkları

The standard deviation of Δy according to CORS-VRS technique is 1.7 cm, mean value is 2.8 cm; standard deviation of Δy according to CORS-FKP technique is 2.8 cm and average 2 cm.

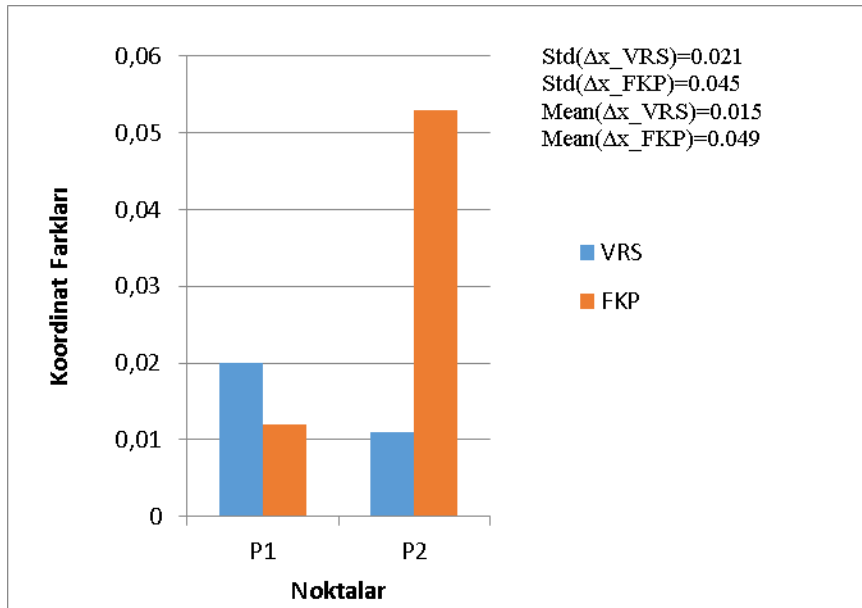


Fig. 3. Δx Koordinat Farkları

The standard deviation of Δx according to CORS-VRS technique is 2.1 cm and the mean value is 1.5 cm; the standard deviation of Δx according to CORS-FKP technique is 4.5 cm and the average value is 4.9 cm.

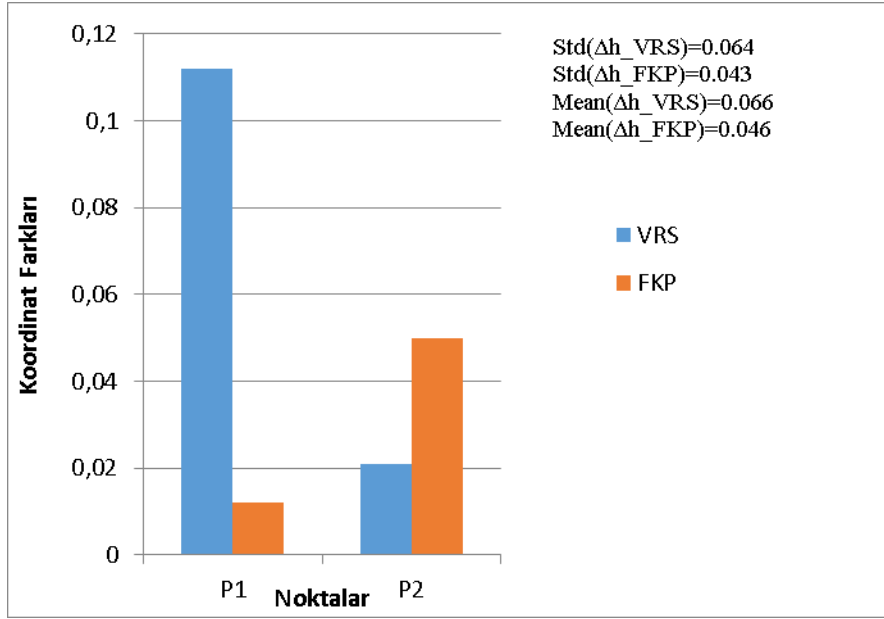


Fig. 4. Δh Koordinat Farkları

The standard deviation of Δh according to CORS-VRS technique is 6.4 cm and the average value is 6.6 cm, the standard deviation of Δh according to CORS-FKP technique is 4.3 cm and the average is 4.6 cm.

3.RESULTS AND DISCUSSION

Δy and Δx according to the calculations performed Positioning for coordinate differences VRS technique; according to Δh coordinate differences, we can say that FKP technique gives better positioning information.

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U-Value Analysis of Argon Filled Double Glazed Windows

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Abstract: U-value assessment is an important process to be able to assess the thermal insulation performance of building materials notably windows. Co-heating test methodology is usually considered in the U-value analysis of building materials. The co-heating test is an experimental technique of determining the heat loss coefficient of a building element which is calculated by plotting the heat input against the difference in temperature between the inside and outside of the building material. Although the reliability and practicality of the co-heating test method in practice is questioned due to the long test duration and uncertainty in the heat loss coefficient, it is still widely utilised for preliminary thermal resistance evaluation of building materials. About 60% of energy losses from building envelope is attributed to windows, hence accurate and reliable thermal resistance evaluation of glazed areas is of vital importance for a sensitive energy demand analysis of buildings. U-value assessment of windows is usually conducted through theoretical and numerical methods in literature. However, dwellers frequently complain about the insufficient thermal insulation performance of commercial glazing products when compared to the reported U-values in datasheets. This inconvenience arises from the lack of comprehensive experimental tests which simulate the actual operating conditions. Therefore, in this research, argon filled double glazed windows, which is one the most common fenestration products in market, is numerically and experimentally analysed in terms of U-value performance. Although computational fluid dynamics (CFD) analyses reveal that the U-value of the reference sample (4 mm pane + 20 mm argon + 4 mm pane) is 0.89 W/m²K, which is in good accordance with the theoretical data (0.80 W/m²K), it is observed from the environmental chamber tests that the U-value in simulated operating conditions is 1.25, 1.18 and 1.32 W/m²K for top, centre and lower positions of the window sample. The tests are repeated for accuracy verification, and the U-value is found to be 1.23, 1.18 and 1.31 W/m²K for the said points. In this respect, it is concluded that thermal bridges and edge effects play a key role in actual U-value performance of glazing products. Therefore, experimental performance figures are recommended to be utilised in energy demand analyses of buildings. Overall, in this research, U-value assessment of commercial argon filled double glazed windows is conducted through theoretical, numerical and experimental methodology. Although there is a good accordance between theoretical and numerical U-values, it is achieved that the experimental U-values from environmental chamber tests are noticeably higher due to thermal bridge and edge effects. In this respect, the reasons of complains of dwellers about the insufficient thermal insulation performance of commercial glazing products when compared to the reported U-values in datasheets are illuminated through an accurate and reliable research. For further energy demand analyses, experimental U-values of glazing systems and other building materials are highly recommended to be utilised to be able to monitor and experience the predicted outputs.

Keywords: U-value Assessment, Double Glazed Windows, Thermal Resistance, Energy Losses, Buildings

1.INTRODUCTION

Today energy and carbon emission savings are vital for buildings. The windows constitute about 60% of the total energy loss in a building and therefore have a great potential to reduce the energy consumption of the buildings to a minimum [1]. Especially in the last decades, a lot of work has been done to improve the thermal performance of windows. Owing to the potential improvements in energy saving, developed countries have announced lower U-value building codes for new buildings [2]. In addition, windows are considered an important solution to reduce greenhouse gas emissions from building cover. Global warming is now considered one of the most serious issues threatening the world [3]. In addition to providing an aesthetic appearance to the buildings, the windows have features such as ventilation in the buildings, passive solar energy gain, and the ability to leave the buildings in extraordinary situations. However, since the U-values of the windows are higher than the U-values of other building elements used in the buildings, most of the energy losses in the buildings are from the windows. Typical values of the construction elements are shown in Figure 1 [4].

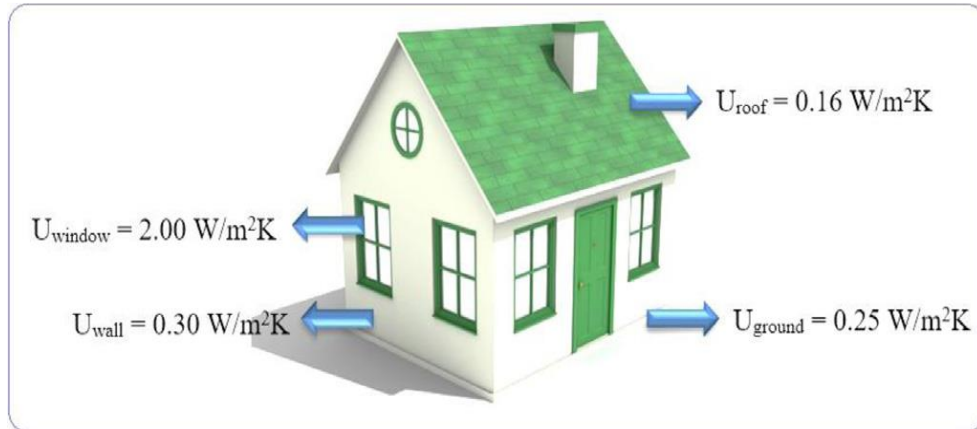


Figure 1. Typical U -values of building elements

U -value is a term that indicates heat loss that occurs in a building element such as a wall, floor, roof or window. This value, known as the overall heat transfer coefficient, indicates how well a building element transfers heat. The higher the U -value, the worse the thermal performance. A low U -value usually means high level of insulation and hence low thermal permeability. [5]. In order to be able to calculate the energy performances of the buildings, it is necessary to know the heat transfer characteristics of the windows as functions of environmental parameters such as lighting intensity, temperature and wind speed. Pencerelerdeki temel ısı transferinin doğru bir şekilde belirlenebilmesi, hem teorik hem de deneysel sonuçların daha iyi yorumlanmasını sağlar [6]. Glass components filled with air or another inert gas are called double glazed windows that reduce the heat transfer from one side of the building wall to the other side as much as possible. The argon-filled double-glazed window scheme is shown in Figure 2 [7].

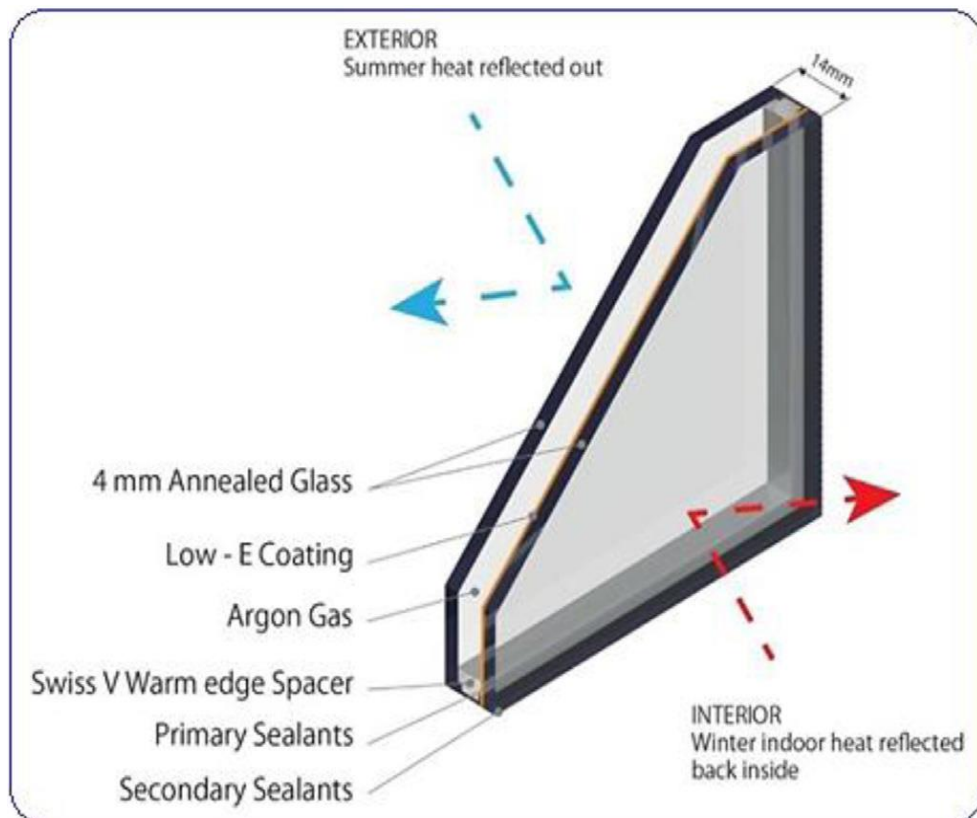


Figure 2. Structural details of conventional argon filled double glazed windows [7] .

2. MATERIALS AND METHODS

Cfd Anlysis

Computational Fluid Dynamics (CFD) analysis of a standard argon filled double glazed window is performed using ANSYS FLUENT software. As shown in Fig. 3, a window system, consisting of two 4 mm glass with 20 mm argon gas, is used.

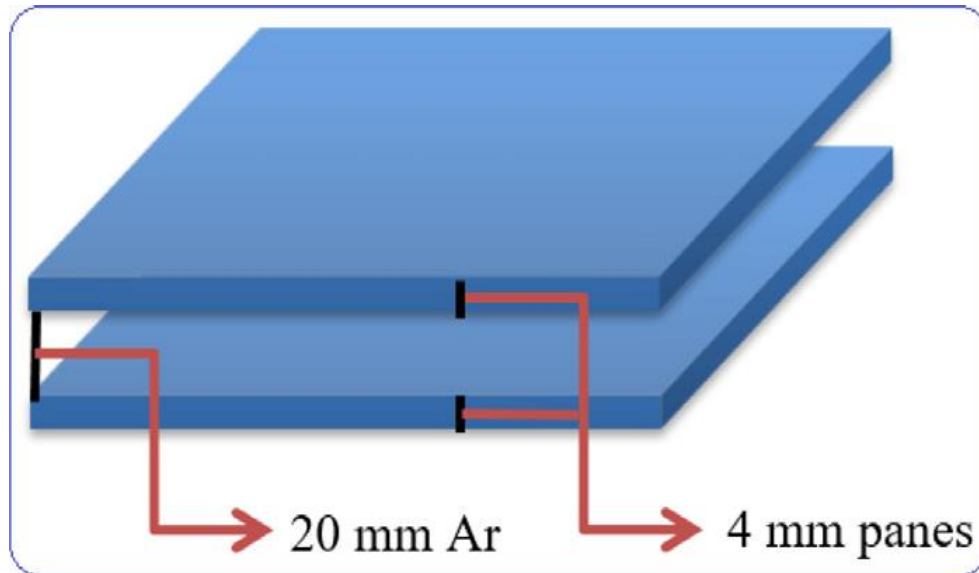


Figure 3. Schematic for the argon filled double glazed window sample.

As a result of the analysis, the static temperature contours in the double-glazed window are as shown in Figure 4.

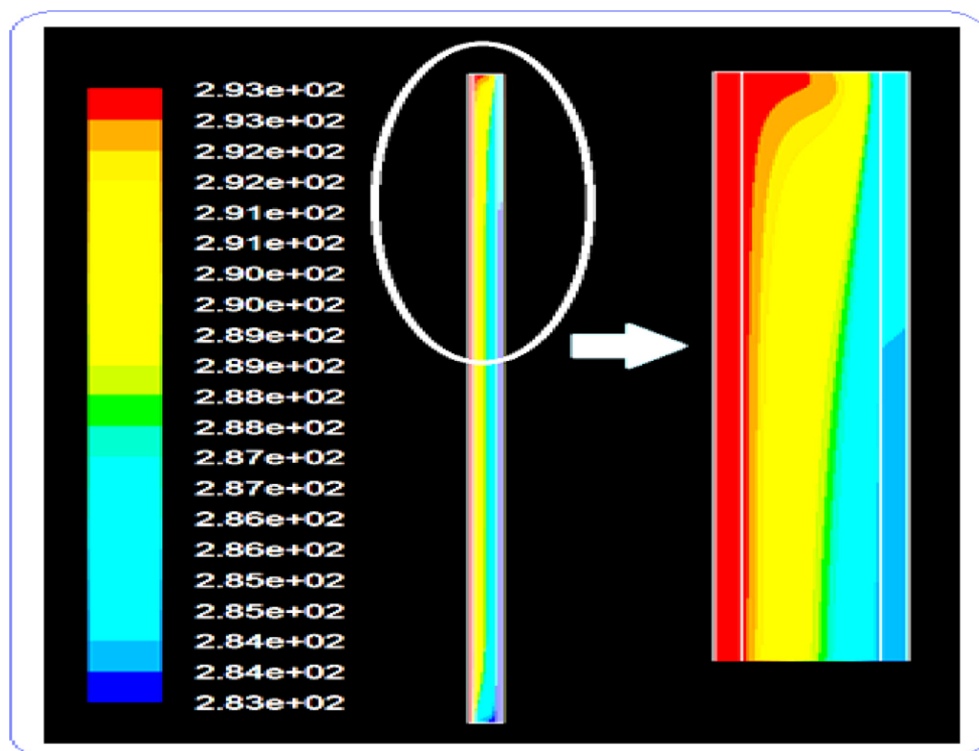


Figure 4. Contours of static temperature inside the double glazed window.

Experimental Analysis

In this section, we present an empirical study of the standard argon filled double glazed window previously shown. The test equipment scheme is shown in figure 5.

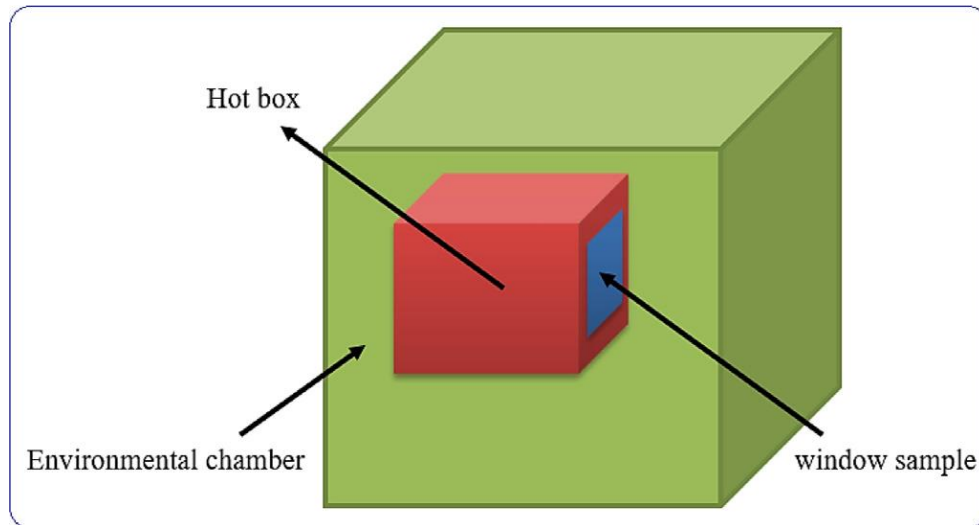


Figure 5. Experimental setup for the U -value assessment of window sample.

As a starting condition, the temperature of the ambient room is set to 5°C , while the temperature of the hot box is 20°C . Temperature and heat flow measurements are made for the three different positions of the window specimen. The average U -value is determined to be 1.25, 1.18 and $1.32\text{ W/m}^2\text{K}$ for top, centre and lower positions of the window sample like shown in figure 6.

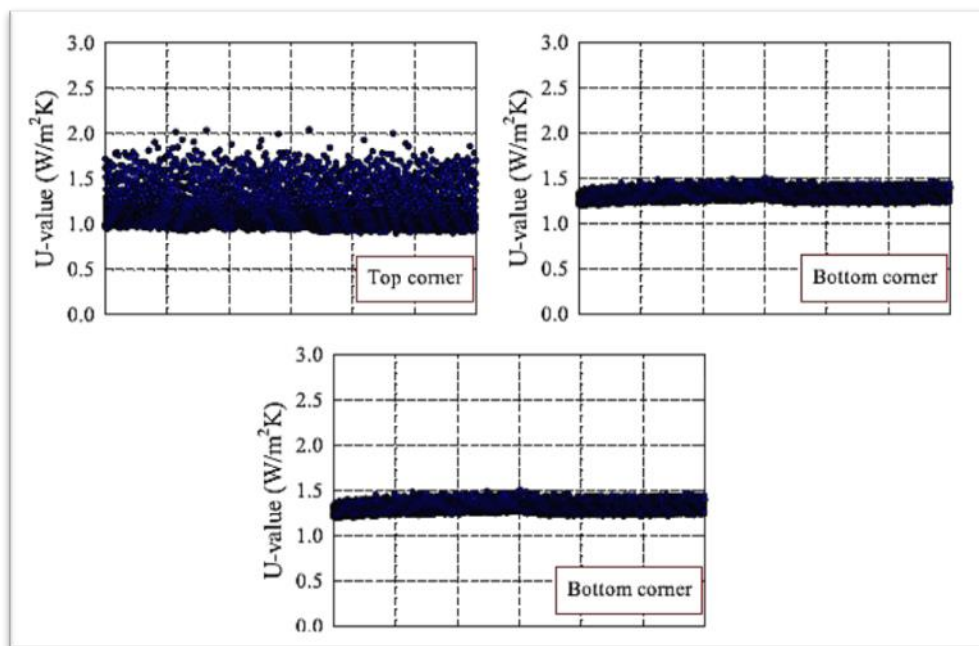


Figure 6. Contours of static temperature inside the double glazed window.

In this study, a numerical and experimental study is carried out to determine the U -values for commercial argon filled double glazed windows. It has been found that the experimental U -values obtained from the environmental chamber tests are significantly higher than their theoretical U -values. The reason for this is thermal bridge and edge effects. In this context, the reasons for the complaints that the U -values given in the catalogs of the companies for commercial glasses can not be observed in practice by the users are illuminated by accurate and reliable research.

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Role of Greenery Systems in the U-Value of Building Envelopes

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Abstract: By increasing urbanisation, the energy consumption due to buildings has considerably grown over the last four decades at global scale. The buildings are responsible for 40% of total world energy consumption, according to United Nations Environment Program (UNEP). For this reason, the effects of building envelopes on building energy consumption is indisputable. The amount of energy used in building sector accounts for one-third of global energy consumption for space heating and cooling. In addition, energy consumption in cold climates has an increasing trend approaching 50%. In buildings, heat loss takes place at walls, roofs and floors due to comprising external areas of buildings. By providing insulation against heat loss, either in cold regions or hot climates, the energy consumption can be decreased remarkably for different building envelope materials. Nowadays, a large number of countries and local administrations are aware of the numerous impacts of building envelopes on the building energy performance. So, building energy codes released by policymakers are growing gradually year after year. Although this progression is conducted through the energy codes, two-thirds of the countries have not implemented the energy codes yet for building sector. Depending on the reports, building envelope performance increases by approximately 6% in the last five years. The wall and roof heat transfer coefficients (U-values) based on uninsulated and typical building stocks take place between 0.6 and 1.2 W/m²K. On the other hand, the rate in the developing countries are greater due to rise in the floor areas and thermal comfort demands. The building envelope performance has considerable influences on the heating and cooling needs. It can, therefore, be assumed that high building envelope performance can be managed by deep renovation and retrofitting of the existing buildings. In this respect, building sector attracts attention of many policy makers and governments to reduce the building-related energy consumption and to mitigate the role of buildings in energy use. For this reason, the energy codes for building need to be revised to meet the target of the building energy performance. The rate of retrofitting the existing buildings are in the range of 1-2% today and the percentage is expected to rise by 2-3% per year up to 2025.

Keywords: Greenery Systems, Energy-efficient Building, U-value, Energy Demand, GHG

1. INTRODUCTION

Nowadays, the population living in cities are rising dramatically and this increment shows that growing tendency towards urbanization. Based on the study reported by UN, in 2050, 67% of the world population is expected to live in urban areas (Raji, Tenpierik, & Van Den Dobbelsteen, 2015).

Environmental issues with related urbanization can be detailed as the depletion of natural resources, the deterioration of natural ecosystems, global warming, rising sea level. Because of climate change throughout the world, it is observed that environmental conditions deteriorate rapidly for instance deforestation in tropics and agricultural productivity levels (Williams et al., 2016).

The European Commission has a target to reduce GHG emissions to protect the natural habitats and the expectation with respect to GHG emission is clarified to be by 25% and 60% between 2020 and 2040 respectively (Becchio, Corgnati, Delmastro, Fabi, & Lombardi, 2016).

In order to mitigate CO₂ emission, UNEP focuses on five main categories as follows;

- Improving energy performance of building including both new and existing
- Use of energy efficient household appliance
- Raising environmental awareness with regard to energy consumption
- Encouraging occupants to use renewable energy technologies instead of fossil fuel in buildings (Abdellatif & Al-Shamma'a, 2015).

In this respect, appropriate investments in energy, transport, industry, information technologies and building sectors are required for the desired outputs. Among the relevant sectors, buildings stand for the most promising field in terms of eco-friendly mitigating energy consumption levels (De Boeck, Verbeke, Audenaert, & De Mesmaeker, 2015). The concept of green structures is such an attempt that becomes widespread day after day. As reported by United Nations (UN), green buildings enable an opportunity of preventing negative effects of existing buildings on environment (Gibbs & O'Neill, 2015).

Greenery Systems

Lack of vegetation in urban areas results in heat island issues such as the increase in ambient temperature. This increment adversely affects building indoor environment. In this respect, scientist and policy makers think of greenery systems as the most promising solution to mitigate carbon emission causing urban heat islands (Besir & Cuce, 2018)(Manso & Castro-Gomes, 2015).

Greenery systems can be divided into two main parts such as green roofs and vertical greenery systems as known as a green wall. By adopted greenery systems to buildings, building energy performance improves considerably such as comfortable indoor environments and nearly zero energy buildings(Besir & Cuce, 2018) (Manso & Castro-Gomes, 2015). Moreover, greenery systems are considered to be passive solutions to increase the energy performance of the buildings in terms of thermal properties of the buildings. These properties can be defined as shading and insulating effects, in summer and winter seasons respectively. By exploited greenery systems, the existing buildings can be owned desired indoor quality in the way of a cost-effective and eco-friendly (Manso & Castro-Gomes, 2015)(Besir & Cuce, 2018)(Pérez, Coma, Martorell, & Cabeza, 2014)(Pérez, Rincón, Vila, González, & Cabeza, 2011).

Energy Saving in Buildings

The building sector has promising potential to reduce carbon emission based on fossil fuel consumption by applying energy efficient technologies to the building. From this point of view, building envelopes play vital role in mitigating energy demand such as heating and cooling loads. Building structure consists of two separate parts as indoor and outdoor and the separation is named as building fabric or shell. Briefly, Figure 1 illustrates the schematic diagrams of building envelopes including floor, walls, windows and roof. In addition, building energy performance is crucial issue due to meeting energy demand. The performance, depending on climate region, building-orientation, building type and age, and lastly behaviour of occupants, can be improved with using appropriate energy efficient systems in buildings(Besir & Cuce, 2018).

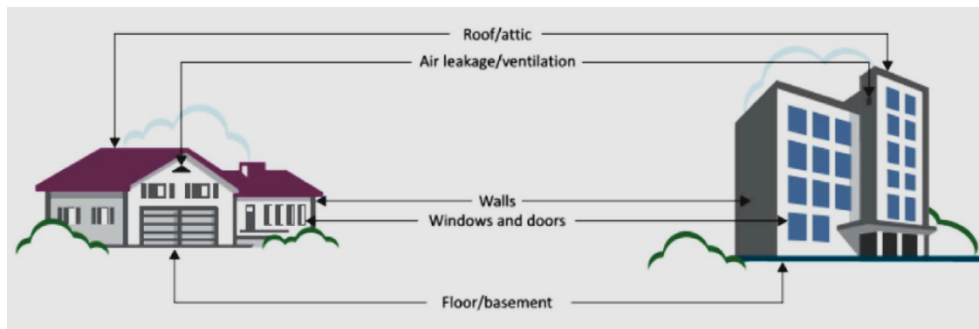


Fig.1. The components of building envelopes (Besir & Cuce, 2018).

In buildings, energy loss is inevitable results depending on external building envelopes consisting of external wall and roofs. To lessen heat loss, insulation materials must be applied to the building envelopes. The energy demand of building is realized to reduce dramatically. Figure 2 indicates U-values of buildings based on building codes implemented by some countries (Besir & Cuce, 2018).

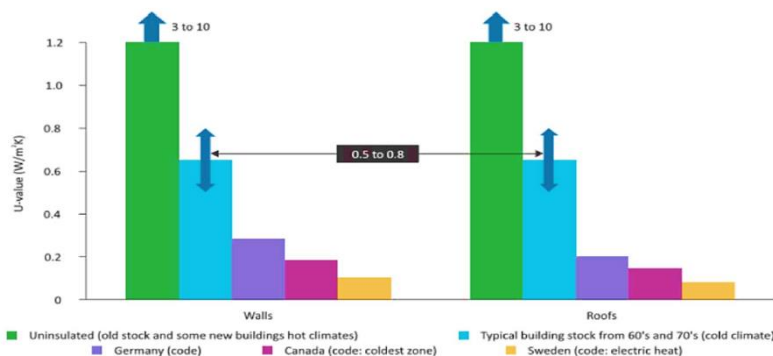


Fig.2. U-values with related to building current codes(Besir & Cuce, 2018).

Many studies show that greenery systems have potential energy savings. Based on researches, the decline rate of heat loss via green roofs is measured to be 70-90% and 10-30% in cooling and heating seasons (Besir & Cuce, 2018). The other study mentions that the reduction in heat loss and heat gain through green roofs is determined to be 95% and 26% in 22 months (Feng & Hewage, 2014).

In Italy, the study mentions that green roofs (except insulation materials) reduce surface temperature by at least 12 °C compared to conventional roof systems used in currently in buildings in cooling period. As for winter period, the green roofs are hotter by 4°C than conventional roofs. In this respect, green roofs consume less energy in comparison with conventional roofs (Bevilacqua, Mazzeo, Bruno, & Arcuri, 2016).

The thickness of substrate affects energy consumption and heat loss. According to research with related two different thickness of substrate (10 and 20 cm), the reduction of heat loss is measured to be by 59 and 96% and energy consumption is found to reduce in the range of 31 and 37% for different thickness substrate (10 and 20 cm) in comparison with bare roofs (Permpituck & Namprakai, 2012).

In another study focusing the temperature of external surface and indoor environment, external surface temperature is decreased by 21 °C via green wall. As for the indoor space, the temperature is determined to decrease by 1.1°C compared to bare wall (Chen, Li, & Liu, 2013). Energy saving from applying green walls to the buildings is calculated to be reached 0.4 kWh compared to a conventional wall (without any insulation materials) (Besir & Cuce, 2018).

Greenery systems (GSs) have a leading role to improve the energy performance of the buildings due to the relation with building envelopes. As claimed by UN, green buildings have an advantage to obviate hazardous effects of existing buildings on environment. Based on the survey carried out in the USA, traditional buildings consume approximately 30% more energy in proportion to green buildings. For this reason, GSs can be utilized to achieve zero energy or zero carbon buildings. While enhancing the energy efficiency of buildings, both energy consumption and carbon emissions steadily decrease as well. The systems can cover the whole building envelope notably roofs and walls. Thermal resistances of green roofs with respects to types of vegetation are reported to be between 0.27 and 0.42 W/m²K. On the basis of the research findings, the heat loss from the roofs in cooling and heating seasons decreases by approximately 70-90% and 10-30%, respectively owing to green roofs.

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Thermoelectric Refrigeration Systems: from Theory to Applications

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Abstract: The environmental disasters such as global warming, greenhouse gas emission, climate change, ozone layer depletion and acid rains increase especially in the last decades as a result of extensive fossil fuel consumptions. Significant efforts are made to mitigate energy consumption levels, and in this respect, sectoral energy consumption analyses are conducted for decisive measures. These analyses reveal that cooling demand plays a key role in primary energy consumption figures, and alternative solutions to conventional cooling systems are developed at global scale. One of the effective solutions developed is expressed to be thermoelectric coolers as a consequence of their numerous application areas, cost-effectiveness and eco-friendly aspects. A thermoelectric cooler (TEC) transforms electricity to heat through Peltier effect. When the current is applied to the thermoelectric cooler, heat is transferred from one side of the thermoelectric cooler to the other side and so one face of TEC gets cool while the other side gets warm. A classic TEC consists of a number of N-type and P-type semiconductor junctions connected electrically in series and thermally in parallel. Since traditional cooling methods such as air cooling, water cooling and liquid cooling reach the limits in terms of cooling capacity, thermoelectric coolers become in the centre of interest as an alternative cooler day by day. The application area of TECs can be split into three main groups as cooling of electronic devices, air conditioning and space cooling, and refrigerator applications. Refrigerators are used for a wide range of purposes from the military, aerospace and biotechnology industries to the food industries and especially in 20th century, scientists achieve great improvements in refrigerator technologies. These technologies can be classified in three groups as electrically operated, thermally operated and hybrid systems. Also refrigeration and air conditioning systems cause 29.6% of the total ozone depletion. Although conventional refrigerators such as vapor compression and absorption systems have a high COP value and provide safe operation, they have some disadvantages like being noisy and having moving parts. In addition, they are harmful for the environment because the refrigerants used in these systems generally pollute the air. Through the enhanced environmental consciousness, thermoelectric refrigerators are considered as a promising alternative to the conventional cooling systems owing to their advantages such as no moving parts, quiet and vibration-free operation, lightweight and eco-friendly structure. A typical thermoelectric refrigerator covers a isolated cabine, a peltier module, two heat exchanger, a DC power supply and a temperature controller. There are many studies in the literature about thermoelectric refrigerators and their COP values are generally between 0.65 and 1. These values are lower than those of other systems, but especially for the low cooling loads, thermoelectric coolers seem promising because of their low energy consumption, high response time and not including a harmful refrigerant, compressor, expansion valve, evaporator, condenser or solution pump.

Keywords: Thermoelectric Coolers, Refrigerators, Coefficient of Performance (COP), Clean Energy

1. INTRODUCTION

As fossil fuels like coal and petroleum decrease due to high energy consumption and sinking resources on the world, scientists looking for new alternative energy resources. In these alternatives, thermoelectric devices have significant role because of their countless usage areas and merits [1]. There are two different thermoelectric devices: one is thermoelectric generator (TEG) that turns into from heat to electricity and its named by Seebeck effect. The other is Thermoelectric cooler (TEC) that turns into from electricity to heat named by Peltier effect [2]. Since traditional cooling methods such as air cooling, water cooling and liquid cooling are attain the limits in point of cooling capacity, thermoelectric coolers becomes considerable area as alternative cooler day by day [3]. Besides, when it compared to other electronic cooler technologies, thermoelectric coolers have lots of advantages, for instance it can be fabricated in every dimension and though it is an active cooling system, it is not contain any fluid or mechanical operation [4]. High reliability, compact structure, quiet operation, simplicity, lightness are the other advantages and so, thermoelectric coolers employed in many areas like microelectronic systems, telecommunications, laser diodes, superconductor systems, aerospace industry, medical devices, food industry. However, low coefficient of performance (COP) in large temperature is seen as main drawback [5]. A thermoelectric cooler occurs P-type and N-type element pairs and those are connected as electrically series and thermally parallel among two ceramic plates like showed in fig. 1 [6].

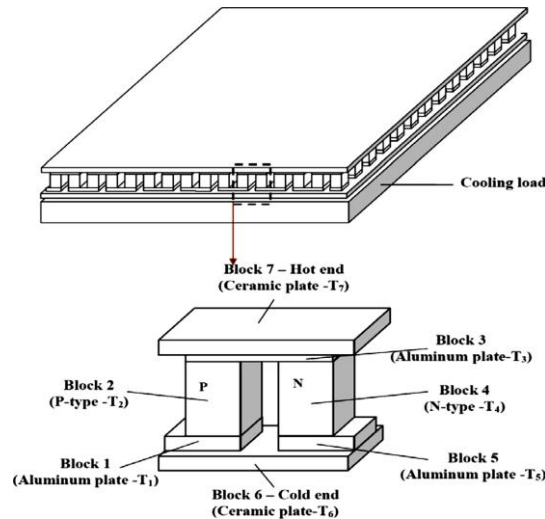


Figure 1: Physical model of thermoelectric cooler [6]

A current flow applied to one side, as seen in Fig. 2, the current bring about movements in the holes in the p-type semiconductor and the electrons in n-type semiconductor and these movements are appropriate with the flow direction. At this time, the heat is transferred from the cold side to the hot side of the thermocouple [7].

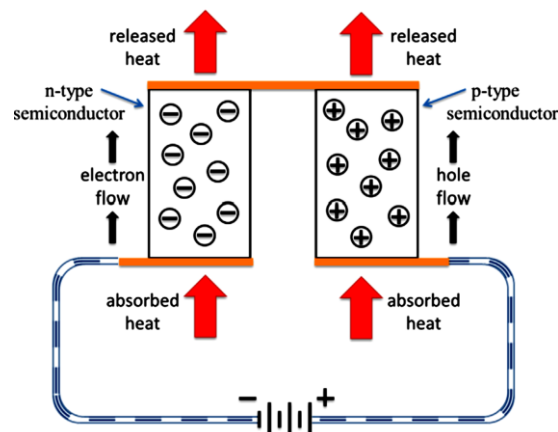


Figure 2: Working principles of TEC [7]

Thermoelectric Materials

High Seebeck coefficient, high electrical conductivity (or high power factor), and low thermal conductivity are the most crucial factors for a good performance of a thermoelectric cooler. Since it is difficult to keep all these parameters at maximum in the same conditions, researchers strive to optimize these parameters to achieve the highest ZT value. If we consider that a good thermoelectric material should also have a high Seebeck coefficient, high electrical conductivity and low thermal conductivity, choosing the correct thermoelectric material is a very important for high ZT values. From the 1960s until the 1990s, bulk alloy materials such as Bi_2Te_3 , PbTe , SiGe and CoSb_3 (Bi_2Te_3 is the most commonly used one) employ as thermoelectric materials and the improvements in ZT values are not remarkable but after the mid-1990s, shows a significant increase with using nanostructured materials [8].

Alam et al. [9] present a review study to show enhancement of figure of merit from bulk to nano-thermoelectric materials and they classify the so far efforts to increase the ZT values. ZT value in bulk materials are generally inadequate and only nearing 1.2 only in TAGS material, nevertheless Bi_2Te_3 and PbTe (ZT values are about 0.75 and 0.86 at room temperature) are generally used bulk materials in high temperature applications. Chen et al. [10] prepare a Bi-Sb-Te thermoelectric materials by using hydrothermal method under low temperature and they achieve increase the ZT value by 1.26 at 398 K. Usenko et al. [11] demonstrate that the ZT value of nanostructured SiGe alloys can increase by %20 at 800 °C with the ball-milling process. The maximum ZT value observe as 1.1 for 1 hour ball-milling process and the influence of proses time on ZT value, thermal conductivity, electrical conductivity and seebeck coefficient. Ding et al. [12] present an experimental study to show thermoelectric features of melt spun PbTe. They prepare p-type PbTe samples by melt

spinning (MS) integrated with a rapid induction hot pressing (RHP) process at rotation speed of 13 m/s, 21 m/s and 29 m/s. The maximum ZT value measure as 0.756 at 673 K for the MS-21 sample. Yin et al. [13] investigate the oxide thermoelectric materials and they decide that, although the oxide thermoelectric materials have several advantages such as low cost, environment-friendly manufacturing and chemical stability at high temperatures, the ZT value of this materials lower than the conventional thermoelectric materials. LeBlanc et al. [14] research the material and fabrication cost of thermoelectrics. For the thermoelectric cooling, Novel nanowire and superlattice materials are not the competitive because of large costs of manufacturing techniques. In the table 1, the ZT values of various thermoelectric materials for some studies conducted from 2016 to 2017 are showed with the manufacturing techniques.

Table 1: ZT values of various thermoelectric materials for some studies

Material Name	Method	ZT Value	Temperature	Publishing Year	Ref.
$\text{Si}_{0.9}\text{Ge}_{0.1}$	Annealed	0.072	Annealed at 1345 °C	2016	[15]
$\text{Bi}_{0.5}\text{Sb}_{1.5}\text{Te}_{2.7}\text{Se}_{0.3}$	Alloy	0.95	503 K	2017	[16]
Bi_2Te_3	-	0.45	525 K	2017	[17]
$\text{Bi}_{0.39}\text{Ge}_{0.01}\text{Te}_{0.6}$	Alloy	0.9	325 K	2017	[17]
$\text{Bi}_2\text{Te}_{2.85}\text{Se}_{0.15}$	Hot-Extrusion	0.47	300 K	2016	[18]
Te- doped $\text{Zr}_3\text{Ni}_3\text{Sb}_{3.95}\text{Te}_{0.05}$	Hot pressing	0.6	773 K	2017	[19]
$\text{Eu}_{0.2}\text{Yb}_{0.2}\text{Ca}_{0.6}\text{Mg}_2\text{Bi}_2$	-	1.3	873 K	2017	[20]
$\text{Cu}_{1.98}\text{S}_{1/3}\text{Se}_{1/3}\text{Te}_{1/3}$	triple-component	1.9	1000 K	2017	[21]
$\text{Co}_{23.4}\text{Sb}_{69.1}\text{Si}_{1.5}\text{Te}_{6.0}$	Alloy	1.6	500 °C	2017	[22]
$\text{Bi}_{0.4}\text{Sb}_{1.6}\text{Te}_3$	Hot-Extruded	0.54	400 °C	2017	[23]
$\text{Ti}_{0.5}\text{Zr}_{0.5}\text{NiSn}_{0.98}\text{Sb}_{0.02}$	-	1.2	873 K	2016	[24]

Thermoelectric Modelling

Thermoelectric coolers have a wide range of applications from field cooling to microprocessor cooling. Although TECs generally have the same operating principles and functions, researchers must make some optimizations in the thermoelectric cooler design, due to differences of usage areas and cooling loads [25]. Optimize the geometry of TECs is one of the main study topic in this optimization technichs and in the literature, there are four basic TEC model as shown in figure 3.[26].

Single-stage TEC

- Multi-stage TEC
- Trapezoid type TEC
- Annular TEC

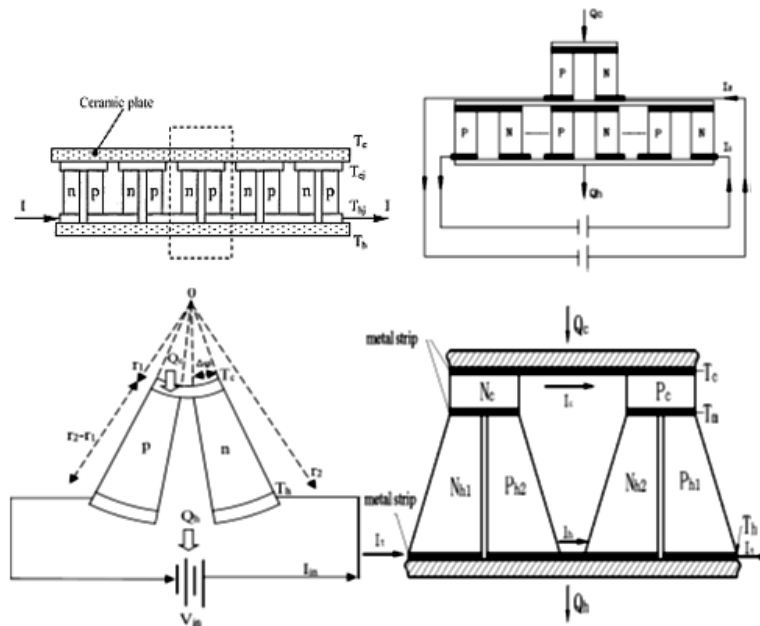


Figure 3: Schematic diagram of the thermoelectric modules (single-stage, multi-stage, annular and trapezoid type, respectively) [27-30]

When the TECs operate at the same conditions such as current ratio, cold or hot side temperature, two-stage TEC is more efficient than single-stage TEC. For instance, if you apply equal current ratio at same operation conditions on TECs, single-stage TEC's performance about half of two-stage TEC. Nevertheless increasing the number of stage too much leads to performance reduction again. In Table 2, comparative studies on this issue and obtained COP values are shown.

Table 2: Comparative studies for TEC modelling

References	Model	COP	Current	Temperature
Nami et al. [31]	Single-stage	3.38	7 A	$T_{\text{cold}} = 290 \text{ K}$
	Two-stage	3.19	4A	$T_{\text{cold}} = 290 \text{ K}$
Sharma et al. [32]	Single-stage	0.4411	16 A	$\Delta T = 300 \text{ K}$
	Two-stage	0.4411	8 A	$\Delta T = 300 \text{ K}$
Chen et al. [33]	Single-stage	0.102	1.47	$T_{\text{Hot}}/T_{\text{cold}} = 1.3$
	Two-stage	0.201	1.15	$T_{\text{Hot}}/T_{\text{cold}} = 1.3$

Thermoelectric Refrigeration Systems

Refrigerators are used a wide range area from the military, aerospace and biotechnology industries to the food industries and especially in 20th century, scientists achieved great improvements in refrigerator technologies [34]. We can classify this technologies in three groups as electrically operated, thermally operated and hybrid systems according to used energy. Also refrigeration and air conditioning systems causes 29.6% of the total ozone depletion [35]. Though conventional refrigerators such as vapor compression and absorption systems have a high COP value and safely operation, they have some disadvantages like noisy, moving parts and the most crucial is they are harmful for the environment because the refrigerants used in this systems are generally pollute the air [36]. With the increase of people's environmental consciousness, thermoelectric refrigerators became promising alternative due to their advantages like no-moving parts, quiet and vibration-free operation, lightweight and as the most importantly dont have the harmful refrigerant [37]. A classical thermoelectric refrigerator consists a cooled cabine, a Peltier module, two heat exchanger, a D.C. power supply and a temperature controller, like shown in Figure 4 [38, 39].

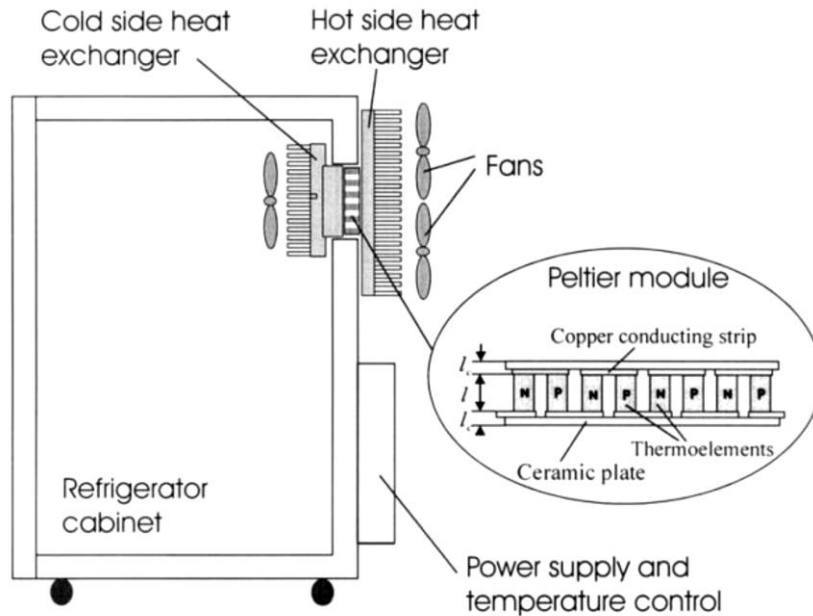


Figure 4: Schematic of thermoelectric refrigerator [38]

In literature, there are various experimental and numerical study about thermoelectric refrigerator systems. For instance, Jugsujinda et al. [40] conduct an experimental study to analyze performance of thermoelectric refrigerator and they achieve reduce the cold side temperature from 30 °C to -4.2 °C in only one hour. Also maximum COP value is observed as 0.65. Palaniappan and Palanisamy [41] carry out a comparative numerical analysis by using ANSYS for Bi-Te and Pb-Te thermoelectric modules and they obtain the COP value for Bi-Te and Pb-Te as 1.1 and 0.92, respectively. Additionally, Hermes and Barbosa Jr [42] compares the thermodynamic performance of different cooling technologies: thermoelectric, Stirling, and vapor compression using two different compressors (reciprocating and linear). The refrigeration systems are tested in same conditions at two different ambient temperatures. The efficiency of thermoelectric refrigerators systems

(COP = 0.69) is lower than other systems, but especially for the low cooling load systems, it would be wise to use a thermoelectric cooler because of their low energy consume, high response time and don't have a harmful refrigerant, compressor, expansion valve, evaporator, condensers, or solution pumps. Some other studies and obtained COP values are summarized in Table 3.

Table 3: Summary of thermoelectric refrigerators reported in literature.

References	Type	COP Value	ΔT (°C)	Cooling capacity (W)
Abdul-Wahab et al [43]	solar-powered thermoelectric refrigerator	0.16	22	15.3
Dai et al. [44]	solar-powered thermoelectric refrigerator	0.23	20	12
Vian and Astrain [45]	Apply phase change thermosyphon system	0.393	~10	19.4
Astrain et al. [46]	Finned heat sink and fan at both hot and cold sides	~0.65	23	~30
Dai et al. [47]	solar-powered thermoelectric refrigerator	0.3	-	12
Martinez et al. [48]	computational model for Peltier effect based refrigerators	0.34	-	-
Astrain et al. [49]	study of different heat exchange systems	0.7	-	-

The advantages of thermoelectric coolers can be listed as follows:

- Ideal for small volume cooling applications.
- It works quietly and without vibration.
- It does not contain any refrigerant and so eco-friendly.
- Ideal for applications where temperature control is important, very precise temperature control can be done.
- It requires very little maintenance as there is no moving part.
- They can work in all kinds of vertical, horizontal, gravity free environments

Disadvantages:

- Cooling performance coefficients are low.
- They are not suitable for high cooling loads.
- Their costs are high.

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Adsorption Performance of Glutaraldehyde Cross-Linked Chitosan-Packed Cranberry (Cornus Mas) Kernel for the Uptake of Cr (VI)

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Abstract: In order to remove Cr (VI) from aqueous solutions, glutaraldehyde cross-linked chitosan-packed cranberry kernel shell (Cts/CbKS) capsules were used as adsorbents. FTIR spectra were completed for the characterization of adsorbent. The interaction of the adsorbents with Cr (VI) was conducted in batch vessels. The adsorbent was slowly added to the prepared Cr (VI) solution and mixed in the vessel in a particular time until equilibrium was reached. The effect of Cr (VI) concentration, adsorbent dose, agitation time, initial solution pH on the adsorption was studied. Adsorption performance is high at pH 2 and equilibrium occurred within 120 min. The experimental data of equilibrium was described by Langmuir, Freundlich, Scatchard, and D-R isotherms. The data were fitted to the Langmuir adsorption isotherm. Adsorption parameters (k , n , A_s , K_b , X_m , K , E) were calculated from these isotherms. The maximum monolayer adsorption capacity of Cts/ CbKS obtained from the Langmuir model was found to be 78.13 mg/g. The experimental results of this work showed that Cts/ CbKS is an effective material for the adsorption of Cr (VI) ions compared to the reported adsorbents in the literature.

Keywords: Chitosan, glutaraldehyde, cranberry kernel shell, chromium, isotherms, equilibrium

1. INTRODUCTION

One of the most important causes of water pollution is pollution by toxic metals (Shen et al., 2016). Toxic substances, even at low concentrations in water, can cause serious illnesses or even death if they cause serious harm to human health. Copper, lead, cadmium, mercury, arsenic, chromium, cobalt, etc. which are called "heavy metals" and can be found in wastewater in small amounts (Parlayıcı et al., 2016; Tumin et al., 2008). They cause death or various diseases (cancer, nervous system damage, organ damage, and in extreme cases etc.). Chromium as a heavy metal is one of the top sixteen toxic pollutants that have harmful effects on human health (Gardea-Torresday et al., 2000). Cr (VI) is 500 times more toxic than Cr (III) (Sarin and Pant, 2006). Cr (VI) is a strong oxidizing agent (Park and Jung, 2001). Toxicity of Cr (VI) causes skin irritation, asthma, ulceration, and severe diarrhea, damage to the kidney, circulatory tissues, liver, and nerve tissues. Exposure to high chromium dosage also causes cancer in the digestive tract and lungs (Ofudje et al., 2014; Karthikeyan et al. 2005; Mungasavalli et al. 2007). The maximum permissible concentration limit for Cr (VI) for drinking waters that is recommended by the Environmental Protection Agency (EPA) is 0.05 mg/L in potable water.

Several techniques are available for the removal of heavy metal ions from drinking water, such as membrane process, electrochemical precipitation, electrodialysis, ultrafiltration, reverse osmosis and ion exchange (Moosavirad et al., 2015). The adsorption technique remains the most preferred method because of its versatile, efficiency, non-hazardous technique and low cost (Jesus et al., 2014). The new adsorbents provide an interesting alternative material, especially if the adsorbent is cheap and available.

Chitosan is a polycationic polymer derived from chitin, a major component of arthropods, and is readily available from seafood processing wastes. Because chitosan has unique physiological and biological properties, it has been widely used as a versatile starting material for the preparation of various products in biomedical engineering. In recent years, chitosan has also increasingly been studied as an adsorbent for the removal of heavy metal ions from aqueous solutions because the amino and hydroxyl groups on the chitosan chain act as a chelation or reaction sites for the substances to be removed.

Agricultural by-products are high volume, underutilized lignocellulosic biomaterials, and contain high levels of cellulose, hemicellulose, lignin (Park et al., 2006). However, the adsorption capacity of raw agricultural by-products is low in general. Cross-linking of Cts with glutaraldehyde greatly affected the Cr (VI) binding ability of the shells. The produced adsorbent was used for the removal of Cr (VI) from aqueous solutions by the batch method. Effective parameters such as initial pH, initial metal concentration, contact time, and adsorbent dosage were investigated.

2. MATERIALS AND METHODS

Cranberries were bought from the local market in the Konya, TURKEY. All other chemicals were purchased from Merck Company. The pH of the solution was adjusted by mixing the appropriate amount of 0.1 M (HCl/NaOH). A stock solution of Cr (VI) with a concentration of 1000 ppm was prepared by dissolving $K_2Cr_2O_7$ in distilled water. FT-IR spectra were recorded by a Bruker VERTEX 70 FT-IR spectrometer. The residual solution was measured using a UV-vis Spectrophotometer (Schmadzu UV-1700) (λ : 540 nm) using a diphenylcarbazide reagent.

Preparation of glutaraldehyde cross-linked chitosan-packed cranberry kernel shell (Cts/CbKS) capsules: 3 g of chitosan were mixed with 300 ml of a 1% acetic acid solution in a magnetic stirrer until the chitosan gel was gelled and after mixing with 3 g of CbKS, the mixture was stirred for about 1 hour using magnetic stirrer. 200 ml, 5% NaOH and 300 ml, 6% ethyl alcohol solution were prepared in a beaker and with a syringe, the mixture was dropped into the basic solution. The particle formation in the spheres was observed by adjusting the height of the droplets and the particle radius. Then, they were washed with pure water until the pH was neutral. It was processed with the glutaraldehyde to form a covalent bond with the chitosan and, at the same time, the number of functional groups in the structure was increased. 3 ml of glutaraldehyde and 100 ml of methanol were treated with Cts-CbKS composite in an oven at 60-70 °C for 30 minutes and then the slurry was allowed to dry for 24 hours.

The batch method was used to perform an adsorption experiment. In 100 mL Erlenmeyer flask, 50 mL of Cr (VI) solution was taken at constant pH and 2 g/L of Cts-CbKS was added and allowed to shake for 2 hours at 200 rpm. All experiments were performed with blank tests and the results were checked to remove the errors. The samples were tested twice to ascertain the accuracy, reliability, and reproducibility of the data obtained from experimental results. After equilibrium was obtained, the filtrate was analyzed for Cr (VI) concentration using a UV-Vis. Percent adsorption of Cr (VI) ions was calculated as indicated in equation (1) below (Parlayıcı and Pehlivan, 2017):

$$\% \text{ Adsorption} = \frac{C_i - C_f}{C_i} \times 100 \quad (1)$$

$$\text{Adsorption Capacity} = \frac{C_i - C_f}{m} \times V \quad (2)$$

where C_i and C_f are the initial and final Cr (VI) concentrations, respectively. The adsorption capacity per unit mass of adsorbent (q_e) was calculated using the equation (2). The determination of functional groups present in the adsorbent was realized by A Fourier transform infrared spectrometer (FT-IR).

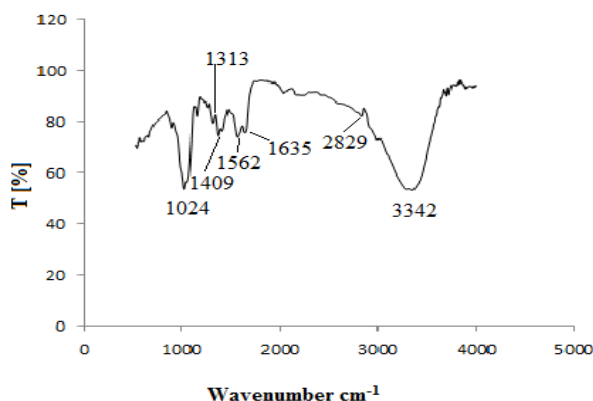


Fig. 1. FTIR spectrum of Cts-CbKS

The FT-IR spectrum of Cts-CbKS is shown in Fig. 1. The band centered at 3342 cm^{-1} is compatible with the $-\text{OH}$ stretching vibration mode of the hydroxyl functional groups. CH_2 and CH_3 group aliphatic C-H stretching vibrations at 2829 and 1635 cm^{-1} ; $-\text{NH}$ line and 1409 cm^{-1} $-\text{NH}_2$ due to bending band. The most interesting bands, in which oxygen-containing functional groups carboxylic and phenolic may be observed, are 1562 and 3342 cm^{-1} . The band between 1313 cm^{-1} is characteristics of phenol groups. The peaks at 1024 cm^{-1} , representative of C-H stretching of aliphatic groups. The FT-IR spectrum displays all functional groups. $-\text{NH}_2$, $-\text{OH}$, and $-\text{CO}-$ were involved in the binding mechanism of the metal ion to Cts-CbKS.

3.RESULTS AND DISCUSSION

Equilibrium relationships between Cts-CbKS and Cr (V) are explained by adsorption isotherms (Fig. 2.). The suitability of the equilibrium curve for the Langmuir isotherm was studied and q_m and b were calculated from the Langmuir equation and were given in Table 1. When the R_L values are between 0 and 1 and all the data in the isotherms were taken into account, the R_L value was calculated as 0.115.

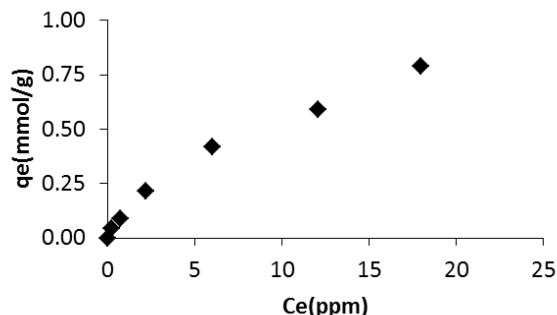


Fig. 2. Adsorption isotherm of Cr (VI) by Cts-CbKS

Langmuir isotherm was more applicable for Cr(VI) adsorption compared to other isotherm data. Maximum capacity according to Langmuir isotherm (q_m) was 78.13 mg/g for Cr(VI). The n values were found to be 1.45, indicating that the adsorption of these values is favorable from 1 to 10. Adsorption energy (E_{ad}) value was found to be 9.46 kJ/mol. The adsorption was considered as electrostatic attraction, complexation, and chemisorption. The maximum capacity calculated from the Scatchard isotherm was found to be 80.45 mg/g (R^2 ; 0.84), but the result supported Langmuir isotherm for the equilibrium.

Table 1. Langmuir, Freundlich, Scarthard and D-R isotherm parameters and correlation coefficients for the adsorption of Cr (VI)

Langmuir				Freundlich			D-R			Scatchard			
Q_m	b	R^2	R_L	K_f	n	R^2	X_m	K	E	R^2	Q_s	K_s	R^2
78.13	0.076	0.985	0.115	6.02	1.45	0.946	0.0074	0.0056	9.45	0.983	80.45	0.069	0.849

The pH of the solution is an important control parameter in the Cr(V) adsorption process (Fig. 3.). The experiments were carried out at a pH range 1.5–6. The hydrolysis of the solution, pH of the solution, redox reactions in the solution phase and the coordination by the functional groups on the surface of the Cts-CbKS and the ionic state can influence the Cr(VI) adsorption from the solution phase or decomposition to the aqueous medium.

The pH of the aqueous solution is one of the important parameter that plays a role in the Cr (VI) adsorption. Usually, at below pH 2.0, partial chromium ions in the solution exist as trivalent state, while above pH 3.0, chemical reduction of Cr (VI) to Cr (III) occurs to a lesser extent and anionic chromium species, such as $HCrO_4^-$ and $Cr_2O_7^{2-}$ are the major species. A possible removal mechanism of Cr (VI) can be proposed for the interaction. When in a low pH condition, negatively charged $HCrO_4^-$ is the dominant form of Cr (VI) existed in solution, and it could be adsorbed by positively charged groups through electrostatic attraction. While Cts-CbKS has the amino (NH_2) and hydroxyl (OH) groups, which can be protonated to ammonium ion (NH_3^+) in the acidic conditions, and they could adsorb $HCrO_4^-$ by electrostatic attraction. The adsorption capacity of Cts-CbKS was strongly dependent on the pH value and the maximum adsorption took place at pH 2.

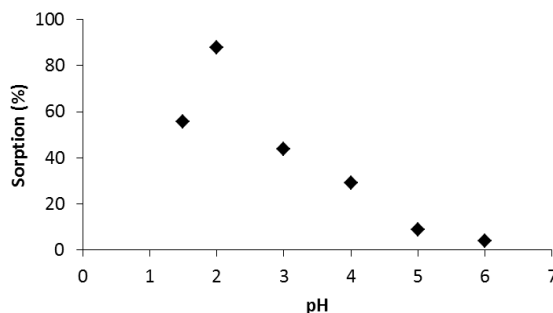


Fig. 3. Effect of pH on the adsorption of Cr(VI) by Cts-CbKS

The amount of Cts-CbKS in the solution is related to the number of surface active sites for the adsorption process. For this reason, as the amount of Cts-CbKS increases, it is expected an increase in the adsorption percentage of Cr (VI). The adsorption amount of Cr (VI) was determined by adsorption experiments with different mass values (1.0-3.0 g/L). % adsorption versus varying amounts of adsorbent was plotted in Fig. 4. When the amount of Cts-CbKS was increased, the percentage of adsorption is increased to the plateau value at the equilibrium stage. The amount of adsorbent to be used in the experiments was taken as 2 g/L for Cr (VI).

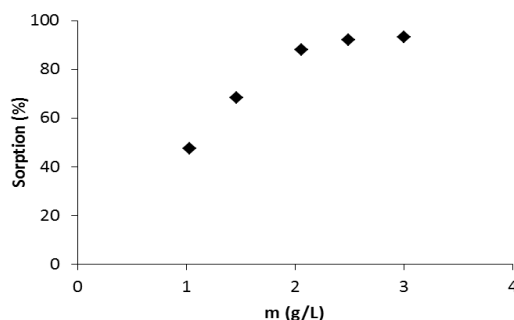


Fig. 4. Effect of by Cts-CbKS dosage on the percentage removal of Cr (VI)

The effect of contact time on the removal of Cr (VI) was shown in Fig. 5. As seen in this figure, the adsorption capacity increased rapidly in the first 30 minutes due to the increase in the adsorption. The increase in the adsorption capacity slowed down in 30-120 minutes. After 120 minutes, even when time passed, the increments seemed small and system-balanced in a negligible level. The equilibrium for Cr (VI) was briefly obtained and the contact duration was chosen to be 120 min.

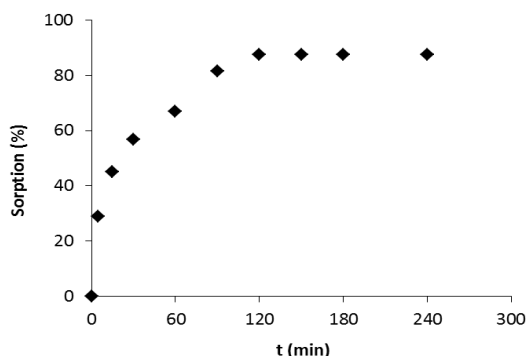


Fig. 5. Effect of contact time on removal of Cr (VI)

Cts-CbKS prepared from cranberry kernel shell can be used as an effective adsorbent for the adsorption of Cr(VI) ions from the aqueous solutions. It was found that the adsorption depended on pH and the optimum pH for the removal was 2.0. The adsorption of Cr(VI) obeyed the Langmuir equation. Maximum capacity (q_m) according to the Langmuir isotherm was 78.13 mg/g for Cr(VI). Cts-CbKS is expected to be economical to remove the Cr (VI) from the wastewater plants.

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Genetic Diversity in Backcross Wheat Mutant Population

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Abstract: Induced mutations using mutagenic agents change in plant genome architecture and play a significant role in adaptation to adverse conditions. Therefore, mutants are valuable germplasm resources in crop improvement programs. DNA based molecular markers have become the most effective tool and feasible method for assessment of genetic diversity and structure in a plant germplasm. In the present study, we have focused on constructing a mapping population from crossing Sagittario and M₆ Sagittario derived drought tolerant mutant(s). The genetic diversity of this population was screened using over the 200 SSR (Simple Sequence Repeats) markers. Consequently, a total of 287 bands (alleles) were detected using SSR markers. Polymorphism rate (23.34%), polymorphic information content (0.72), marker index (1.83) and resolving power (1.16) were recorded according to SSR marker results. Two SSRs, Xwmc170 and Xwmc416 were identified as the most useful markers and proved information for diversity. UPGMA dendrogram classified the backcross mutant lines into five main groups.

Keywords: Wheat, Genetic diversity, Backcross mutant population, SSR markers, UPGMA.

1. INTRODUCTION

Several abiotic and biotic stressors affect production and productivity of wheat worldwide (Shewry, 2009). In order to protect it by stressors different strategies are developed. However the technologies to reclaim land are expensive, so its implementation is often not economically viable. Therefore, improving novel lines, which are tolerant/resistant of these stresses, seem to be the ultimate solution (Rana et al., 2015). Induced mutations via artificially ways bring about heritable changes on plant genome and offer new genetic varieties, which are resilience to climate change and tolerant to environmental stresses (www.iaea.org/topics/plant-breeding) or germplasm recourses to implement breeding programmes (Song et al., 2012). Mapping populations generally consist of individuals of one species and are used to identify genetic factors or loci that influence phenotypic traits and to determine the recombination distance between loci (Schneider, 2005). DNA based molecular markers frequently use to investigate the polymorphism in plant genomes (Tahir, 2010). Among the molecular markers, microsatellites or SSRs are multiallelic, chromosome-specific, evenly distributed along chromosomes, and have been developed and widely used for studies of wheat genetic diversity (Mason, 2015) and genetic mapping, such as association to drought tolerance in *Triticum* species (Barakat et al., 2015). The aim of the present investigation was to identify genetic diversity in a constructed mapping population (BCF₂) developed using Sagittario (elit cultivar) and M₆ Sagittario derived drought tolerant mutants via gamma ray applications with SSR markers. The parameters of polymorphic information content (PIC), marker index (MI) and resolving power (Rp) were used to calculate according to SSR markers profile and genetic distance among the candidate mutants was assessed by Unweighted Pair-Group Method with Arithmetic Mean (UPGMA) dendrograms.

2. MATERIALS AND METHODS

A mapping population of 112 BCF₂ developed from crossing between Sagittario and M₆ Sagittario derived drought tolerant mutant. Seeds of the 112 BCF₂, Sagittario (elite cultivar) and 2 M₆ Sagittario derived drought tolerant mutant lines induced with gamma ray application used to construct mapping population were germinated in petri dishes and leaves from them were used to isolate genomic DNA. In order to isolate genomic DNA, 2x Cetyl Trimethyl Ammonium Bromide (CTAB) buffer was used (Doyle and Doyle 1990). The quality and quantity of purified genomic DNA were estimated with spectrophotometry and gel electrophoresis. Each sample was diluted to 25ngμL⁻¹ in TE buffer and stored at 4°C. Genomic diversity was analysed by using over the SSR markers. In SSR analysis, the reaction mixture (total 25μL) was consisted of 400nmol of forward and reverse SSR primers, 0.2mM of each nucleotide, 2.5mM MgCl₂, 10x Polymerase Chain Reaction (PCR) buffer, 1unit of *Taq*-DNA polymerase, and 75ng of genomic DNA. As depicted previously in the study of Shahzad et al., (2012), sample amplification, separation on 2.5% agarose gel electrophoresis and gel staining were carried out in this analysis. Comparison of mutants was carried out based on the presence or absence of fragments produced by SSR primer amplifications. The Multivariate Statistical Package v3.1 (Kovach, 1999) was used to estimate genetic diversity with Nei and Li's similarity coefficients to construct a UPGMA dendrogram with a neighbor-joining algorithm (Nei and Li, 1979). PIC, MI, and Rp were calculated according to Anderson et al., (1993), Powell et al., (1996), and Prevost and Wilkinson (1999), respectively.

3.RESULTS AND DISCUSSION

Results

The genetic diversity of this population was screened using 203 SSR markers. A total of 287 bands (alleles) were detected using SSR markers. Polymorphism rate (23.34%), polymorphic information content (0.72), marker index (1.83) and resolving power (1.16) were recorded according to SSR marker results (Table 1). Two SSRs, Xwmc170 and Xwmc416 were identified as the most useful markers and proved information for diversity. UPGMA dendrogram classified the backcross mutant lines into five main groups (Figure 1).

Table 1. Effectiveness of SSR marker in detecting polymorphism

Parameters	Results
Primer Numbers	203
Total bands scored	287
Polymorphic fragment scored	67
Percentage of polymorphism	23.34
Minimum polymorphism scored per primer	1
Maximum polymorphism scored per primer	4
Average polymorphism scored per primer	2.1
Average PIC	0.72
Average MI	1.83
Average Rp	1.16

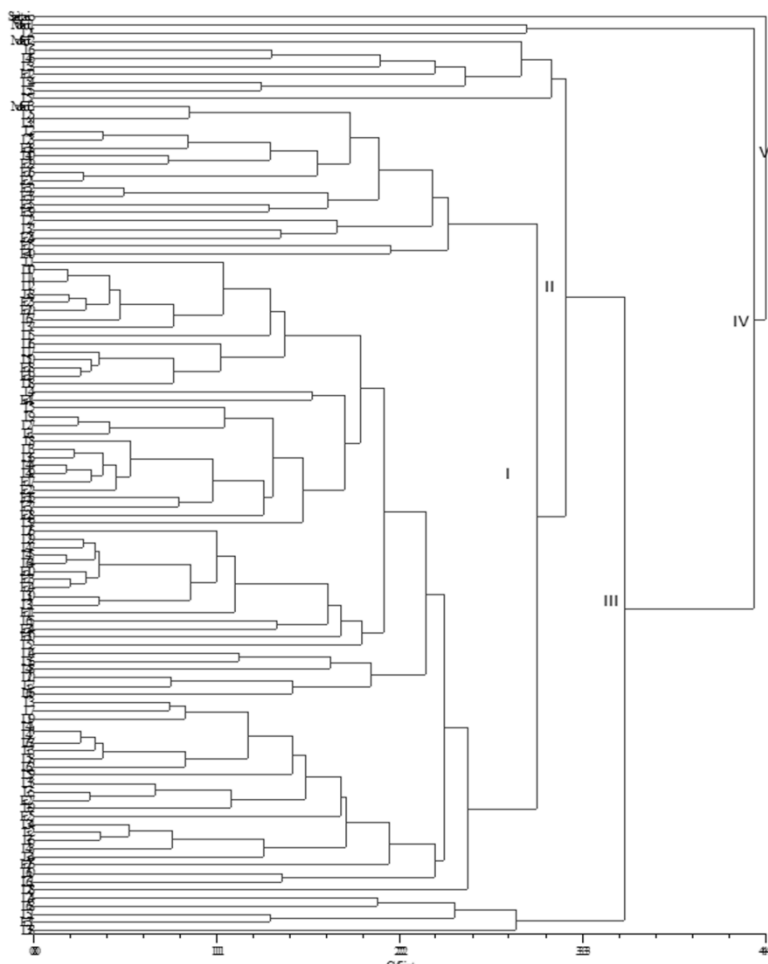


Figure 1. UPGMA dendrogram of SSR data using Nei and Li's coefficient showing relationships between Sagittario (elite cultivar), 2 M₆ Sagittario derived drought tolerant mutant lines used to construct mapping population and 112 BCF₂ lines

Discussion

Increasing genetic diversity, where genetic diversity has especially been shrinking due to various reasons such as domestication, and detecting it for germplasm improvement and innovation are the main tasks in wheat breeding programmes. In order to detect DNA alterations, molecular markers are more efficient and faster than other techniques and they can be applied at any plant developmental stage. Among the molecular markers, microsatellites or SSRs are multiallelic, chromosome-specific, evenly distributed along chromosomes, and have been developed and widely used for wheat genetic diversity studies (Tahir, 2010) and provide an opportunity to study quantitative traits such as drought tolerance via quantitative trait loci (QTL) analysis (Barakat et al., 2015). In breeding genetics, mapping populations are the tools used to identify the genetic loci controlling measurable phenotypic traits such as tolerance to drought stress (Barakat et al., 2015). The main goal of creating this population is to illuminate the molecular structure that may be related to tolerance to drought in the mutant lines with improved tolerance to drought obtained in the previous study. So, QTL analysis is planned in the next step in this study.

Summarizing all results obtained from SSR markers showed that the mutant lines used to construct mapping population and BCF₂ lines were genotypically different from elite cultivar (i). The numbers of polymorphic markers are not enough to QTL analysis (ii). So, it was decided to increase the number of polymorphic markers with further analysis (iii).

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Effect of Whey Protein Concentrate as Fat Mimetic on the Structure and Textural Properties of Labneh Cheese

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Abstract: In recent years, since excess adiposity is thought to be responsible for the development of chronic diseases, people prefer reduced intake of dietary fats having low- or reduced-fat and fat free foods, which has led to the development of nutraceutic foods. Many ingredients have been developed for the specific purpose of fat replacement in functional dairy foods. Objective of this study was to develop reduced-fat (12% fat) and low-fat (6% fat) Labneh cheese using whey protein concentrate (WPC) as a protein based fat mimetic. The results revealed that the addition of WPC enhanced viscosity, altered the textural properties, and microstructure of low-fat Labneh cheeses.

Keywords: Labneh Cheese, Fat Mimetic, Whey Protein Concentrate (WPC)

1.INTRODUCTION

Fat-reduced or low-fat food; refers to "foods that have a lower fat content than the reference fat ratio". Nowadays, health problems related to obesity, diabetes mellitus, cardiovascular diseases, hypertension and stroke, cancer and metabolic syndrome have led to greater consumer awareness for healthier, fat-reduced foods (Delas, 2011). As a result, the demand for low-calorie foods has increased and many researchers have been done especially in dairy products to reduce the amount of fat in foods and to develop new products with the use of oil-like substances (Ritvanen et al. 2005).

Milk fat in cheese; besides being a source of energy, also plays an important role in functional and technological properties such as textural, flavor and aroma profile (Romeih et al. 2002). However reduction of fat in cheeses caused the bland, harder, and more rubbery/chewy texture, color and melting defects compared to its full-fat system (Aryana and Haque, 2001). In order to prevent defects caused by fat reduction in cheese; modification of the production process, selection of suitable starter cultures, auxiliaries and enzymes, use of fat substitutes are methods applied (Mistry, 2001; Banks, 2004).

Using of fat replacers decrease the calorific value of cheese and but also improve the functionality of milk fat in cheese due to rheological and sensory problems by reducing fat in low-fat products. Generally, the ingredients of fat replacers are fats, proteins, or carbohydrates, giving similar physiochemical properties as milk fat. Fat replacers are classified into two subgroups; Fat substitutes which are fat based indigestible macromolecules with a caloric value lower than that of milk fat, or fat mimetic often called protein and/or carbohydrate based fat replacers which are polar, water soluble compounds having different chemical structures in contrast to fat. Fat mimetics are the commonly used ingredients for producing emulsion-based reduced-fat products. They give some functional properties of fats such as viscosity, mouthfeel, appearance and desirable rheological and eating qualities. Their major functions are gelling, water binding, viscousifying, stabilising, suspending, emulsifying properties and adhesion (Sandrou and Arvanitoyannis, 2000; Metzger and Kapoor, 2007).

The use of whey protein concentrate (WPC) in dairy products would be an alternative trend for maintaining the favorable sensory and textural quality with more functional properties for the consumer. WPC has been considered an interesting fat- mimetic ingredient due to its technological properties, as well as its nutritional appeal since it contains high concentrations of bioactive proteins. WPC are used in reduced-fat foods, either alone or in combination with other fat mimetics (Solowiej et al. 2010; Delikanli and Ozcan, 2014).

Labneh cheese is a popular fermented milk product in the Eastern Mediterranean countries. This study aims to develop reduced-fat (12% fat) and low-fat (6% fat) Labneh cheese using WPC as a protein based fat mimetic.

2. MATERIALS AND METHODS

Labneh Cheese Manufacturing

Milk standardized to 18% (full-fat control Labneh cheese, FC), 12% (reduced-fat Labneh cheese, RC) and 6% (low-fat Labneh cheese, LC) fat ratio with homogenized and pasteurized cream. 2% w/w (prepared in sterilized reconstituted milk 12% w/w) WPC (Enka, Konya/Turkey) was added into reduced fat (12%, RW) and low fat (6%, LW) cheese milk then it was pasteurized (85°C, 1 min) and cooled to inoculation temperature. Milk was inoculated with addition of 3% culture consisting of *Streptococcus thermophilus* and *Lactobacillus delbrueckii* ssp. *bulgaricus* (Clarici Sacco, Italy) and incubated at 42°C until the final pH value was reached at 4.7. Salt (0.5%) was added with stirring to cheese curd while heating at 85°C for 5 min. The packaged cheese was stored at 4±1 °C for 120 days (Aydinol and Ozcan, 2018).

Analysis

Textural characteristics of the cheese samples were determined on TA-XT Plus Texture Analyzer (Stable Micro Systems) using texture parameters firmness, work of shear, stickiness, and work of adhesion (Aydinol and Ozcan, 2018). The microstructure of samples was visualized by scanning electron microscopy (SEM), according to Hussein and Shalaby (2014). Statistical analysis was performed using SAS and StatisticaTM.

3. RESULTS AND DISCUSSION

Texture represents rheological, structural and sensorial properties which affected with casein matrix density and fat globules embedded within the protein matrix. Increasing casein bond strength and density results in enhanced firmness of the matrix of cheese. Besides, fat has the significant role in curd structure which improves the textural properties of cheese such as appearance, palatability, smoothness, melting, oiling off and shredability (Rogers et al. 2010; Ozcan, 2013).

Textural properties of the Labneh cheese samples are shown in Fig.1. There was significant difference observed between reduced fat (12%) and low fat (6%) cheeses produced with WPC ($P<0.01$). In this study firmness, work of shear, stickiness, and work of adhesion properties of reduced fat (RW) and low fat (LW) cheeses with WPC samples were significantly higher due to the emulsification property of WPC and new formation of cheese curd.

Lobato-Calleros et al. (2002) explained that using fat-replacers give rise to new structures and matrix than whole milk gels due to the interactions between the casein chains and the fat-replacers. Whey proteins and WPCs are mainly used in dairy products with functional properties such as solubility, gelation, emulsification, fat substitution and water binding (Delikanli and Ozcan, 2014). Sołowiej (2007) and Sołowiej et al. (2010) indicated that the addition of whey protein to process cheeses increases the hardness of the final product with respect to the increase in water binding capacity as a result of replacing casein with these proteins.

Firmness, work of shear, stickiness, and work of adhesion parameters of cheeses were determined the highest values in the 1st day while decreasing during the storage time (Table 1). Stickiness and work of adhesion were important textural attribute that was significantly affected by fat reduction in low and reduced fat Labneh cheese with WPC (RW).

Gunasekaran and Ak [2003] reported that the hardness/firmness of cheese reflects the physicochemical state of constituents i.e. solid to fat ratio, cheese macrostructure, heterogeneities of granules in curd, fissures and cracks. WPC increased firmness in RW samples while enhancing of adhesiveness and preventing serum separation in cheese such as explained by Britten and Giroux (2001).

Proteins function as a fundamental element in creating the structure of foods. Karaca et al. (2009) reported that fat-reduced samples with added protein using inulin, microparticulate protein and maltodextrin as fat substitute and fat mimetics had better texture than the control group and other supplemented samples. Johnson (2000) explained that WPCs increase the viscosity of the product as well as the tendency to stickiness.

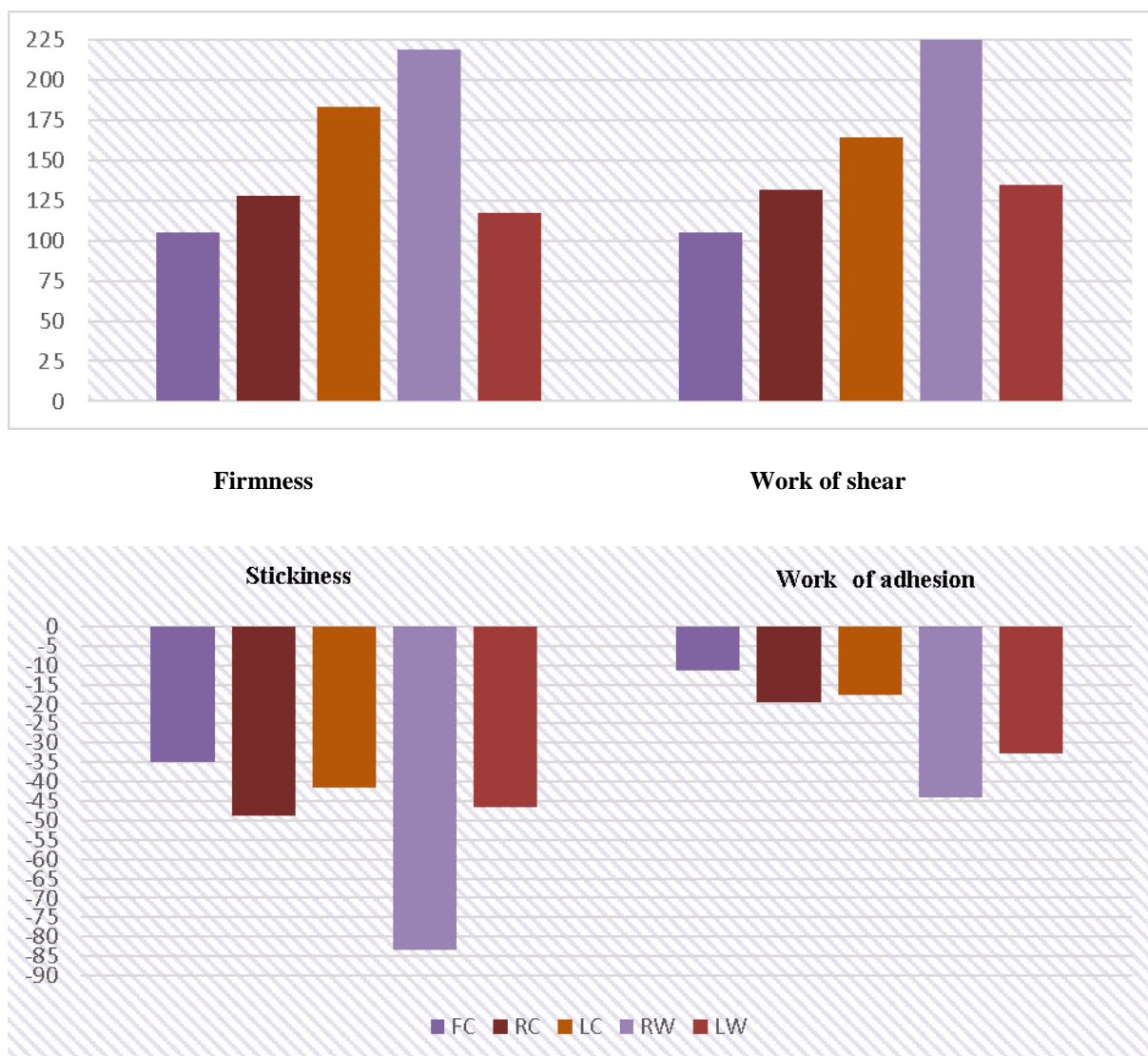


Figure 1. Textural properties of Labneh cheese using WPC (FC: Full fat cheese, RC: Reduced fat cheese, LC: low fat cheese, RW: reduced fat cheese with WPC (12%), LW: low fat cheese with WPC (6%)).

Table 1. Textural properties of Labneh cheese during storage (120 days)*

Ripening time	Firmness	Work of shear	Work of adhesion	Stickiness
1	103,40 ^a	54,94 ^a	-317,38 ^a	-293,88 ^a
60	15,44 ^b	9,30 ^b	-57,08 ^b	-57,66 ^b
120	18,69 ^b	11,92 ^b	-83,31 ^b	-84,64 ^b
Ripening time	**	**	**	**

*Significance level: significant at $p < 0.01$ (**), Different superscript letters on the same column indicate significant differences

Britten and Giroux (2001) reported that denaturation of whey proteins due to the effect of temperature, followed by increase of viscosity by formation of protein aggregation and gel formation. WPCs also surround the fat globules between the interfacial membranes, providing a creaming, adhesion-prone and oil-free emulsification feature (Beuschel et al. 1992).

Confocal laser scanning microscopy images were taken to evaluate the changes in the structure of the milk protein network and coarsely distributed fat and cheese particles (Fig. 2). Confocal laser scanning microscopy was chosen to visualize major changes in the formation of the protein/fat particle network and confirm differences in texture and sensory evaluation, as well as water loss after processing and storage, using WPC in Labneh Cheese. When the obtained images

were examined, it was seen that the homogeneity of protein matrix of 6% and 12% fatty WPC supplemented (LW, RW) Labne cheeses was better and showed a related structure. In 6% fat control (LC) cheese serum blanks were detected more. Whey proteins form a smooth and creamy texture; as well as increasing nutritional value by researchers (Huginin, 2009; Salvatore et al. 2014).

Given the rapidly growing world population, cheese is a dairy product that has an important place in human nutrition. Fat is a basic ingredient of cheese with specific sensory perception in texture such as bite and mouthfeel. Low fat cheeses are usually characterized as having poor functional properties. Using of protein based fat replacers such as WPC in Labneh cheese formulation could solve the problems associated with enhancing technological properties. In conclusion, addition of WPC to Labneh cheese milk improved the textural and sensorial properties of reduced fat and low fat Labneh cheeses. Moreover dietary fats are not just energy-rich components but also essential lipid components. Therefore, to bear in mind fat-free diets are unacceptable as a long-term therapy for obesity and other disorders.

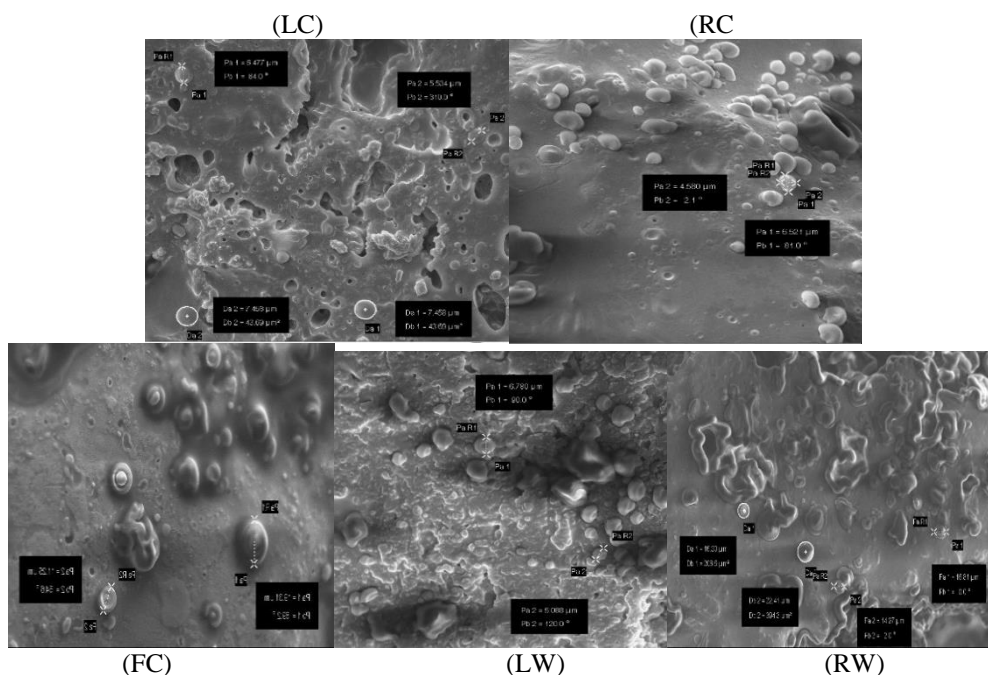


Figure 2. Microstructure of Labneh cheese using WPC (FC: Full fat cheese, RC: Reduced fat cheese, LC: low fat cheese, RW: reduced fat cheese with WPC (12%), LW: low fat cheese with WPC (6%)).

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The Evaluation of the Textural and Sensorial Properties of Chocolate Dairy Dessert

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Abstract: The objective of this study was to characterize the textural, sensorial and color properties of chocolate dairy dessert. To verify properties of these products, random samples were collected from industrial and artisanal manufactures in Bursa. Instrumental texture analyses for hardness, adhesiveness, cohesiveness, springiness, gumminess, chewiness and resilience were carried out. The five-point hedonic scale was used to measure acceptance-preference of product by trained panelists. The color, texture and sensory analyses indicated that the chocolate dairy dessert made using artisanal methods presented distinct characteristics than industrial methods.

Keywords: Chocolate dairy dessert, texture, sensory, consumer acceptability

1.INTRODUCTION

Nowadays, people are being more interested in dessert consumption along with the rapid change in popular life style and eating habits. Concerning consumer preferences, a pleasant taste and an attractive texture are essential key parameters for acceptability of a dairy dessert. Dairy desserts have important contributions to daily diet as being a major source of calcium and vitamin D, and also phosphorus, potassium, magnesium, riboflavin, niacin, essential fatty acids and protein (Akpınar-Bayizit et al., 2009; Abdel-Latif and Saad, 2016).

Dairy desserts exist in a broad variety of products. They are prepared with various formulations which are widely appreciated by consumers. They can be formulated with several traditional and/or innovative additives. These ingredients result in a wide variety of textures aside with nutritional, physical, and sensory characteristics that interact directly with consumer acceptability and technological properties. The knowledge of the textural and sensorial properties during shelf life is another key parameter for consumer preference of dairy desserts since the predicted shelf life is generally related to organoleptic characteristics (Akpınar-Bayizit et al., 2009; Arcia et al., 2011; Celeghin et al., 2016; Estevam et al., 2017).

Knowledge of the textural properties of dairy desserts during storage is critical since the shelf life depends on maintaining the desired physical, chemical and sensory quality characteristics throughout storage. Instrumental texture profile analysis (TPA) have been extensively studied used to evaluate textural properties of desserts, which play an important role on sensory perception and consumers' acceptance (Ares et al., 2010; Alamprese and Mariotti, 2011; Gonzalez-Tomas and Costell, 2006; Tarrega and Castell, 2007; Abdo Qasem et al., 2017).

It is necessary for the manufacturers to apply sensory and textural techniques to interpret the consumer responses for quality and preference. Consequently, sensory and texture evaluation of chocolate dessert can contribute, either directly or indirectly, to standardisation process, cost reduction, product formulation, determination of consumers' preferences, and quality maintenance (Imram, 1999; El-Gendi Marwa and El-Shreef Lamiaa, 2013).

The chocolate dairy dessert namely "chocolate pudding" is made from milk, plain flour, cocoa powder, sugar, vanilla extract and butter or margarine. It is preferred mostly by children and youngsters. In Turkey, chocolate dessert is manufactured either at small-scale with artisanal/traditional methods by factories or pastries or large-scale with mechanised processes. The traditional manufacturing is foremost based on empirical knowledge and experience passed on from one generation to another, and thus results in variations in physicochemical, textural and sensorial properties of the final products. Since the main quality parameters that directly link to consumers' acceptance are the sensorial and textural properties like viscosity, sweetness and taste, combining traditional production methods with the advantages of the technological improvements could offer consumers higher levels of quality for chocolate dessert (Morais et al., 2014). The main objective of this study was to evaluate the textural, sensorial and color properties of chocolate dairy desserts obtained from different producers and to understand the correlation between texture and sensorial characteristics for consumer preference.

2. MATERIALS AND METHODS

The samples were purchased from various artisanal (n=24) and industrial (n=8) manufacturers. The desserts, purchased in their original plastic or glass packages depending on the manufacturer, were held at 4°C until further analysis.

Instrumental Texture Analysis

Textural properties of samples were evaluated instrumentally using a texture analyzer TA-XT Plus (Stable Micro System Ltd, Model TA-XT plus, Surrey, UK). Before textural analysis, the samples were left at room temperature (25°C). Textural attributes were determined by TPA method fitted with a 5 kg load cell. A 20-mm-diameter cylinder probe was used to measure the texture profile of dessert and penetrated the samples to 75% of their original depth. The speed of the probe was fixed at 0.1 mm/s during the pretest compression and relaxation of the samples. The distance of penetration from the surface of sample was set at 20 mm. Parameters like hardness, adhesiveness, cohesiveness, springiness, gumminess, chewiness and resilience were calculated using the Texture Expert Exceed software (v 2.55) extracted from the resulting force time curves. All measurements were carried out in triplicates.

Instrumental Color Analysis

Instrumental color analysis of pudding samples was performed by using a Minolta Chromameter (Konica Minolta Co., Ltd., Osaka, Japan) calibrated with white calibration plate as specified by the manufacturer.

Sensory Analysis

Sensory evaluation of samples was conducted by a panel of seven trained panelists, specifically selected on the basis of their interest and experience in sensory evaluation of dairy products. Samples were removed from the refrigerator (4±2°C) 1 h prior to sensory evaluation and kept at room temperature (22±2°C). All samples were presented in three random numbers and served with a glass of water for mouth rinsing between samples. The five-point hedonic scale (1 = dislike extremely, 3 = neither like nor dislike, 5 = like extremely) was used to measure acceptance-preference of the product. All the samples were evaluated for sensory attributes such as color and appearance, odor, body and texture, taste, sweetness, cocoa ratio and overall acceptability.

Statistical Analyses

The results obtained from texture, color and sensory analysis were statistically analysed by one way analysis of variance (ANOVA) in order to observe differences between artisanal and industrial manufacturers.

3. RESULTS AND DISCUSSION

Textural Properties

The textural properties of samples obtained in this study has been depicted in Table 1. In this study, all textural parameters (hardness, adhesiveness, cohesiveness, springiness, gumminess, chewiness and resilience) were found significantly different within the dessert samples. Based on the data presented, it can be confirmed that the higher values of textural properties were found for samples from artisanal manufacturers.

Table 1. Textural properties of chocolate dairy dessert

<i>Parameters</i>	<i>Industrial Manufacturers</i>	<i>Artisanal Manufacturers</i>	<i>Level of Significance</i>
<i>Hardness, (g)</i>	125.91±26.746	188.98±24.260	**
<i>Adhesiveness (gs)</i>	-108.39±28.844	-155.30±15.435	**
<i>Gumminess (g)</i>	89.24±19.182	129.76±12.284	**
<i>Chewiness, Nmm</i>	79.17±13.893	119.09±19.581	**
<i>Cohesiveness</i>	1.22±0.085	0.75±0.003	**
<i>Springiness (mm)</i>	0.89±0.069	1.40±0.057	**
<i>Resilience</i>	0.22±0.112	1.37±0.046	**

**Significant at $P < 0.01$

Color Properties

Color is an important attribute for foods because it can increase or decrease their acceptability by consumers (Goldberg et al., 2012). The color analysis results were shown in Figure 1. In the CIELab color scale, the L^* parameter ranges from 0 to 100, indicating the color variation (brightness) from black to white; the a^* axis shows the variation from red (+a) to green (-a); and the b^* axis shows the variation from yellow (+b) to blue (-b). L^* (Lightness),

Although the responses for the color attributes showed no significant differences ($P>0.01$), the a^* and the b^* values of industrial samples were slightly higher than the artisanal samples. The differences observed in chocolate dessert samples were mainly dependent on the ingredients, formulation and manufacturing conditions.

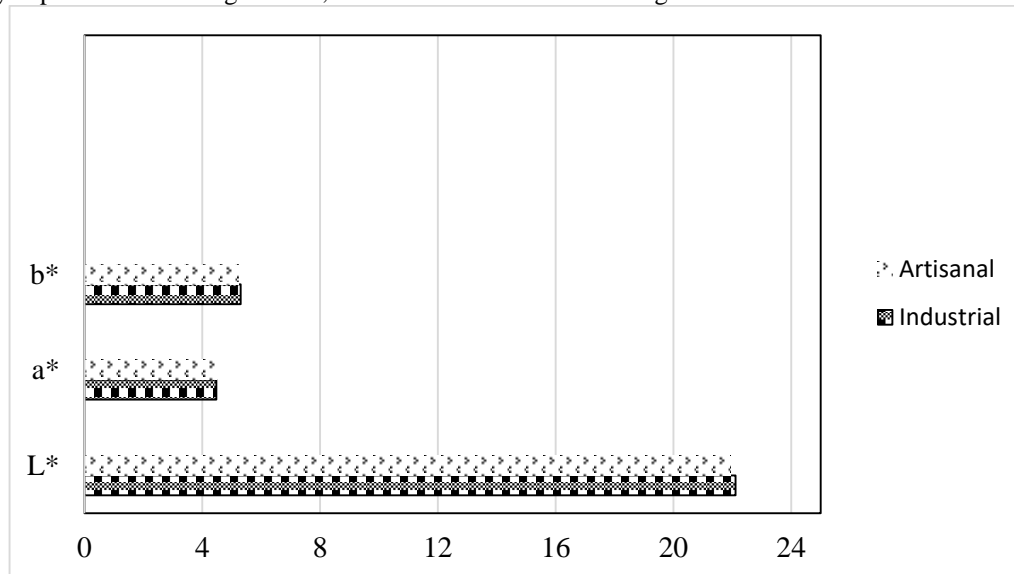


Figure 1. Color values of chocolate dairy dessert

Sensorial Properties

Sensory evaluation has a great influence on consumer preference as it helps to improve the organoleptic attributes of a product, including appearance, flavor and texture. In addition, it can also provide the development technologist with useful information in order to achieve and control quality, at a level which is particularly acceptable to the consumers (Celeghin et al. 2016). The results of the sensory evaluation are shown in Table 2. Graphical representation of the sensory attributes evaluated through the acceptance test is presented in Figure 2. Based on the evaluation significant differences ($P<0.01$) were observed among the sensory properties of the samples. In general, industrial dessert samples received the highest scores for all of sensorial properties.

Table 2. Sensorial properties of chocolate dairy dessert

Parameters	Industrial Manufacturers	Artisanal Manufacturers	Level of Significance
Color and appearance	4.81±0.460	4.56±0.564	**
Odor	4.85±0.233	4.49±0.577	**
Body and texture	4.74±0.448	4.30±0.819	**
Taste and Flavor	4.59±0.529	4.13±0.866	**
Sweetness	4.59±0.489	4.18±0.739	**
Cacao ratio	4.61±0.544	4.16±0.879	**
Overall Acceptability	4.58±0.485	4.23±0.749	**

**Significant at $P<0.01$

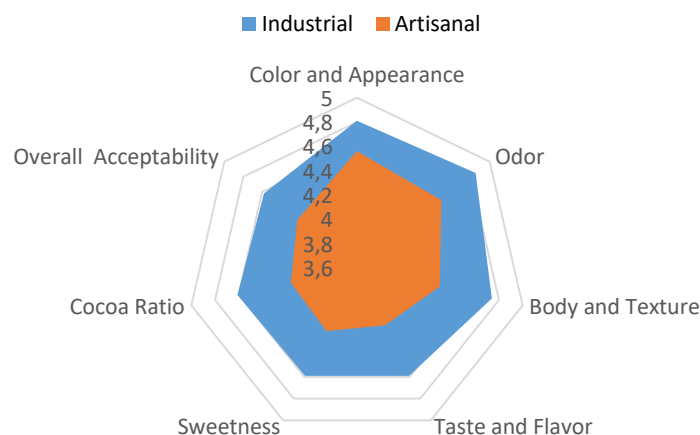


Figure 2. Graphical representation of the sensory analysis

Due to its nutritional value and unique taste, chocolate dairy dessert has become a common dessert choice and a delicious alternative to ice cream for people, in particular children and youngsters. The consumers' preference for chocolate dessert depends on its noteworthy flavor, taste, and excellent texture. The sensorial and textural quality is based mainly upon the ingredients used in the mix, which include milk, sugar, cacao and a thickening agent as well as the method of production. The results of color, textural and sensorial analyses indicated that chocolate dairy dessert obtained from different producers presented distinct characteristics. The study indicated that manufacturers who seek to improve the quality of dessert should rather focus on standardization of the manufacturing processes. This information will be useful to understand the similarities and differences of manufacturing methods in order to meet consumers' expectations aside with enhancing the market share of dairy desserts. Consequently, the sensorial evaluation approach could assist the food industry in designing new dairy-based product with nutritional and technological characteristics that meet consumer demands.

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Association between Intake of Yogurt Consumption and Sensory Aspects

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Abstract: Yogurt is made by fermenting milk with *Lactobacillus delbrueckii subsp. bulgaricus* and *Streptococcus thermophilus*. With the consumer interest in health and dietary issues, yogurt types have the biggest share among dairy products in Turkey. Therefore, the objective of this study were to assess on the identification of differences in the prevalence of yogurt intake according to the yogurt type, consumption time, frequency of purchasing, technologic-quality and hygiene parameters as well as consumer's demand for novel products. The results revealed that demographic, socio-economic, and lifestyle factors associated with yogurt intake had dissimilar effects, and consumption habits and perception of consumers were the main drivers for preferences regarding yogurt consumption.

Keywords: Yogurt, consumption behavior, sensory aspects

1. INTRODUCTION

The need for food is a basic, physiological need which is essential by human beings to sustain life and proper functioning of the body and depend on how or how much we are satisfied. Humans are faced with several food choices each day and their purchasing response to food products are determined by mainly four different drivers. First, consumers perceive the sensory characteristics of a product. Second, the consumer has a general response to a product, which is an affective component. Third, the consumer applies a cognitive component which is related to the information the consumer has about the product and to the consumers' attitudes and beliefs. Fourth, the response is affected by a behavioral component which involves the persons' intentions or actions for future behavior (Aksulu, 2009; Annunziata and Vecchio, 2011; Akpinar-Bayizit et al., 2017; Kaur and Singh, 2017).

It is important to estimate the consumers' behavior, expectations and attitude for marketing success of any product, service or trading form which, in particular, depends on consumers' sensory satisfaction and ethnic eating habits. An understanding of such factors helps producers in the decision-making process to meet the consumer expectations and stay competitive in the market (Keller, 2012; Vabø and Hansen, 2014). Consumer behavior studies analyse; i) the relation between needs for food products and daily ration taken, ii) the influences of personal and psychological attributes (age, occupation, education, motivation, perception and beliefs and attitudes), iii) culture, iv) reference groups v) society, and vi) marketing strategies (i.e. advertisements, leaflets, etc.) effective upon consumer decision for food purchasing. "Consumer Preference Surveys" are powerful tools to understand customers' behavior since cultural practices, sensory properties (color, taste, and texture), package and socio-economic status strongly influence the popularity of any product. Through encouraging consumers to complete surveys regarding their preferences, habits, dislikes, etc., producers hope to understand the consumer and often shape their product to meet the consumer demand (Kapsdorferova and Nagyoova, 2005; Keller, 2012; Vabø and Hansen, 2014).

Yogurt is a dairy product made by fermenting milk with a yogurt culture containing *Lactobacillus delbrueckii subsp. bulgaricus* and *Streptococcus thermophilus*. There are many types of yogurt such as plain, drinking, probiotic/prebiotic, fruity, that provide varying levels of nutritional benefits (FDA, 2013; Weerathilake et al., 2014; Fisberg and Machado, 2015). Yogurts with fruits/vegetables/cereals are not only an excellent source of antioxidants, prebiotic fibers and polyphenols but also relatively low in energy, thus can promote human health (Staffolo et al., 2012; Fernandez and Marette, 2017). Yogurt constitutes fundamental components of milk which is considered as the only foodstuff that contains all essential nutrients for human diet such as protein, B group vitamins (thiamine, riboflavin, niacin, vitamin B₆, and folate), vitamin A, vitamin C, calcium, magnesium, zinc, and essential fatty acids. Therefore, yogurt has been reported to reduce the risk of osteoporosis, due to calcium of which is generally associated with improved bone health, and prevent chronic diseases such as obesity, diabetes, hypertension, and heart disease (El-Abbadi et al., 2014; Buendia et al., 2018; Panahi et al., 2018).

As a consequence, the vast majority of consumers are aware of product type/characteristics and market prices of yogurt. In general consumer research surveys basically focus on the socio-demographic factors that affect consumption behavior and preferences such as age, occupation, education, motivation, perception and beliefs, attitudes, culture, reference groups, society, and marketing strategies (i.e. advertisements, leaflets, etc.) (Ferreira Mendes, 2013; Amarukachoke, 2015; Košičiarová et al., 2017; Wantasen et al., 2017). The individual consumer's acceptance for a food product takes

place in a complex context and is highly dependent on a multitude of factors such as cultural practices, sensory aspects (colour, taste, and texture), package, habits, dislikes and health consciousness (Aksulu, 2009; Annunziata and Vecchio, 2013; Cerjak and Tomić, 2015; Bimbo et al., 2017).

The present study focused on the identification of differences in the prevalence of yogurt intake according to the yogurt milk and yogurt type, preferred purchasing place, packaging material, technologic-quality and hygiene parameters as well as consumers demand for novel products.

2.MATERIALS AND METHODS

A quantitative-descriptive study was performed using by non-random sampling method. The questionnaires were administered between the months of January to March 2018 in Bursa, Turkey. The questionnaires assessed the attitudes, preferences and willingness of consumers to pay for yogurt, consumption patterns and their individual household demographic information. Initially, socio-demographic characteristics and the buying frequency of consumers were asked. A sample of 314 interviewee using the standard error formula ($n = Nt \ 2 \ pq / d \ 2 \ (N-1) + t \ 2 \ pq$) were selected with a 95% confidence level. The questionnaires were applied by face-to-face interviewing and 18-year-old consumers or older in different hours of the day in Osmangazi, Nilufer and Yildirim districts. The results were presented as means \pm standard deviations with coefficient of variation by SPSS 22.0 software.

3.RESULTS AND DISCUSSION

The present study assessed the tendency and determinants of consumers' perception and preferences towards yogurt in Bursa. Characteristics such as gender, age, education, profession, occupation, income level, and marital status, are typical examples of demographics which are used to describe a population. Of the interviewers, 26.20% were men and 73.80% women, and these were predominantly married (57.82%). Fotopoulos and Krystallis (2002) and Verbeke (2005) mentioned that females are the main food-purchase decision-makers of the household. With respect to age, 57.51% of the respondents aged between 21-40 years. 27.47% of interviewers had only completed their basic education, 27.79% had completed their high school education and 44.08% had their bachelor or graduate degree. A total of 42.17% of respondents were working in private sector as workers or engineers, followed by 32.59% of non-working including housewives and students. A minimum monthly income of 3000 TL is generally considered as high income, and with respect to monthly income 57.50% of interviewers reported having an income more than this. The differences in consumers' personality traits, such as food-related personality traits, purchasing habits and lifestyles were found to be effective on their yogurt preferences.

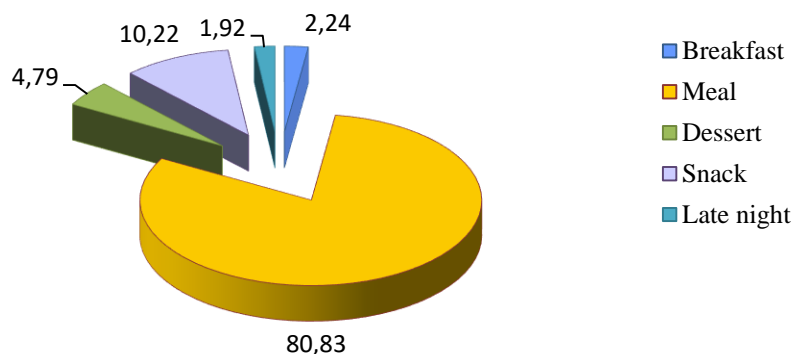


Figure 1. Consumers' preference for consumption time for yogurt (%)

As shown in Figure 1. yogurt was mostly preferred as for main meal (80.83%). In the present study the frequency of yogurt purchasing; 82.11% of consumers preferred to buy yogurt either on a weekly or two/three times a week basis.

Health consciousness, perceived quality, trusts in labeling and marketing and concern over food safety influence consumer behavior. The people participating in the survey mentioned that the most important parameters in yogurt purchasing were; "sensory characteristics" (26.52%), "health effects" (21.09%) followed by "price" (17.57%), "expiry date" (13.10%), "hygiene" (8.95%), brand (7.99%) and packaging (4.47%). The respondents mentioned yogurt quality was dependent on the sensory and taste/textural properties as well as the hygienicity of the applied technological processes and raw material. However, the respondents said the price had minor or no importance for yogurt preference, especially when taste and other sensorial parameters were taken into consideration.

Regarding the fat content, the buying intention of 34.82% of the respondents was for full-fat yogurt, 43.45% for reduced fat whereas for 2.56% consumers preferred “light yogurt” with fat content $\leq 0.05\%$ (Figure 2). In the present study 19.17% of consumers stated that fat content had no significance on purchasing. However, fat content seemed to be an influential factor for purchasing decision in relation to increased occurrence of chronic diseases and should be taken into account.

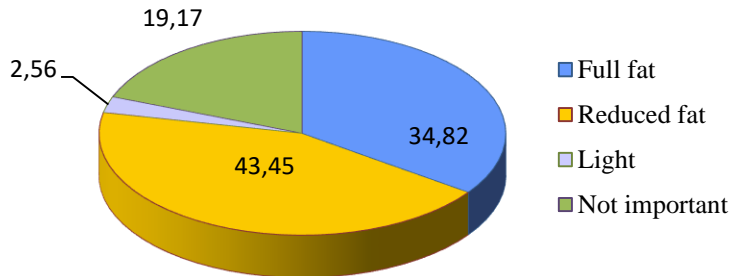


Figure 2. Preference for fat content

Majority of the respondents preferred plain (non-homogenized or cream-on-top) (41.85%), whereas 20.13% preferred homogenized and 21.41% flavored yogurt. Evaluation of the results showed that minority of respondents mentioned their preference for probiotic (14.06%) and drinking (8.65%) yogurts (Figure 3).

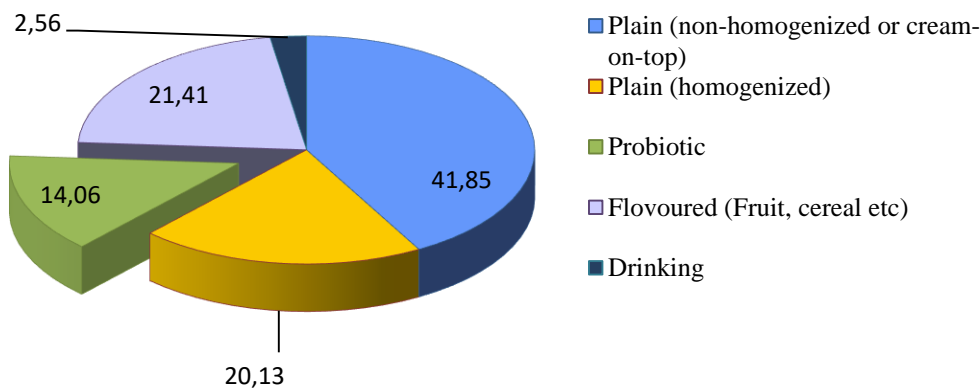


Figure 3. Consumers' preference for yogurt type (%)

Preferences for fruit type used in yogurt were forest fruit yogurt (74.76%), strawberry yogurt (46.96%), peach yogurt (20.45%), banana yogurt (12.78%) and apricot yogurt (11.50%). The consumers also stated that they want to see the following tastes on the yogurt market; melon (17.25%), pomegranate (12.46%), orange (12.46%), watermelon (10.54%) and mango (8.30%).

As a consequence, the vast majority of consumers are aware of product type/characteristics and market prices of yogurt. In general consumer research surveys basically focus on the socio-demographic factors that affect consumption behavior and preferences such as age, occupation, education, perception and marketing strategies. Our study suggests that there are several factors affecting their behavior for yogurt and the consumers can be categorized in different classes according to their expectations. The most important attributes that affects consumers' preferences towards yogurt are characteristics of socio-demographic, fat content, technologic-quality and hygiene parameters and types (e.g. homogenized, non-homogenized or cream-on-top, flavored and probiotic).

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Biochemical Properties, Biological Activities and Usage of Truffles

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Abstract: Edible mushrooms are considered and consumed as valuable foods in many cultures due to their unique flavor, taste, nutritional properties and biological activities. Amongst all the edible mushrooms, the truffles (Genus *Tuber*) have a number of distinctive characteristics. In general, they have no stalk, no gills, and its mycelium grows underground. Truffles are in association with lots of tree species such as oak, hazelnut, linden, beech, poplar, chestnut, walnut and pine. Today, the most popular species of truffles are *Tuber magnatum*, *T. melanosporum* and *T. aestivum*. Truffles are famous with their flavor and taste in all over the world. They are highly regarded in the gourmet culinary world, evident from the sobriquets “underground gold” and “diamond of the kitchen”. They also have a high economic value and amongst all other mushrooms, they are the most expensive mushrooms of the world. Each kilogram of truffles is sold on the open market from 600-6000 € (Euros) depending on species. Some popular delicacies using truffles include pasta, pizza, risotto, omelette, salads oil, jams and biscuits. Fresh black and white truffles are supplied in the season or they become truffled products either as a sliced food on the dishes (red and white meats, pasta, rice, entrees etc.) and soups or as sauces (truffle sauce, ketchup, mustard, barbecue sauce etc.), pastes (with different vegetables or other mushrooms), spice (truffle salt) and truffle juice. They are also used as an additive in dairy products (butter, cheese spread, Burrata, Boschetto al Tartufo, Sottocenere, Caciotta and Pecorino cheeses etc.), burger patties, caviar and truffle flour. In addition, truffled bonbons, honey and pasta (tagliatelle etc.) are available in the market. Furthermore, they can be found commercially processed as truffle balsamic vinegar, truffle olive oil, truffle vodka, etc. and preserved as in brine and canned. It has previously been reported that truffles are rich in protein, essential amino acids, fatty acids, ash, carbohydrates, dietary fiber, minerals and vitamin D. In addition, they have different sense of smells such as earthy, musky and pungent, coming from their volatile organic compounds including alcohols, aldehydes, alkanes, esters, ketones, terpenes, etc. Furthermore, truffles have antioxidant, antiviral, antimicrobial, hepatoprotective, anti-mutagenic, and anti-inflammatory bioactivities. It is stated in the recent researches that the bioactive compounds existed in truffles could be used as potential therapeutic agents. In this review, general information on the nutritional profile, aromatic composition and biological activities of some truffles and their usage in foods are presented.

Keywords: Truffles, nutritional, aromatic, bioactivity, therapeutic, food additive

1.INTRODUCTION

Edible mushrooms are considered and consumed as valuable foods in many cultures due to their unique flavor (Cho et al., 2006), taste (Naknaen et al., 2015), nutritional properties (Heleno et al., 2015) and biological activities (Ferreira et al., 2010). Amongst all the edible mushrooms, the true hypogeous truffles have a number of distinctive characteristics. In general, they have no stalk, no gills, and their mycelium grow underground (Hall et al., 2008). Most truffle fungi are ectomycorrhizal having symbiotic root associations. Truffles are in association with lots of tree species of the Pinaceae, Cistaceae, Saliaceae, Betulaceae, Fagaceae, Malvaceae and Myrtaceae (Luard, 2006; Hall et al., 2008; Castellano and Türkoğlu, 2012; Türkoğlu and Castellano, 2013; Geloğlu et al., 2014). Mycorrhizal symbioses play essential role in the life history of these fungi, survival and growth of the plant hosts, and ecosystem function including nutrition of many forest animals such as mammals, birds and insects (Türkoğlu, 2015).

Taxonomically, truffles are hypogeous Ascomycetes fungi belonging to the genus *Tuber*, the family Tuberaceae, and the order Pezizales (O'Donnell et al., 1997) and distributed in six Pezizalean families: Discinaceae-Morchellaceae, Glaziellaceae, Helvellaceae, Pezizaceae, Pyronemataceae and Tuberaceae (Kagan-Zur and Roth-Bejerano, 2008). All truffles are not edible but those of genus *Tuber* serve as a food source. Of the edible truffles, black and white truffles are the most highly prized in French, Spanish, northern Italian, and Greek cuisines (Luard, 2006; Hall et al., 2008). Certain types of truffles have been harvested in Europe since Roman times and likely earlier than that in Africa, Australia, Greece and the Middle East. In Europe today, the two most valuable truffle species are the Italian or Piedmont white truffle, *Tuber magnatum* pico, and the French or Périgord black truffle, *Tuber melanosporum*. Other species, such as *Tuber aestivum* (the Burgundy or black summer truffle) and *Tuber borchii* (the white bianchetto truffle) are also harvested in Europe (Luard, 2006; Hall et al., 2008; Wang and Marcone, 2011).

In Turkey, *Tuber aestivum* Vittad. (Solak et al., 2007; Türkoğlu et al., 2015), *T. borchii* Vittad. (Kaya, 2009), *T. brumale* Vittad. (Castellano and Türkoğlu, 2012; Türkoğlu and Castellano, 2014), *T. excavatum* Vittad. (Türkoğlu and Castellano, 2014), *T. mesentericum* Vittad. (Castellano and Türkoğlu, 2012; Türkoğlu and Castellano, 2014), *T. nitidum* Vittad. (Castellano and Türkoğlu, 2012; Türkoğlu and Castellano, 2014; Türkoğlu et al., 2015) and *T. rufum* Pico (Türkoğlu and Castellano, 2014) have been previously identified. It has also been reported that *T. aestivum* and *T. borchii*, which have a high economic value, naturally occur in our country. In addition, *T. magnatum* species grows naturally in Marmara, Eastern Black Sea and Eastern Mediterranean regions (Çaka and Türkoğlu, 2016).

High economic valued truffle species are grown in narrow geographical areas and in limited quantities. This causes the prices to rise day by day all over the world and the rising demand cannot be met. For example, *Tuber melanosporum* harvests have fallen from around 2000 tons in the 1900s to sometimes less than 100 tons annually (Olivier, 2000; Hall and Wang, 2002). Today, many *Tuber* species are used in new plantations (especially oak and hazelnut) consisting of mycorrhiza seedlings all around the world and commercial seedlings are cultivated after *Tuber* spores are successfully inoculated. In Turkey, there are also some studies on cultivation of truffles conducted by Universities, government establishments and TUBITAK (Anonymous, 2014; Türkoğlu, 2015; Korkmaz and Türkoğlu, 2016; Saka et al., 2017).

Truffle Hunting

Truffles are one of the most expensive foods in the world since they are uncommon. Black truffles are hunted between late November and early March for *T. melanosporum*; September or late December or the end of January for *T. aestivum*. White truffles are hunted between mid-October and end of December or the end of January for *T. magnatum*; during winter and early spring for *T. borchii* (Luard, 2006; Hall et al., 2008; Wang and Marcone, 2011).

Truffle hunting is regularly organized in Europe, especially in France and Italy, every year. Truffles are harvested with the help of female pigs or truffle dogs since they are able to sniff the strong smell of mature truffles buried deep inside the ground. Dogs are preferred to pigs since they do not eat truffles like the pigs do. Truffle hunting tours are organized both professionally and for the tourists all over the world as well as in the European countries (Anonymous, 2018a).

World Market, Truffle Fairs and Valorisation

Truffles also have high economic value, each kilogram of truffles is sold on the open market from 600 to 6000 € depending on species (Luard, 2006). Italian white truffles retail for \$1,500 or more per pound and Périgord black truffles for more than \$800 per pound.

There are some important fairs in Europe that bring the hunters, sellers and consumers close together. For instance, in Italy, the International Alba White Truffle Fair takes place every year between first week of October and last week of November at the weekends (Anonymous, 2018b). The highly prized *Tartufo bianco* (*Tuber magnatum* Pico) truffle bursts with aroma and flavor. It is too delicate for cooking, so is only served as fresh. The pricey truffle is literally worth its weight in gold.

Biochemical Properties

Nutritional profile

Researchers discovered that the nutritional contents of truffles varied from species to species. It has previously been reported that truffles are rich in protein, fat, fatty acids, dietary fibre, ash, essential amino acids (methionine, phenylalanine, valine, serine, isoleucine and threonine), carbohydrates, dietary fiber, vitamin D, ash, and metals (K, P, Fe, Cu, Zn and Mn). Moreover, truffles are rich in unsaturated fatty acids (UFA) and some kind of free sugars that are good for human health (Sawaya, 1985; Murcia et al., 2002; Janakat and Nassar, 2010).

Crisan and Sands (1978) reported crude protein 23.3%, crude fat 2.2%, carbohydrate 66.2%, crude fibre 27.9% and ash 8.3% of dry weight for *T. melanosporum* (Black truffle). Truffles are more richer in protein and minerals than other mushrooms and contain 53-76% water, 9% protein, 7% carbohydrate and 8% mineral (Türkoğlu, 2015). The protein contents of four different species of fresh truffles (*T. melanosporum*, *T. aestivum*, *T. magnatum* and *T. borchii*) were found as ranging from 8.7 to 24% per 100 g sample (dry weight). Most European truffles are rich in the sulphur containing amino acids (Saltarelli et al., 2008). A total of 20 free amino acids and five 50-nucleotides were identified in the *Tuber* fermentation mycelia and natural fruiting bodies. Not only the total contents of the free amino acids and 50-nucleotides, but also the contents of umami amino acids and flavour 50-nucleotides in the fermentation mycelia were higher than those in the fruiting bodies (Liu et al., 2012).

Truffles are also good source of sterols (Patel, 2012). The total lipid content of *Tuber* spp. fruiting bodies ranged from 3 to 5% of the dry weight, and the total sterol content ranged from about 1.0 to 2.5 µg/mg dry weight. In the same study, ergosterol was the principal sterol of *Tuber* species which also contained 28-44% brassicasterol depending on the species and source of the sample (Weete et al., 1985). Ergosterol (ergosta-5,7,22-trienol) and brassicasterol (ergosta-5,22-dienol) have been identified as key components of *T. melanosporum* (Harki et al., 1996).

In another study conducted by Yan et al. (2017), powder formulations of the *Tuber latissporum*, *T. subglobosum* and *T. pseudohimalayense* revealed the presence of essential nutrients such as proteins, carbohydrates and unsaturated fatty acids, and *T. latissporum* presented the highest contents of total sugar (50.10 g/100 g) and monounsaturated fatty acids (265.19 mg/100 g dw); *T. pseudohimalayense* showed the highest content of polyunsaturated fatty acids (367.98 mg/100 g dw). They all presented a low fat content, but high contents of proteins and unsaturated fatty acid, which is beneficial to human health.

A relatively high level of carbohydrates (30% by dry weight) and melanin (15% by dry weight) and the presence of rhamnose, calcium and iron are the factors characterizing the mature truffles (Harki et al., 2006). Potassium, phosphorus, iron, and calcium were found to be particularly abundant in European truffles (Saltarelli et al., 2008).

Aromatic composition

Gioacchini et al. (2005) identified 36 volatile organic compounds (VOCs) including alkanes, alcohols, esters, aldehydes, ketones, terpenes, etc. widely distributed in six different species of white and black truffles (*T. magnatum*, *T. borchii*, *T. dryophilum*, *T. aestivum*, *T. mesentericum* and *T. brumale*), all harvested from different geographical areas in Italy. The researcher confirmed that the influence of the geographical origin contribute to the specific variation in VOC profiles of the white truffle *T. magnatum*. Piloni et al. (2005) found 2 important aromatic compounds namely bis (methylthio) methane and dimethyl sulphide (DMS) in *T. magnatum*. In a study conducted by March et al. (2006), the six species of truffle examined were *T. aestivum*, *T. brumale*, *T. melanosporum*, *T. miesentericum*, *T. rufum* and *T. simonea*. Of the 36 volatile compounds identified, 15 of these compounds were observed from all 6 species. Dimethyl sulfide was identified from all species except *T. brumale*. Culleré et al. (2010) found that aroma compounds of black truffles include 2,3-butanedione, di-methyl disulphide (DMDS), ethyl butyrate, di-methyl sulphide (DMS), 3-methyl-1-butanol and 3-ethyl-5-methylphenol, and aroma compounds of summer truffles include DMS, DMDS, methional, 3-methyl-1-butanol, 1-hexen-3-one and 3-ethylphenol. In the same study, the aromatic rate order of different truffles from highest to the lowest were as black truffles, white truffles, and summer truffles. Aroma compounds detected in the black truffle *T. melanosporum* were 2,3-butanedione (Diacetyl), dimethyl disulphide (DMDS), ethyl butyrate, dimethyl sulphide (DMS), 3-methyl-1-butanol, and 3-ethyl-5-methylphenol (Liu et al., 2013). More than 200 microbial VOCs have been reported from truffles. The aldehyde 2-octenal is common to both white as well as black truffles, whereas bis (methylthio) methane has been identified as a major aroma component of the white truffle *T. magnatum*. Terpenoids such as carveol, p-cymene, cumene hydroperoxide, guaiane and limonene have also been detected in a number of truffles (Kanchiswamy et al., 2015).

Aroma of truffles can range from mild to intense, and can vary from onion, meaty, fruity green apple, cheese-like, roses, butter, earthy, garlicky, musky, pungent, vanilla-like, creamy, leathery, cooked potatoes, dusty to gasoline like (Culleré et al., 2010; Vita et al., 2015; Xiao et al., 2015).

Biological Activities

Truffles are rich in therapeutic compounds with anti-inflammatory, antioxidant, antiviral, antimicrobial, anti-mutagenic, anti-carcinogenic and hepatoprotective bioactivities.

Some recent reports had shown that the truffles contain various polyphenolic/phenolics, flavonoids or sterols, which are known as antioxidants due to their ability to scavenge free radicals by acting as reducing agents, hydrogen donating antioxidants and singlet oxygen quenchers. Truffles have vitamin A, vitamin C, β -carotene, total carotenoids, anthocyanins, total flavonoids, total esterified phenolic and total free phenolic compounds with antioxidant effects such as scavenging peroxy radicals and chelating ferric ions, thus reducing lipid peroxidation (Al-Laith, 2010; Patel, 2012). Antioxidant activity of the traditional edible truffles *T. latissporum*, *T. subglobosum* and *T. pseudohimalayense*, from China were evaluated. The methanol extract from *T. pseudohimalayense* showed a high radical scavenging activity and the highest content of total phenols (735.01 mg/100 g dw); *T. subglobosum* presented the highest content of flavonoids (1355.43 mg/100 g dw) (Yan et al., 2017).

Antimutagenic activities of fresh and irradiated black truffles (*T. aestivum*) from Italy were reported by Fratianni et al. (2007). The fresh truffle showed a stronger inhibitory effect than the irradiated truffle.

52 polysaccharides were isolated from the fermentation systems of *T. melanosporum*, *T. indicum*, *T. sinense*, and *T. aestivum*, and from the fruiting bodies of *T. indicum*, *T. himalayense*, and *T. sinense* by elution with an activated carbon column. These fermentation-derived polysaccharides exhibited invitro antitumor activity against a multitude of cancer cell lines such as HepG2 (human hepatocellular carcinoma), A549 (human lung adenocarcinoma), HCT-116 (Human colon carcinoma), SK-BR3 (human breast cancer), and HL-60 (Human promyelocytic leukemia) cells (Zhao et al., 2014).

Beara et al. (2014) reported that only *T. magnatum* showed anti-inflammatory potential by inhibiting COX-1 and 12-LOX pathway products synthesis. Methanol extracts exerted cytotoxicity against some tumour cell lines (HeLa, MCF7, HT-29), besides the prominent activity of water extracts towards breast adenocarcinoma (MCF7).

A new polyhydroxy sterol glycoside named tuberoside has been isolated from fruiting bodies of *T. indicum*. These compounds are assumed to be structural constituents of cellular membranes and precursors of steroid hormones that antagonise anxiety and act as sedatives by positively modulating GABA receptors (Jinming et al., 2001).

The intracellular polysaccharides isolated from the fruiting-body of *T. sinense* also had immunomodulating and antitumor activity (Hu et al., 1994).

Usage of Truffles

The truffles are served on the dishes as a food- sauce or spice- in the culinary field and also added into foods as a food additive such as butter or transformed into truffle products by processing such as truffle oil etc. It also has a very special place in perfumery, cosmetics and pharmaceutical industries (Hall et al., 2008; Rodríguez, 2008; Anonymous, 2014; Türkoğlu, 2015; Anonymous, 2018c).

Truffles' utilization in foods

Some popular delicacies using truffles include pasta, pizza, risotto, omelette, salad oil, jams and biscuits. Fresh black and white truffles are supplied in the season or they become truffled products either as a sliced food on the dishes (red and white meats, pasta, rice, entrees etc.) and soups or as sauces (truffle sauce, ketchup, mustard, barbecue sauce etc.), pastes (with different vegetables or other mushrooms), purees, spice (truffle salt) and truffle juice. They are also used as a food additive in dairy products (butter, cheese spread, Burrata, Boschetto al Tartufo, Sottocenere, Caciotta and Pecorino cheeses etc.), burger patties, caviar and truffle flour. In addition, truffled bonbons, honey and pasta (tagliatelle etc.) are commercially available in the market. Furthermore, they can be found commercially processed as truffle balsamic vinegar, truffle olive oil, truffle vodka, etc. and preserved as in brine and canned (Anonymous, 2018d, e).

A variety of "truffle oils" can be found in specialty stores. Virtually all are flavored with one or a few synthesized chemicals known to be in truffle scents, not the full suite of aromatic compounds found in real truffles. Olive oil is often infused with fresh truffles for immediate use such as dipping bread or drizzling on pasta.

Truffle gastronomy

Culinary truffles are obviously edible, but they are predominantly used for aroma flavoring. Their aroma differs by species and they must be smelled to be appreciated. Adjectives such as "fungal," "musky," "garlicky," "cheesy," "earthy," and even "fruity" all provide hints. Actually, they add more fragrance than flavor to a dish, and their scent is easily destroyed with cooking, so truffles are often added just before the dish is served; truffle-flavored products are minimally cooked. Some aromatic compounds of truffles cling to fat molecules, so any dish with fat in it can be enhanced with truffles. Olive oil, butter, eggs, meat, cheese, and cream are often infused with the flavor of truffles to add savor to pasta dishes, soups, omelets, dips, and spreads. Many people even find truffle-flavored vanilla ice cream to be surprisingly delicious.

Truffles are famous with their flavor and taste all over the world. They are highly regarded in the gourmet culinary world, evident from the sobriquets "underground gold" and "diamond of the kitchen" (Tang et al., 2015). Due to the unique and intense aroma of the white truffle, it should be served raw on rice, pasta, meat and eggs. Black truffle from Perigord are handled with gloves and priced by every paper-thin shaving you get in the restaurants.

Truffles must be harvested at full maturity, then marketed and used quickly. Because of growing underground, dirt clings to them, and because they are minimally cooked, they should be thoroughly cleaned. However, water used to clean them can hasten decay and shorten their shelf life, particularly if the outer surface is broken. Hence, truffles are usually brushed clean for market and then washed only immediately before use.

Storage after harvesting

Various methods are used to allow harvested truffles to "breathe" without becoming too wet or dry. Examples include placing them in waxed paper bags or nestling them in uncooked rice in jars. Microporous plastic bags designed for long-term storage of vegetables would likely also work. The truffles are highly perishable, they are incapable to retain their sensory and biochemical peculiarities for a long time. Drying, chilling and freezing are the common methods used to store truffles (Patel, 2012). Saltarelli et al. (2008) reported that refrigeration at 4 °C best preserves the biochemical and microbiological characteristics. Some studies on preservation techniques to extend the shelf-life of Black truffles such as irradiation (Nazzaro et al., 2007; Reale et al., 2009), modified atmosphere packaging (MAP) with microperforated films and treatment combination (MPA, electron-beam irradiation, refrigeration (4 °C)) (Rivera et al., 2011) were conducted. In MAP, high CO₂ and low O₂ atmospheres reduce the polyphenol metabolism, anerobic pathways and polyamine biosynthesis slowing senescence (Hajjar et al., 2010), so increase the shelf-life of truffles. Use of gamma rays

are potentially effective to improve the shelf life and save the sensory characteristics of truffles (Nazzaro et al., 2007). However, if applied in an inappropriate mode, irradiation could trigger unwanted sensory and chemical changes, resulting in free radicals, whose reaction with proteins, lipids and polyphenols, could increase the detrimental effects (AlRawi and Aldin, 1979).

Culleré et al. (2013) determined fifteen compounds with high aromatic potential in truffles. In the same study, the aroma of frozen truffles differed significantly from the aroma of fresh truffles. Methional and some phenols were suggested as markers of freezing time and 1-octen-3-one appeared as a general marker of freezing process. It was stated that truffle aromatic profile of the species *T. melanosporum* and *T. indicum* is mainly maintained after lyophilization whereas *T. aestivum* profile is substantially modified (Palacios et al., 2014).

T. aestivum and *T. melanosporum* species were decontaminated with the selected treatment, packaged with a microperforated film and stored at 4 °C for 28 days. In this situation, the microbial counts and the sensory quality were maintained throughout storage and the shelf-life of both truffle species were prolonged to 28 days (Rivera et al., 2011). The quality and microbiological characteristics of fresh truffles, packaged in 15% CO₂/ 7% O₂ at 4 °C, revealed that the microbial counts of *Pseudomonas* spp. and *Enterobacteriaceae* were decreased, the weight loss was reduced, the typical hard texture was maintained, and the development of mycelium growth was delayed, enabling good scores for aroma and flavor, and therefore prolonging the shelf life of *T. melanosporum* and *T. aestivum* truffles to 28 and 21 d, respectively (Rivera et al., 2010).

2.CONCLUSION

Apart from their enviable status in culinary domain, truffles have ample health roles as well. Antioxidant, anti-inflammatory, antimicrobial, anti-mutagenic, and aphrodisiac properties of truffles have been validated via in-vitro and in-vivo studies. It has been stated in the recent researches that the bioactive compounds existed in truffles could be used as potential therapeutic agents in nutraceuticals and antioxidant-rich supplements. However, research with regards to the chemical properties is very limited with some species which further limits the exploration of bioactivity of truffles. With the recent progress in food technology, more innovative ways are expected to be found to preserve truffles while maintaining their biochemical properties.

More research should be focussed towards the natural products extracted from truffles and their bioassay against different diseases and pathogens. Their special aromatic specialties and potential therapeutic activities may add value to truffle-related foods although therapeutic amounts have not been determined and accepted by the medical community. It is quite clear that further scientific studies need to pay greater attention on how to incorporate the determined biochemical and biological properties into the value-added truffles and truffle-related products.

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Mushroom Foreign Trade of Turkey in the Last Decade

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Abstract: Turkey is one of the most favorable countries in the world for the production and trade of edible wild and cultivated mushrooms and processed mushroom products due to its advantages such as its climatic characteristics, proximity to major markets, cheaper raw materials and labor. In this study, it was aimed to determine the edible mushroom species and processed mushroom products which are traded in our country and to make a general evaluation intended for edible mushroom export. Within the scope of the study, some mushroom exporter companies were interviewed in the years of 2016-2017, and data of The United Nations Food and Agriculture Organization (FAO), Turkey Statistical Institute (TUIK) and the Exporters' Associations were used. The most important exported mushroom species have been determined as *Agaricus* spp., *Amanita caesarea*, *Boletus* spp., *Calocybe gambosa*, *Cantharellus cibarius*, *Craterellus cornucopioides*, *Hydnum repandum*, *Lactarius* spp., *Morchella* spp., *Rhizopogon* spp., *Terfezia* spp., *Tricholoma* spp., and *Tuber* spp. These mushrooms are exported as fresh/cooled, frozen, pickled, canned and dried. Foreign trade of edible mushrooms is mainly done with European countries, Middle East, East Africa, Japan, USA, Canada, the Turkish Republic of Northern Cyprus and Georgia. Turkey has earned approximately 171 million \$ (USD) income from the foreign trade of edible mushrooms and mushroom products between the years of 2007 and 2017. It will be provided to increase the income obtained from foreign trade of these products through consciousness-raising of the public about the collection of wild mushrooms, provision of state support and mechanization in the production of cultivated mushrooms, use of actual processing methods in mushroom processing plants and provision of modernization, increase of competition power with foreign competitors and use of modern export marketing methods in foreign trade.

Keywords: Edible mushroom, processed mushroom, foreign trade, Turkey, exportation, importation

1. INTRODUCTION

Mushrooms are considered as a delicacy with high nutritional and functional value, and they are also accepted as nutraceutical foods (Manzi et al., 2001; Chang and Miles, 2008) of which around 25 species are widely consumed as food and few are commercially cultivated (Chang and Miles, 2008).

World mushrooms and truffles production reached to 10790859 tons in 2016 (FAO, 2018). *Agaricus bisporus* (button mushrooms), *Lentinula edodes* (shiitake mushrooms), and *Pleurotus* spp. (oyster mushrooms) represented 76% of the global mushroom market in 2013 (Markets and Markets, 2016), and *Volvariella volvacea* (paddy mushroom), *Calocybe indica* (milky mushroom), and *Ganoderma lucidum* (reishi mushroom) are also consumed worldwide (Boin and Nunes, 2018). In recent years, there has been an increase in the worldwide consumption of wild mushrooms such as *Lactarius deliciosus*, *Boletus edulis*, *Cantharellus* spp., *Hygrophorus* spp. and *Tricholoma* spp. (Fernandes et al., 2014; Han et al., 2015). The world market for the mushroom industry in 2005 was valued at over 45 billion American Dollars (Chang, 2006). These global trade values are much higher than other products (Allı and Şen, 2016). Nowadays, in more than 80 countries, wild growing mushrooms are collected in order to earn money (Boa, 2004).

The mushroom production quantity in Turkey was about 49000 tons in 2012 and 45000 tons in 2014 (Eren and Pekşen, 2016). Consumption of cultivated mushroom per capita per year was 4.0 kg in developed countries and 579.2 g in our country in 2014 (Royse, 2014; Eren and Pekşen, 2016). Because of low production (45000 tons), our cultivated mushroom consumption was low. On the contrary, edible wild mushroom consumption was high (Eren and Pekşen, 2016).

In Turkey, about 40 species of mushrooms are gathered from the nature for consumption and nearly 25 of them (e.g. *Boletus edulis*, *Cantharellus cibarius* and *Morchella* spp.) are sold commercially or exported abroad (Pekşen and Akdeniz, 2012; Okan et al., 2013). Turkey is one of the most favorable countries in the world for the production and trade of edible wild and cultivated mushrooms and processed mushroom products due to its advantages such as its climatic characteristics, proximity to major markets, cheaper raw materials and labor. Edible wild mushrooms constitute the main source of livelihood for forest villagers and provide significant foreign exchange income to our country (Pekşen and Akdeniz, 2012; Ak et al., 2016; Allı and Şen, 2016; Pekşen et al., 2016; Pekşen and Kaplan, 2017; Bulam et al., 2018). In addition, Turkey is an important country for mushroom foreign trade all around the World.

In this study, some knowledge about the edible mushroom species and processed mushroom products, which are traded in our country, are present.

2. MATERIALS AND METHODS

Within the scope of the study, some mushroom exporter companies were interviewed in the years of 2016-2017, and data of The United Nations Food and Agriculture Organization (FAO), Turkey Statistical Institute (TUIK) and the Black Sea Exporters' Union (KIB) were used.

Mushroom Exporting Companies

The mushroom exporter companies interviewed in the years of 2016-2017 were Akya Mantar Ltd. Şti., - Producer (Demiral Gıda Ürün. San. ve Dış Tic. Ltd. Şti. - Exporter) (Tekirdağ), Bektaş İth. İhr. ve Dış Ticaret Ltd. Şti. (Çanakkale), Çalışkan Tarım Ür. İnş. Taahhüt Tekstil San. ve Tic. Ltd. Şti. (Denizli) and Doğa Mantar Ürünleri Üretim Soğuk Hava Depolama Pazarlama San. ve Tic. Ltd. Şti. (Kastamonu) (Anonymous, 2017a, b, c, d).

3. RESULTS AND DISCUSSION

The most important exported mushroom species from Turkey have been determined as *Agaricus* spp., *Amanita caesarea*, *Boletus aereus*, *B. edulis*, *Calocybe gambosa*, *Cantharellus cibarius*, *Craterellus cornucopioides*, *Hydnum repandum*, *Lactarius* spp., *Morchella conica*, *M. esculenta*, *Rhizopogon* spp., *Terfezia* spp., *Tricholoma* spp. and *Tuber* spp. (Anonymous, 2017a, b, c, d; KIB, 2017; TUIK, 2018). In a study, *A. caesarea*, *Boletus* spp., *C. cibarius*, *C. cornucopioides*, *H. repandum*, *Lactarius* spp., *Morchella* spp., *Rhizopogon* spp., *Terfezia boudieri* and *Tricholoma* spp. were reported as the edible wild mushroom species exported abroad and their picking up times were also stated (Pekşen and Akdeniz, 2012). Ak et al. (2016) reported 10 edible wild growing mushroom taxa (*A. caesarea*, *Boletus* spp., *Calocybe gambosa*, *C. cibarius*, *C. cornucopioides*, *H. repandum*, *Lactarius* spp., *Morchella* spp., *Terfezia* spp., *Tricholoma anatolicum*) that had been exported to other countries from Turkey.

In addition, it was stated in this study that the processes such as the identification of the mushrooms, product processing, packaging and labeling, and giving the company name or brand were carried out by the companies themselves (Anonymous, 2017a, b, c, d) as previously reported by Ak et al. (2016).

In this study, the collection sites of edible wild mushrooms such as *A. caesarea*, *Boletus* spp., *C. cibarius*, *C. cornucopioides*, *Lactarius* spp. and *Morchella* spp. based on interviewed mushroom exporter companies are given in Table 1. Pekşen and Akdeniz (2012) stated the provinces where the edible wild mushrooms were gathered as Kastamonu, Bursa, Bolu, İstanbul, Amasya, Giresun, Sinop, Balıkesir, Zonguldak, Ordu, Artvin, Erzurum, Muğla, Denizli, Antalya, İzmir and Isparta.

Table 1. Collection sites of some edible wild mushrooms based on interviewed mushroom exporter companies in this study

Latin name	Locality
<i>Amanita caesarea</i>	Sinop (Erfelek), Samsun (Vezirköprü) and İstanbul (Şile)
<i>Boletus</i> spp.	Bursa (İnegöl, Mustafakemalpaşa), İstanbul (Çatalca), Bolu, Sinop (Erfelek, Boyabat), Tokat, Gümüşhane, Giresun (Bektaş plateau), Trabzon (Çarşıbaşı) and Kastamonu (Ayancık)
<i>Cantharellus cibarius</i>	Thrace Region, Kastamonu (all districts), Bolu (Mengen), Giresun (Center, mountains, plateaus), Sinop (Erfelek, Boyabat, Ayancık), Zonguldak (Çaycuma, Devrek), Tokat (Niksar, Erbağ), Amasya (Taşova), Samsun (Havza, Ladik, Vezirköprü) and Ordu (Akkuş)
<i>Craterellus cornucopioides</i>	Sinop (Erfelek), Kastamonu, Bolu, Balıkesir (Susurluk), Bursa (İnegöl) and İstanbul (Şile)
<i>Hydnum repandum</i>	Sinop (Erfelek, Boyabat) and Kastamonu
<i>Lactarius</i> spp.	Kastamonu and Samsun (Vezirköprü)
<i>Morchella</i> spp.	Muğla, Denizli, İzmir, Antalya, Çanakkale, Bursa, Adana, Konya, Yozgat, Gümüşhane, Kars, Ardahan, Sinop (Boyabat), Kastamonu, Çorum, Giresun (Alucra, Şebinkarahisar), Ordu (Mesudiye) and Samsun (Vezirköprü)

Ak et al. (2016) determined that the mushrooms were collected from all of the regions (60%), Mediterranean Region (20%), Marmara+Aegean Regions (10%) and Marmara+Aegean+Mediterranean Regions (10%).

In Turkey, edible wild mushrooms have been exported for about 30 years. Pacioni (1991) stated that edible wild mushroom species such as *Boletus* spp., *C. cibarius*, *Lactarius* spp. and *Morchella* spp. were important for Turkey and, *Boletus* spp., *C. cibarius* and *Morchella* spp. were exported 22 tons, around 10.5 tons and more than 47 tons in 1989, respectively. It was previously reported that *Boletus* spp., *C. cibarius*, *Morchella* spp. and *Terfezia boudieri* export from Turkey had a value of 14.4 and 9.5 million American Dollars for the years of 1991 and 1999, respectively (Sabra and Walter, 2001). On the other hand, mushroom import of Turkey varied between 60-400 tons during 2007-2014, the amounts were 312 and 395 tons in 2015 and 2016, respectively. But this amount decreased to 163 tons in 2017. Turkey paid approximately 29 million American Dollars for the importation of edible mushrooms and mushroom products between 2007 and 2017 (Table 2) (TUIK, 2018).

In Turkey, other economically popular mushroom taxa were stated as *C. cibarius* and *Morchella* spp. Both of two species are sold in the local markets and expense of *Morchella* spp. is about 100 Turkish Liras per kilograms as fresh. In addition, they have been exported other countries. Moreover, in Black Sea Region, *Morchella* spp. (Morel, Kuzu Göbeği), *Boletus* spp. (Bolet, Ayı Mantarı) and *C. cibarius* (Sarı Mantar, Sarıkız, Tavuk Mantarı) were stated in the first 3 place in exportation. *Morchella* spp. of Turkey ranks 1st place in terms of quality all around the world (Anonymous, 2017a, b, c, d). It was previously determined that *Boletus* spp., *C. cibarius*, *H. repandum* and *Morchella* spp. were exported abroad (Pekşen et al., 2016; Pekşen and Kaplan, 2017; Bulam et al., 2018).

Turkey is a natural habitat of truffles with Spain, France and Italy due to its suitable climatic conditions and 42 truffles taxa have been identified in Turkey (Türkoğlu, 2015). Truffles having unique taste and aroma are one of the most expensive mushroom groups as 100-2500 American Dollars per kilograms (Boa, 2004). Truffles collected from Turkey are exported in variable amounts, yearly. However, it is not clearly known which taxa have previously been exported.

Table 2. Foreign trade of edible mushroom and mushroom products in Turkey

Years		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
FRESH MUSHROOM	Export Amount (tons)	401	671	1.067	780	550	474	301	401	737	517	544
	Value (thousand \$)	5.962	8.576	11.791	7.522	8.888	7.822	6.156	6.735	9.230	4.601	6.152
	Import Amount (tons)	0.2	4	0.2	2	0.12	5	—	4	200	3	6
	Value (thousand \$)	8	29	16	6	11	56	—	5	12	18	29
PROCESSED MUSHROOM	Export Amount (tons)	635	1.283	1.756	993	1.087	1.099	1.069	1.225	1.701	1.006	988
	Value (thousand \$)	4.342	11.874	15.888	8.005	15.025	6.978	15.037	10.484	15.131	6.839	6.548
	Import Amount (tons)	166	347	224	217	87	79	60	83	112	392	157
	Value (thousand \$)	2.063	2.494	1.694	2.008	1.602	2.280	2.118	3.080	4.212	4.795	1.824
TOTAL	Mushroom Export Amount (tons)	1.036	1.954	2.823	1.773	1.637	1.573	1.370	1.626	2.438	1.523	1.532
	Value (thousand \$)	10.304	20.450	27.679	15.527	23.913	14.800	21.193	17.219	24.361	11.440	12.700
	Mushroom Import Amount (tons)	166.2	351	224.2	219	87.12	84	60	87	312	395	163
	Value (thousand \$)	2.071	2.523	1.710	2.014	1.613	2.336	2.118	3.085	4.224	4.813	1.853

Reference: TUIK, 2018

According to Doğan and Akata (2011), more than 50 tons of *Tricholoma anatolicum* is exported per year. But, this reported amount is not certain because there is not any official data about it. *Agaricus bisporus* is cultivated and some of them are sold in the markets and are also exported abroad in Turkey. According to Turkish Statistical Institute data, exportation rate of *A. bisporus* is much higher than importation rate, and Turkey earns revenue from external trade of this mushroom. In addition, various mushroom products of *A. bisporus* such as fresh/cooled, frozen, dried and canned

materials are exported and imported. Turkey's income was about 7 million American Dollars between 2007 and 2017 from foreign trade of *A. bisporus* and its products. In 2017, *A. bisporus* was mainly exported to Syria, Georgia, UAE, France, Germany, Switzerland, Turkish Republic of Northern Cyprus, Iraq, Turkmenistan and Kazakhstan. Turkey imported *A. bisporus* from China, United Kingdom, India, Italy and Holland in 2017 (TUIK, 2018).

It has also been determined that processed mushroom export of Turkey varied between 1000-2800 tons during 2007-2014, the amount was 2.438 tons in 2015, but decreased to 1.523 and 1.532 tons in 2016 and 2017, respectively. Turkey earned about 200 million American Dollars income from the exportation of edible mushrooms and mushroom products between the years of 2007 and 2017 (Table 2) (TUIK, 2018).

The mushrooms were exported as fresh/cooled, frozen, pickled, canned and dried (Anonymous, 2017a, b, c, d; KIB, 2017; TUIK, 2018). In addition, *Lactarius deliciosus* and *L. salmonicolor* (Kanlıca, Melki) were stated as the only mushroom types exported as pickled. The exportation types and their rates of some edible wild mushrooms are given in Table 3 (Anonymous, 2017a, b, c, d). Ak et al. (2016) reported that the mushrooms were exported as fresh/cooled (20%), fresh/cooled+dried (10%), fresh+frozen (10%), dried (10%), fresh+dried+frozen+pickled (40%) and dried+pickled (10%).

The mushrooms collected from the nature all over Turkey are delivered to exporting companies through sellers and vendors by refrigerated vehicles (Anonymous, 2017a, b, c, d). According to the data obtained from KIB (2017), some mushroom and mushroom products exporting companies mostly located in the west and south regions of Turkey in the term of January 2014-July 2016 are given in Table 4. In general, frozen *Morchella* spp. mushrooms were exported by 17 companies; the other mushrooms were exported by 10 companies and 3 companies exported both frozen *Morchella* spp. and the other mushrooms in our country (KIB, 2017).

Table 3. The exportation types and their rates of some edible wild mushrooms

Latin name	Exportation type	Rate (%)	Latin name	Exportation type	Rate (%)
<i>Amanita caeserea</i>	Fresh	(very low amounts)	<i>Hydnum repandum</i>	Fresh	90
	Frozen	(very low amounts)		Frozen	5
	Dried	(very low amounts)		Dried	5
<i>Boletus</i> spp.	Frozen	80	<i>Lactarius</i> spp.	Pickled	70
	Fresh	10		Fresh	20
	Dried	10		Frozen	10
<i>Cantharellus cibarius</i>	Fresh	80	<i>Morchella</i> spp.	Fresh	50
	Frozen	15		Frozen	25
	Dried	5		Dried	25
<i>Craterellus cornucopioides</i>	Fresh	80			
	Dried	15			
	Frozen	5			

In this study, it was also determined that foreign trade of edible wild mushrooms was mainly performed with European countries (Italy, France, Switzerland, Holland, Germany, Belgium and Bulgaria), Middle East countries (Iraq, Syria, Iran), East African countries (Ethiopia, Somali), Japan, USA, Canada, the Turkish Republic of Northern Cyprus and Georgia as fresh and processed (TUIK, 2018). It was stated that the most *Boletus* spp., *C. cibarius*, and *Morchella* spp. were exported to Italy, Germany, and France, respectively. In addition, Italy imported *A. caeserea* from Turkey. *C. cornucopioides* and *H. repandum* were also exported to Spain (Anonymous, 2017a, b, c, d). Pilz et al. (2007) reported that Europe is the main market for edible wild mushrooms such as *Boletus* spp. *Cantharellus* spp. and *Morchella* spp., and Japan is the most important market for *Tricholoma calignatum*, *T. anatolicum* and *T. matsutake* in Turkey. Geographical proximity of Turkey to European countries has affected its exporting prosperity positively. Okan et al. (2013) reported that forests of the Eastern Black Sea Region have commercially important mushroom species (*Boletus edulis*, *C. cibarius*, *Lactarius* spp., *Lepista nuda*, *Morchella* spp. and *Ramaria botrytis*) which are collected and sold to more than 80 countries including China, Japan, Mexico, several European countries, and major areas of Central and Southern Africa. It has previously been determined that 50% of the companies exported to European countries, mainly France, while the other countries were America, Japan and Middle East countries (Ak et al., 2016).

In addition, the strongest competitor countries for foreign trade were stated as Balkan countries (Bulgaria, Romania, Macedonia and Greece) for *Boletus* spp., *C. cibarius* and *Morchella* spp.; Russia for *C. cibarius*; Chile for *Morchella* spp. and *Lactarius* spp.; the North African countries (Morocco, Algeria and Tunisian), and China for *Morchella* spp. Besides; Uzbekistan, Afghanistan and Pakistan were informed as competing countries especially for *Morchella* spp. It has also been informed that the mushrooms were marketed as both bulk and packaged by air and road transportation. The packages from 10 g to 10-100 kg are available for the external trade (Anonymous, 2017a, b, c, d). It was previously reported that 90% of the mushrooms have been exported by cargo aircraft and 10% by refrigerated trucks (Ak et al., 2016).

Furthermore, it was informed that the exportation prices of fresh *Boletus* spp., *C. cibarius*, *Lactarius* spp. and *Morchella* spp. varied 4.0-12.0, 4.0-12.0, 5.0-10.0 and 20.0-100.0 Euro kg⁻¹. Frozen *Boletus* spp., *C. cibarius*, *Lactarius* spp. and *Morchella* spp. export prices were stated as 4.0-6.0, 4.0-6.0, 4.0-6.0 and 15.0-30.0 Euro kg⁻¹. In addition, dried *Boletus* spp., *C. cibarius*, *Lactarius* spp. and *Morchella* spp. export prices were informed as 20.0-40.0, 20.0-40.0, 20.0-40.0 and 150.0-400.0 Euro kg⁻¹ (Anonymous, 2017a, b, c, d). In a study conducted by Yaman and Akyıldız (2008), the product selling prices of *B. edulis*, *C. cibarius* and *M. conica* for exporter and processor companies were determined as 12.27, 3.18 and 30.70 Dolar kg⁻¹, respectively. The factors, that had determined the export prices, were previously reported as supply-demand (90%), weather conditions and competition with Eastern Europe and Russia (Ak et al., 2016).

4.CONCLUSION

In this study, *Boletus* spp., *C. cibarius* and *Morchella* spp. were determined as the most important species in Turkey contributed into income of approximately 171 million American Dollars from the foreign trade of edible mushrooms and mushroom products during the years of 2007 and 2017. It can be said that Turkey might earn more revenue, because our country has much more economically important mushroom taxa such as *Lepista nuda*, *Lactarius* spp. and *Sparassis crispa* etc. For this reason, local people should be educated about mushrooms in order to protect mushroom sustainability.

Table 4. Exportation companies of mushroom and mushroom products in Turkey (KIB, 2017)

Company Name	Contact Information	Company Name	Contact Information
Ağaoğlu Gıda San. İnş. Nak. İth.	Cami Şerif Mah. Çakmak Cad. 5 Gazioğlu İş Mrk. K: 3 Akdeniz, Mersin.	Kemal Balıkçılık İhr. Ltd. Şti.*	Abide-İ Hürriyet Sit. Celil Ağa İş Merkezi K: 12 D: 48, İstanbul.
Ahmet Aydeniz İnş. Turz. Eğitim	Mebusevleri Mah. Ayten Sok. No:9 Çankaya, Ankara.	Kozak İhracat İthalat Ltd. Şti.	Bayramyeri Cad. No: 3 Halil Sınmaz İş Hanı K: 3 Saraylar Mah. Merkez, Denizli.
Akper Tarım Ürünleri Dış Tic.	Cami Şerif Mah. Çakmak Caddesi Akdeniz No: 19/17 33060 Mersin.	Kybele Özel Gıda Ürün. İç ve Dış Tic. Ltd. Şti.	Halit Ziya Bul. No: 25/702 Pasaport Konak, İzmir.
Armeda İnş. Mim. Tur. Haf. Nak.	Pelitli-Adnan Kahveci Mah. Şehit Murat Yıldız Sok. 26 Merkez, Trabzon	Mersin Kardeşler Gümrük ve Dış Ticaret*	Cami Şerif Mah. 5227 Sok. Utku Apt. B Blok Kat: 2/4. Akdeniz, Mersin.
Asaf Dış Tic. Lojistik İth. İhr.	Cami Şerif Mah. 5232. Sok. 4 Akdeniz, Mersin.	Miris Gıda Tarım Ürünleri San. İth. İhr. Ltd.Şti.*	Yeşiloba Mah. 46004 Sok. No: 1 Seyhan, Adana.
A-Tek Doğal Ürün. Gıda Tekstil*	Organize Sanayi Bölgesi, Sinop.	Niobe Uluslararası Paz. İth. İhr.	Halit Ziya Bul. No: 25/702 Gümrük Konak, İzmir.
Bektaş İth. İhr. ve Dış Tic. Ltd. Şti.*	Namık Kemal Mah. Setbaşı Sok. No: 66 Merkez, Çanakkale.	Özel Doğa Ürünleri Dış Ticaret	Merkez Mah. Kale Caddesi No: 33 D: 2 Ağlı, Kastamonu.
Belizz Gıda ve Dış Tic. Ltd. Şti.	Evren Mah. Koçman Cad. Ziyal Plaza A Blok No: 54 Kat: 7. Mersin.	Pakyürek Dış Tic. Ltd. Şti.*	Karataş Yolu Üzeri 3. km No: 425/A Yüreğir, Adana.
Çalışkan Tarım Ür. İnş. Taahhüt Tekstil San. ve Tic. Ltd. Şti.*	Fabrika: Bozburun Mah. 7040 Sok. No: 35 (Peugeot yanı) Denizli,	Syb-Meynar Gıda İnş. Nak. San.	Şevket Sümer Mah. 5945 Sok. No: 2 Mersin.
Demiral Gıda Ürün. San. ve Dış Ticaret Ltd. Şti.*	Çerkezköy Cad. Ayaspaşa Mah. Saray, Tekirdağ.	Şerif Öztürk-Öztürk Yaş Sebze ve Meyvecilik	Hal Mah. Hal Kompleksi Sevkiyatçılar Bölümü R Blok No: 17 Akdeniz, Mersin.
Ekol Gıda Ürün. San. ve Dış Tic.	Mimar Sinan Mahallesi Sarı Lale Sokak No: 8 Eyüp/İstanbul.	Tahhan İletişim Elektrik Elektronik	Karatarla Mah. Eski Saray Cad. Büyük Pasaj Apt. No: 2/1067 Şahinbey, Gaziantep.
Eren Tarım Ürünleri San. ve Tic. Ltd. Şti.	Mersin Tarsus Karayolu 17. km Bağcılar Mevki, Tarsus.	Toroslar İthalat Makina İnş.	İlkiz Sokak No: 21/7 Sıhhiye, Çankaya, Ankara.
Hatipoğlu Tarım O.Ü.E.İ.T.T.E Ltd. Şti.	Toptancı Hal Kompleksi No: 304 - 305 Kepez, Antalya.	Troya İç ve Dış Tic. Danış. Paz.	Çetin Emeç Bulvarı No: 19/23 Dikmen, Ankara.
Hüseyin Özer (Özer Tarım)	Toptancı Hal No: 643 Kepez, Antalya.	Turkuaz İthalat İhracat ve Dış Tic. Ltd. Şti.	Havaalanı Kavşağı Egs Business Park Blok. B1 Bl. Kat: 12 No: 391 Yeşilköy, Bakırköy, İstanbul.
Kara Gümrük İç ve Dış Tic. Ltd. Şti.	Soğuksu Mah. Uygur Sok. Çamlık Sit. K: 2 D: 13 Merkez, Trabzon.	Vize Mantar Gıda ve Tarım Ürünleri Paz.*	Evren Mah. Bostancı Çeşme Sok. No: 21, Vize, Kırklareli.

* The most exporting company

For this aim, several activities about mushroom collection such as fairs and courses by experts and academicians might be carried out locally. Mushroom hunting should be supported with protection policy by government in Turkey. Frequent checks should be made to protect product quality for exportation. Standards should be established and products that are out of specs should not be marketed. There must be new studies on research and development of demanding value-added mushroom products for domestic and foreign markets.

Recommendations for increasing the income from the export of these products are consciousness-raising of the public about the collection of wild mushrooms, providing of state support and mechanization in the production of cultivated mushrooms, using actual processing methods in mushroom processing plants and providing of modernization, increasing of competition power with foreign competitors and using modern export marketing methods in foreign trade.

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Erzincan Tulum Cheese Production and the Images from the Plateaus in the Original Production Area

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Abstract: Beyaz, Kaşar and Erzincan Tulum cheeses are the most popular varieties in Turkey. The name “tulum” means “goat’s or sheep’s skin bag” in Turkish, in which the fresh cheese is pressed and ripened in it. Recently, plastic barrels are also used as container due to its cheap and easy to find. However, the flavour of the cheese is ripened in tulum is better than plastic barrel. Erzincan Tulum cheese has a white or cream colour, a high fat content, a crumbly- semi-hard texture, a buttery and pungent flavour. It was the first cheese to receive a geographical indication by the Turkish Patent and Trademark Office in 2000. The cheese is manufacturing in plateaus around Erzincan, Erzurum, Tunceli, Bingöl and Elazığ and in the East Anatolian regions by the Şavak tribe using raw Akkaraman sheep milk between May and September. Home-made rennet is usually used. Especially Kemah salt is used (Kemah is a county of Erzincan province, Turkey). The cheese was originally ripened in caves; however, it is now ripened in cold deposits. During the last 15 years, a number of studies have been carried out on the chemical composition, biochemistry, microbiology and volatile composition of Tulum cheeses during the ripening. In this study, Erzincan Tulum cheese production and the original production process are presented with original images from the Erzurum plateaus. Its popularity has been increased increasingly; however, there is some problems during its production and ripening conditions, e.g., hygienic conditions in production, packaging, ripening and marketing stages. However, use of Tulum in manufacture, not in marketing, as packaging material and animal rennet as clotting agent should be maintained with strict hygienic conditions. These problems have been discussed in the local and national “Tulum cheese festival” of the government and private supporters in order to increase the popularity of the cheese on the market. Growing of sheep and sheep’s milk production geographical around for Tulum cheese and life conditions or standards for producers’ should be granted by government. Also, further studies should be performed by universities by collaborating with different laboratories.

Keywords: Erzincan Tulum cheese, Traditional cheeses of Turkey, original production method, Erzurum plateaus

1.INTRODUCTION

There are more than 100 varieties of cheese in Turkey, but three of these varieties (Beyaz, Kaşar and Tulum cheeses, especially Erzincan Tulum cheese is one of the most popular variety (Çakmakçı, 2011). Erzincan Tulum cheese, which is the best known among the Tulum cheeses, is the third most commonly produced cheese in Turkey. The cheese is made from raw Akkaraman sheep's milk. Akkaraman sheep's milk also has higher fat and protein content than other species and this is commonly grown in these geographical area and prefer for cheese manufacture (Cakir et al., 2016). Tulum cheese has a white or cream in colour, high fat content, buttery flavour and semi-hard and crumbly in texture (Çakmakçı 2011). The cheese has a high economic value and gain higher profits than the other types of cheeses in Turkey (Beyaz and Kasar cheeses) (Çakmakçı 2011). It is recorded a geographical indication status by the Turkish Patent and Trademark Office (TÜRKPATENT) in 2000, and it is the first registered cheese by TURKPATENT in Turkey. According to this document, Tulum cheese is produced in plateaus around Erzincan province using sheep milk between May and September. In comparison to other types of cheeses, its ripening process is longer and is produced on the mountains indicated in plateaus of Erzincan, Erzurum, Bingöl, Tunceli and Elazığ by the Şavak tribe. It was originally ripened in caves for 3 months or longer (Kurt et al., 1991a,b; Çakmakçı, 2016). The manufacturing and ripening processes have been extensively reviewed and discussed by Hayaloglu et al. (2007a, b), Çakmakçı (2011), Cakir et al. (2016) and Cakir and Cakmakci (2018) in detail. In addition to be convenient for exportation, having high nutritional value and being more expensive than butter increase the economic importance of Tulum cheese. Studies on Tulum cheese have been performed on the chemical and microbiological characteristics of the cheese and the effects of different packaging materials on the various properties of cheese during ripening were also studied (Çakmakçı 2011). Hayaloglu et al. (2007) studied the microbiology, biochemistry and volatile profiles of Tulum cheese, and Cakmakci et al. (2011) studied the proteolysis, sensory properties and gross composition of Tulum cheese ripened in goat’s skin or plastic bags.

Traditionally Production Process of Erzincan Tulum Cheese

In plateaus of Erzincan Tulum cheese production is shown in Figure 1 and the manufacturing protocols were also illustrated in Figures 2-17.

Raw Akkaraman sheep's milk

(Plateaus: in Erzurum, Bingöl, Tunceli, Erzincan of Turkey).



The homemade calf rennet is added at a level of 1.0% (v/v) at 35 °C into raw sheep's milk.



After approximately 60 min, the coagulum is cut into pieces (close 1 cm cubes) and transferred into cotton bags for whey drainage.



Drainage is carried out at 20 °C for 24 h, and the curd is press by piling the cotton bags on top of each other, with regular turning.



Stacking of the curd at this temperature allows curd acidity (pH drops below 6.0) to develop and increases the removal of whey.



Following this step, the curd is break into pea-size pieces by hand and salt (3.0%, wt/wt), knead, and transferred into the bags.



The bags are piled on top of each other and turn regularly at 15-18°C for 10 d.



The plastic containers have drain holes in the cover.



The curds are tightly fill into the hardened plastic barrels and/or goatskin bag the package samples are ripened at 4±1°C for 90 days or longer.

Figure 1. Tulum cheese production flow chart (Cakir and Çakmakçı, 2018)



Figure 2. Akkaraman sheep flock (Dumlu, Erzurum) **Figure 3.** Şavak tribe tents (Başkurdere, Erzurum)



Figure 4. Milking (Çat, Erzurum)

Figure 5. Acidity control (Çat, Erzurum)



Figure 6. Rennet addition (Dumlu, Erzurum)



Figure 7. Coagulum control



Figure 8. Press by piling the cotton bags



Figure 9. Fresh curd



Figure 10. Kemah salt (NaCl)



Figure 11. Press (Başkurdere, Erzurum)



Figure 12. Lunch in the tent (Çat, Erzurum)



Figure13. Researcher and Şavak tribe (Dumlu, Erzurum)



Figure 14. Images from plateaus (Dumlu, Erzurum)



Figure 15. Tulum cheese festival (Erzincan)



Figure 16. Tulum cheese into plastic barrel and



Figure 17. Erzincan Tulum cheeses (Elazığ) in cold deposits (Erzincan)

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Thermally Resistive Pv Glazing (Tr-Pvg) Systems

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Abstract: Windows are useful elements of buildings which provide air ventilation and passive solar gain. Besides, owing to their transparent structure, they enable residents to view the outside. However, the role of windows in total energy losses from building envelope is unequivocal. This can be attributed to the poor thermal resistance characteristics of conventional fenestration products. When the glazed area is noticeably large in a building envelope like in case of glass curtain walls, the dramatic role of windows in total energy loss from buildings becomes much more remarkable. In this respect, alternative solutions are considered to mitigate window-oriented energy losses in buildings, and photovoltaic (PV) glazing systems are of significant relevance. PV glazing is highly utilised in modern architecture owing to aesthetic features as well as being capable of generating electricity. However, thermal insulation performance of traditional PV glazing products is even worse than ordinary single glazing. Therefore, advanced PV glazing systems are required to provide clean energy generation and attractive thermal insulation in a single fenestration product. Within the scope of this research funded by The Scientific and Technological Research Council of Turkey (TUBITAK) through the project (216M531) entitled “Development of a novel, energy-efficient, eco-friendly and multi-functional glazing technology for low/zero carbon buildings: An experimental, numerical and statistical investigation”, a novel PV glazing (thermally resistive PV glazing – TR-PVG) is developed. It is reported in previous literature that the overall heat transfer coefficient (U-value) of air filled double glazed window, air filled double glazed window with low-e and argon filled double glazed window with low-e is 2.53, 2.10 and 1.90 W/m²K, respectively. It is also clear from the state-of-the-art building codes that these values are not sufficient to meet the 2030 and 2050 low/zero carbon building standards. TR-PVG is expected to have a U-value below 0.60 W/m²K as a consequence of thermally resistive composite structure behind the semi-transparent amorphous silicon (a-Si) PV cell consisting of inert gases and liquids with low thermal conductivity and high specific heat capacity. TR-PVG is predicted to generate about 100 W electricity per m² PV cell area. Moreover, TR-PVG has a self-cleaning feature owing to a nano-coating on the PV cell surface. The whole structure is also attractive in terms of sound insulation. The cost of TR-PVG is estimated to be lower than €250.00, which is also promising and competitive with the PV conventional glazing products in market.

Keywords: PV Glazing, TR-PVG, U-value, Thermal Insulation, Clean Energy Generation, Buildings

1.INTRODUCTION

In the buildings, enormous amounts of energy are consumed around the world to keep the temperatures of living areas at desired levels. Especially in developed countries, the energy consumption of residential and commercial buildings is increasing rapidly and it is between 20% and 40%, exceeding the amount of energy spent in transportation and industry sectors [1]. Due to the insufficient and different heat transfer coefficients of the windows, energy is wasted in large quantities. For example, in a two-story building with 30% of its walls covered with windows, about 60% of energy is lost to these windows [2]. The windows provide a great deal of light comfort and skin health, as well as ventilation, acoustic comfort and photo protection. The correct design and selection of the window to be used is very important, as they provide an aesthetic appearance in their use on the facades of the building [3]. For a typical building, the roof, floor, exterior walls and windows have 0,16, 0,25, 0,30 and 2,00 W / m² K respectively. Since windows constitute about 60% of the total energy loss of a building, new work is always required to improve the thermal performance of the windows [4]. Especially in the last decades, a lot of studies have been done to improve the thermal insulation properties of glass, and new glass technologies have been given great importance to reduce window energy losses. Nevertheless, it is often easy to say that it is very difficult to produce a definitive solution for some reasons, such as cost, thermal comfort, performance and aesthetic aspects [5]. For example, multilayer glasses can provide high-grade thermally resistant structures, especially when supported by low e-coatings and hanging films. However, in most cases thicker and heavier structures are required for optimal reinforcement, which is not preferred by most residents. Another option is vacuum glass, which provides highly resistant structures in very thin designs to minimize energy loss from glazed areas [6,7]. Nevertheless, it should not be forgotten that the conversion of vacuum glasses to commercial products compared to traditional types of glassware is still a problem because of the higher production costs [8]. Other new glazing technologies for effective thermal regulation of building shells include Aerogel glazing, PCM glazing and TIM glazing. However, these glasses considerably disturb the transparency and thus disturb the thermal comfort of residents. Adaptive glass technologies are also attractive for multifunctional use, but their total cost is not at the desired level [9,10].

Pv Glazing

The aesthetic appearance of PV glasses as well as the ability to produce electricity made it possible for these glasses to be widely used in modern architecture. However, thermal insulation performance of conventional PV glazing products is even worse than ordinary single glazing as also reported by Peng et al. [11] in their recent comprehensive experimental research. However, the concept of PV glazing is very dynamic and numerous researches are in progress to enhance their current power generation and thermal insulation performance. Conventional PV glazing systems are mostly fabricated from crystalline silicon solar cells (c-SiPVs). There are several studies in the literature where semi-transparent c-Si PVs are used to replace traditional glazing at residential and commercial buildings as reported by Skandalos and Karamanis [12]. Typical c-Si PVs are encapsulated between highly transparent glass panes to form a standard PV glazing. Ethylene vinyl acetate (EVA) film is widely used for encapsulation. The orientation of PV cells is adjusted properly to be able to achieve the level of transparency required. The schematic of a typical c-Si PV glazing is shown in Fig. 1. Current electrical efficiency of conventional c-Si PV glazing products is in the range of 16–22%. However, the technology is expensive due to high costs of silicon wafers. Another disadvantage of these products is the limited external view as c-Si PVs are typically opaque. Semi-transparent c-Si PVs provide better lighting performance, and increasing the area covered by the cells in a semi-transparent PV glazing leads to more electricity generation. However, this causes excessive solar heat gain in summer resulting to considerable rise in cooling demand of buildings. Hence, a balanced solution between day lighting, solar heat gain and electricity generation is usually needed in conventional c-Si PV glazing products [13].

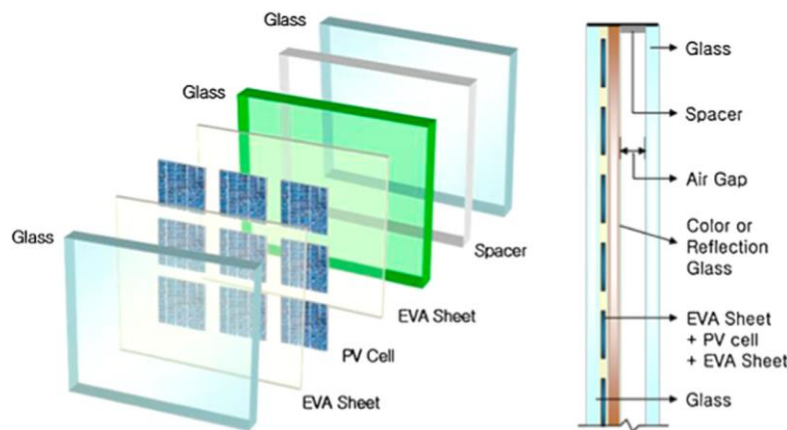


Figure 1. Structural Details of c- Si PV Glazing [12]

The development of low-cost PV cells to create cost-effective and energy efficient glass systems has received great interest in recent years. In this context, special features and low cost [14], easy scalability, simple production process [15], low material consumption, sensitivity to low light levels, and so on, have been made on dye and organic PV cells. The ease of use for large area applications makes them ideal candidates for use as energy windows [16]. Illustration of dye-sensitized PV cells as window applications is shown in Fig. 2. The dye-sensitized PV glazing products are attractive because of their low-cost, however their energy conversion efficiencies are very poor compared to conventional PV glazing systems. Table 1 provides a comprehensive illustration of advanced PV glazing systems in terms of structure, electrical efficiency, cost, transparency and time [17].

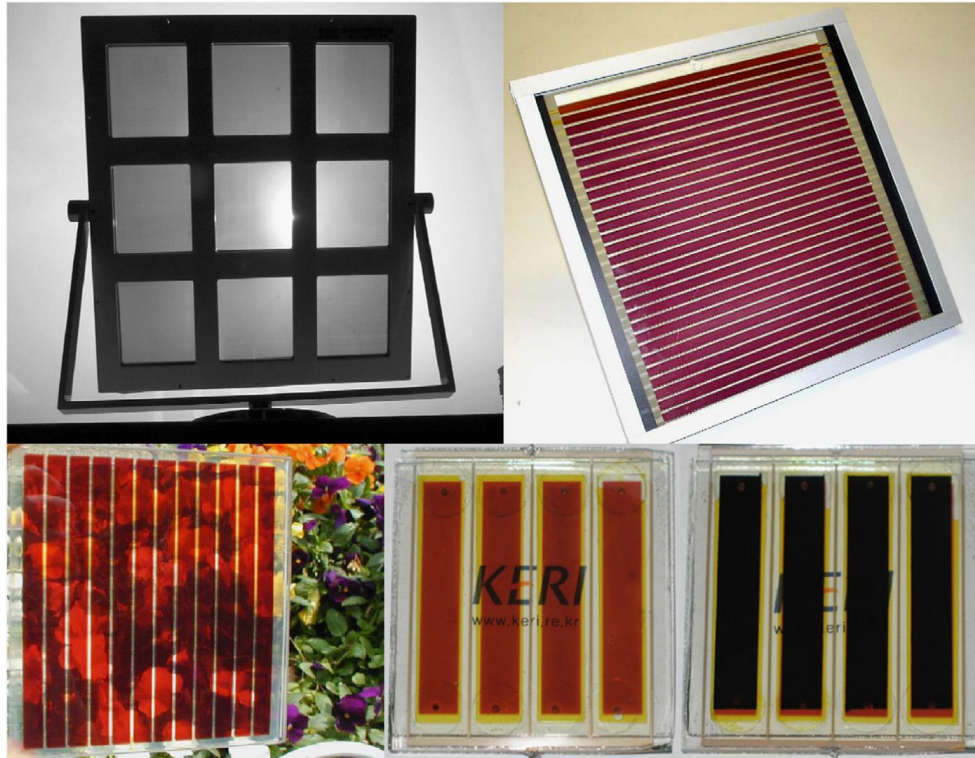


Figure 2. Dye-sensitized PV cells as window applications [12]

Table 1: Evaluation of advanced PV glazing systems in terms of several performance parameters [17]

Structure	Efficiency (%)	Transparency (%)	Benefits/Issues	Year
Nine PV cells in series	---	60 (visible)	The method for electrical contacts can suppress the IR drop	2003
Glass frit sealing technology	3.5	semi-transparent	Successful in a large scale application	2008
Twenty nine PV cells in series	7.0	semi-transparent	Cost-effective	2006
Flexible dye-sensitized PV cell	7.6	---	High efficiency and low-cost	2010
Silver embedded transparent conducting glass	4.2	semi-transparent	Similar performance with platinum	2008
Stainless steel substrate flexible dye-sensitized PV cell	4.2	---	High temperature sinter ability small loss in efficiency	2006
Screen-printing technology	5.5	---	Stable performance	2007
Heat insulation solar glass thin film amorphous silicon	12.0	semi-transparent	Cost-effective and energy-efficient suitable for retrofitting purposes	2016

Thin film PV glass systems are seen as a good alternative to energy saving in climates where the cooling needs are particularly high, especially in the Middle East. Bahaj et al. [18] In extensive research on high-glazed buildings, cooling reductions of up to 31% can be achieved for the first year of operation. In a study conducted by Radhi [19], it has been proven that an integrated PV glass system in a commercial building reduces the building's total energy consumption by 1.1-2.2%. Li et al. [20] show that the thermal and visual properties of PV glass systems are highly effective on overall energy performance. Greenhouse gas emissions can be significantly reduced through these systems. The estimated repayment period for these systems is reported to be 15 years. It has been demonstrated in studies conducted by Chow et al. [21] that the energy consumption of the buildings can be reduced by 61% using natural ventilated PV glass systems. In another study, Chow et al. [22] have shown that innovative vented PV dual glass technology can reduce air conditioning power consumption by 28% when compared to the conventional single-absorbent glass system.

This literature review shows that each new glass technology has its own advantages as well as certain disadvantages. For this reason, it is wiser to conduct studies to combine the useful properties of different glass technologies into a single window.

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Low Velocity Impact Behavior of Aluminum-Polyurethane-Aluminum Composites

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Abstract: In this study, low velocity impact behavior of laminated aluminum composite plates was investigated. Three layered aluminum-polyurethane-aluminum (Al-PU-Al) composite plates which have 3 mm and 4 mm thicknesses were subjected to low velocity impact tests. Composite panels which were cut in 150 mm x 150 mm dimensions were constrained from all degree of freedoms. Mass of impactor was 6.35 kg and had semispherical punch which is 24 mm in diameter. Impact tests were applied to middle of the specimens at 10 J, 20 J, 30 J, 40 J, 50 J and 56.25 J energy levels. After impact tests force-time and force-displacement graphics were drawn and evaluated. Failure analysis was done for each impacted specimen. For same energy levels, displacement values for the specimens which have 3 mm thickness were higher than the specimens which have 4 mm thickness, due to high stiffness of 4 mm thick composite plates. Failures of specimens were investigated and any fixation or puncture was observed. Displacement values were increased as impact energy increased. Maximum displacement was occurred on the specimen that has 3 mm thickness and impacted at 56.25 J energy level.

Keywords: Aluminum layered composite, Impact behavior, Failure

1.INTRODUCTION

Today, it is very important to investigate the impact and ballistic strength of the materials used in the automobile, aerospace, defense and space industries and to determine the damages and to optimize the designs. In particular, the behavior of these materials exposed to impact at medium and high velocities needs to be examined.

Aluminum is used in millions of different products in many branches of the industry and has a very important place in the world economy. Structural components made of aluminum are indispensable for space and aviation industry. Lightweight and high strength properties make it widely used in transportation and construction industry.

Aluminum is a soft and light metal with a silvery silver color. This color comes from the thin oxide layer that forms on exposure to the air. Aluminum is not poisonous and magnetic. It will not spark.

The new material that is formed by combining at least two different materials is called composite material. The purpose of the composite production is to add new properties to bring the unsuitable, insoluble materials alone into a state that can give them suitable properties for their use (Strength, lightness, flexibility, cost, etc.).

Composite materials have been widely used in recent years due to their high rigidity and strength, although they are light compared to metal constructions. In particular, fiber reinforced layered composite materials are used predominantly in high-tech aircraft and defense industries. These composites may be subjected to impact loads which can cause damage during their use. It is therefore of great importance to investigate these damages which may lead to life and property losses and to simulate the impact load caused by damage in the laboratory environment (Aslan et al., 2002).

When an object hits a surface, it can bounce back, stumble, or pierce it. Drilling is the final limit in energy absorption of material. In this case, if the impact energy is given too much, the drill bit continues to pierce and move the end material (Liu and Raju, 2000).

2.MATERIALS AND METHODS

Drop Weight Test Device

Dynamic impact tests were performed on specially manufactured tester to obtain low velocity impact behavior of the samples. The device has a special ability to record pulses at different pulse energies, from the beginning to the end of the pulse.

Our device consists of three main elements. The first of these is the bottom plate, which keeps the lashing, steel rails and striking mass on. The second one is the steel rail-striking mass connection and the sample bonding apportionment group. The last one is the electronic control unit. Our weight reduction test equipment is shown in Figure 1.

In addition, there is a pulley system on the device where we can take the ball mass to the desired height. At the tip of the pulley rope there is a mechanical hook system that holds the striking mass. When the manual lever on this system is lifted, the striking mass moves vertically on the steel rail with free fall.

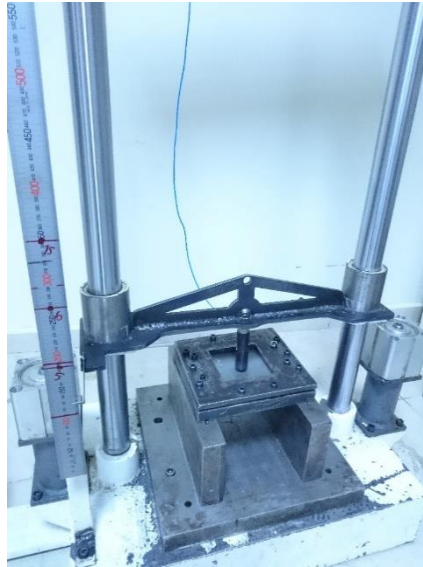


Figure 1. Drop weight test rig

Impactor Geometry and Force Sensor

Figure 2 shows the impactor and force sensor connection. The impactor used in the experiment has a 24 mm diameter, semi-spherical tip geometry. The force sensor PCB used in the experiment is the Quartz ICP Force Sensor (M202B04). Measuring capacity is 22.6 kN. It is mounted between the striking mass and the striker. The signal is transmitted to the electronic control unit with the aid of a Teflon cable connected to the force sensor.

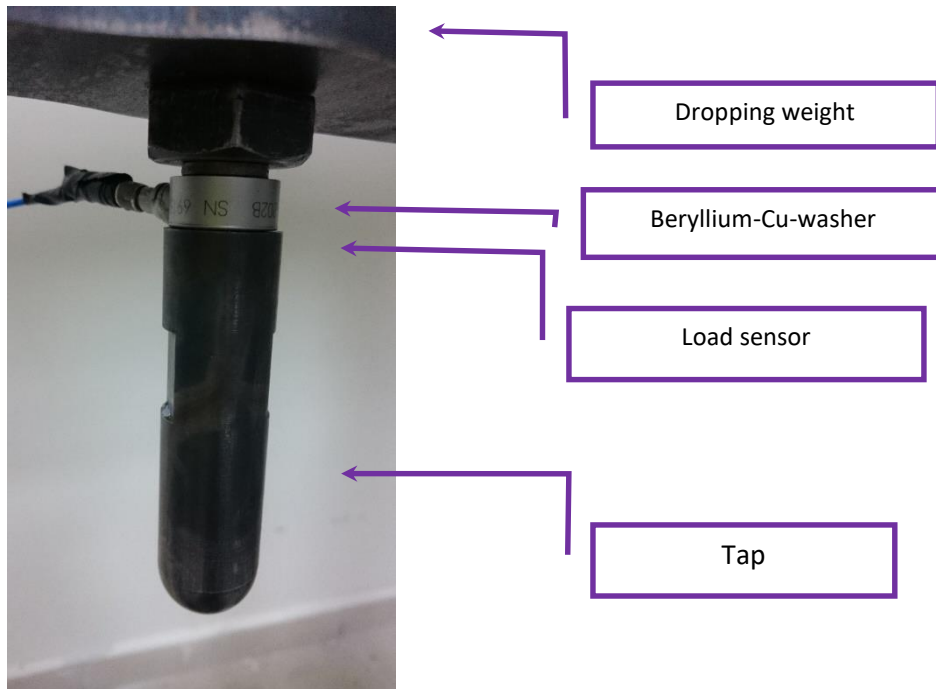


Figure 2. Impactor force transducer assembly.

Electronic Control Unit

The electronic device has a signal conditioner that detects and amplifies the signal from the force sensor. A PCB 480C02 ICP type signal conditioner has been chosen to be compatible with the power sensor and system. It works with 24 volt voltage. The energy is supplied by three 9 volt batteries. PCB 003C30 Teflon cable is used for connection between force sensor and signal conditioner. The cable ensures that the signal from the force sensor is transmitted without losing its feature. In the signal conditioner, the BNC connector block is used to transmit the raised signal to the DAQ card.

There is a risk that the signal will be sent directly to the DAQ card. It may cause the card to burn or lose functionality. Thus, the amplified signal is transmitted through a connector block. The BNC 2110 connector block is used for compatibility with the system. The linker block can be used to transfer in different data. For example, data from the velocity sensor can be easily transmitted to the DAQ card. In addition, for the devices to be operated with the existing system, the voltage generated by the DAQ card can be received via this connector block. The Teflon cable used between the signal conditioner and the connector block is the cable produced on the PCB 003D03. The cable model used between the connector block and DAQ card is SHC 6868EPM.

The DAQ card placed on the motherboard is the card which detects and processes the incoming signal. The NI PCI-6251 M series multifunction DAQ card has been selected. The DAQ card can receive and process many different signals at the same time. In addition to this, new signals can also be produced. Other systems can be operated by taking these signals through the connector block. With NI Signal Express software, a strong change graph was obtained over time. This software allows determining the characteristics of the signal. For example; how many seconds the signal will be received, how many data will be received at the moment. Furthermore, the force can be taken as Newton by multiplying the data received with a conversion factor.

Figure 3 shows the electronic control unit.

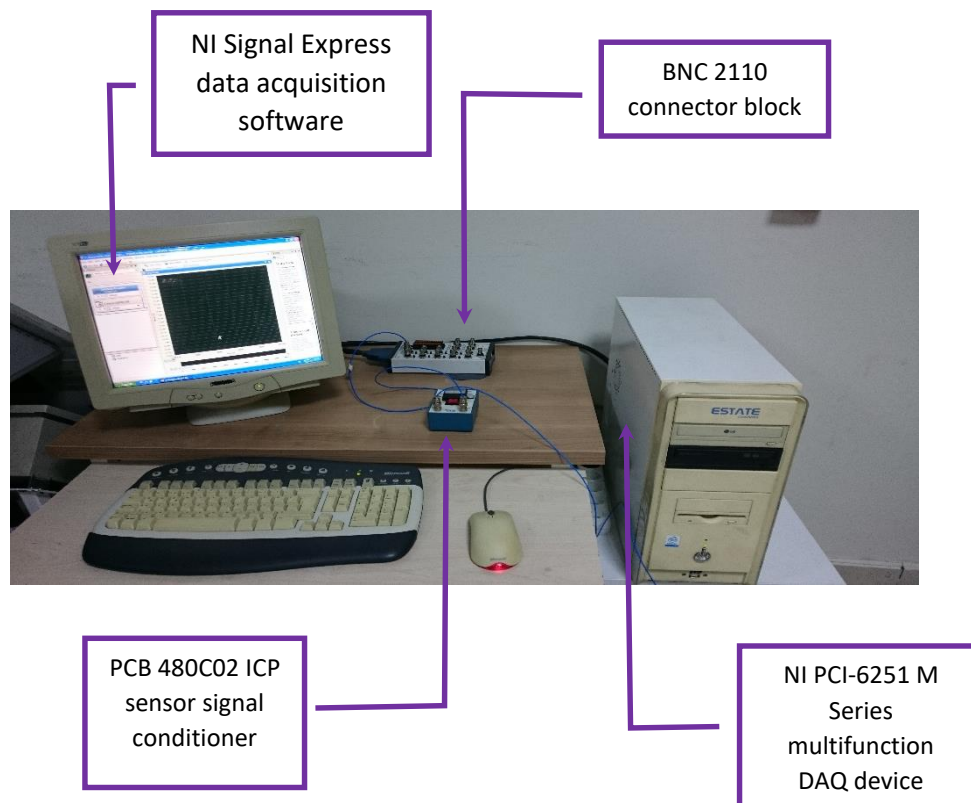


Figure 3. Electronic Control Unit

Experimental Procedure

The dimensions are 150 mm x 150 mm and the thicknesses are cut to 3 mm and 4 mm.

The Al-PU-Al test specimen was formed by attaching the four sides of the test specimen to be embedded, at 10 J, 20 J, 30 J, 40 J, 50 J and 56.25 J pulse energy levels.

It is based on changing the impact height in increasing the impact energy.

3.RESULTS AND DISCUSSION

As a result of the calculations performed on all experimental values, force-time, force-displacement changes have been obtained. The graphs obtained for each test sample are similar to those obtained for other samples. For this reason, Al-PU-Al test samples of 150 mm x 150 mm dimensions were given in the sub-sections of 10 J, 20 J, 30 J, 40 J and 50 J 56,25 J energy values.

Force Time Graphics

In order to determine the influence of impact velocity on contact force in a sample subjected to a low-velocity impact, the data obtained from the experiments are compiled for samples in different configurations, and these changes are shown in Figure 4 and Figure 5. The force in the form rapidly increases to reach a maximum force value and then falls to zero. In each chart, it appears that the pulse has begun to oscillate at the beginning. It is seen that in graphs the duration of contact decreases with the increase of impact energy, and the greatest contact force on the sample increases. The duration of the impact on the 4 mm composite plate was shorter than that of the impact on the 3 mm composite plate. Since the 4 mm Al-PU-Al plate is more rigid than 3 mm Al-PU-Al plate, the 4 mm composite 3 mm is more rigid than the composite.

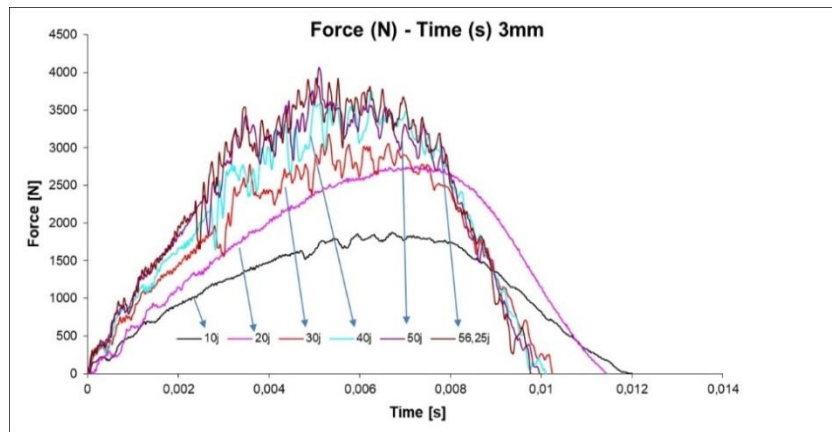


Figure 4. Force -Time Graphs for 3 mm Thickness Al-PU-Al

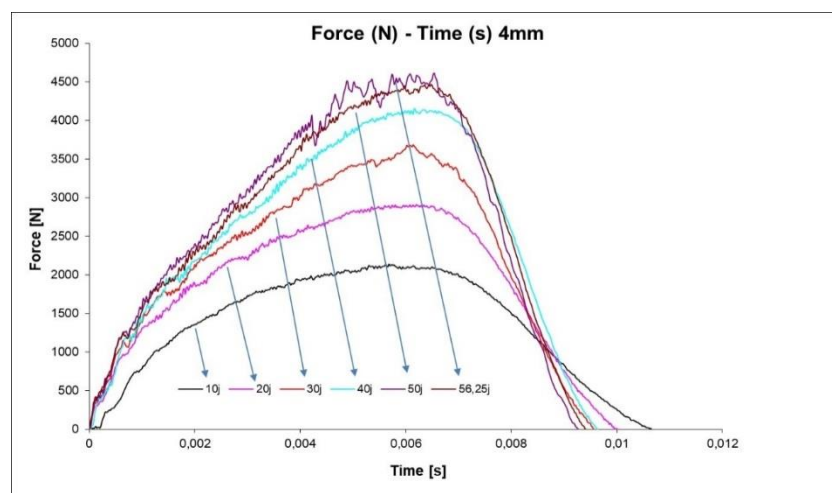


Figure 5. Force-Time Graphs for 4 mm Thickness Al-PU-Al

Force Displacement Graphics

Another graph of force-displacement (force-collapse) change graphs is used to determine the impact behavior of composite metal sheets exposed to impact. The induced displacement values obtained for composite metal sheets exposed to low-velocity impact at different energy levels are given in Figure 6 and Figure 7. During the impact, the impactor began to displace (collapse) on the sample with the touch of the sample and the force continued to reach its maximum value. As the impact energy increases, the amount of force and displacement increases. When the force reaches its maximum value, the amount of displacement reaches its maximum value. The slope at the increment of the force-displacement curve is called the bending stiffness because of the resistance of the sample against the impact load. Discontinuities in bending stiffness and changes indicate damage to the sample. As the impact energy increases, there is no significant change in the bending stiffness of the specimens. The prime reason for this is that the samples are metal and the rigidity is high. The composite material consisting of different metal sheets is less deformed against the externally applied loads and accordingly the bending stiffness does not change significantly. The fact that there is not a large change in the bending stiffness suggests that large damage does not cause stabbing and puncture damage in the test sample. There are serious changes in the bending stiffness of composite plates subjected to low-velocity impact at different energy levels. Thus, when the force reaches a certain value at the increasing portion of the force-displacement curve, a sharp drop in bending rigidity occurs due to sample damage (Kara, 2006).

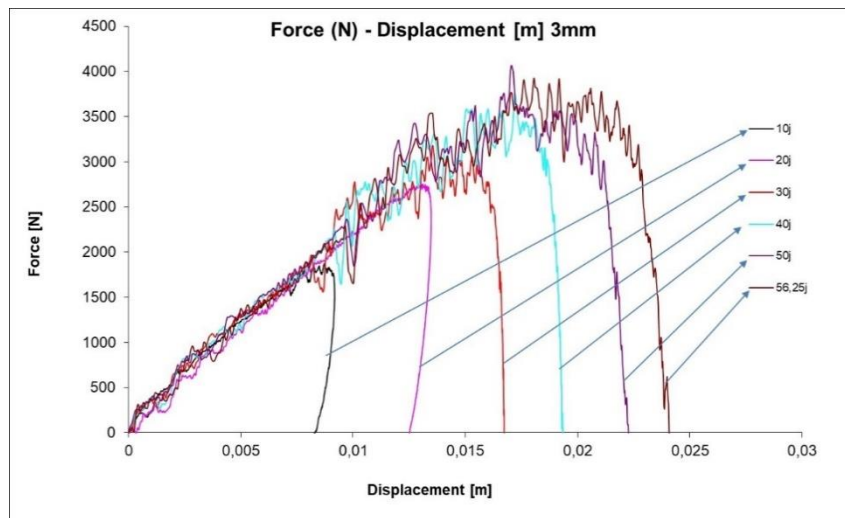


Figure 6. Force-Displacement Graphs for 3 mm Thickness Al-PU-Al

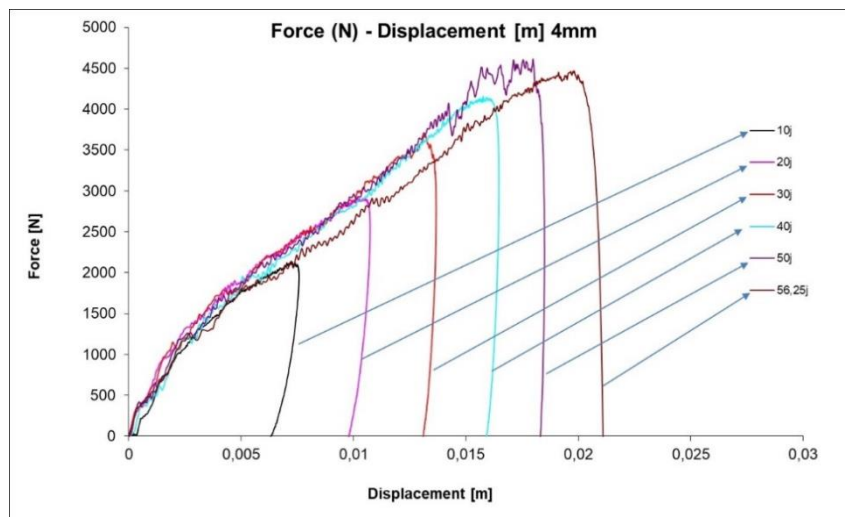


Figure 7. Force-Displacement Graphs for 4 mm Thickness Al-PU-Al

Failure Analysis

As the impact energy increases, the amount of collapse in the layers also increases. In Figure 8, damage to the front and back surfaces of the Al-PU-Al composite plate with thicknesses of 3 mm and 4 mm for different energy levels is given. When the damage analysis is performed, the collapse occurring in the 3 mm composite plate is more than the collapse occurring in the 4 mm composite plate. Since the final energy level of the device is 56.25 J, no drilling occurred in the 3 mm composite plate. For a 3 mm plate, cracking starts at a power of 20 J and a visible crack at the energy level of 56.25 J can be mentioned. No cracks were observed for the 4 mm composite plate at any energy level.

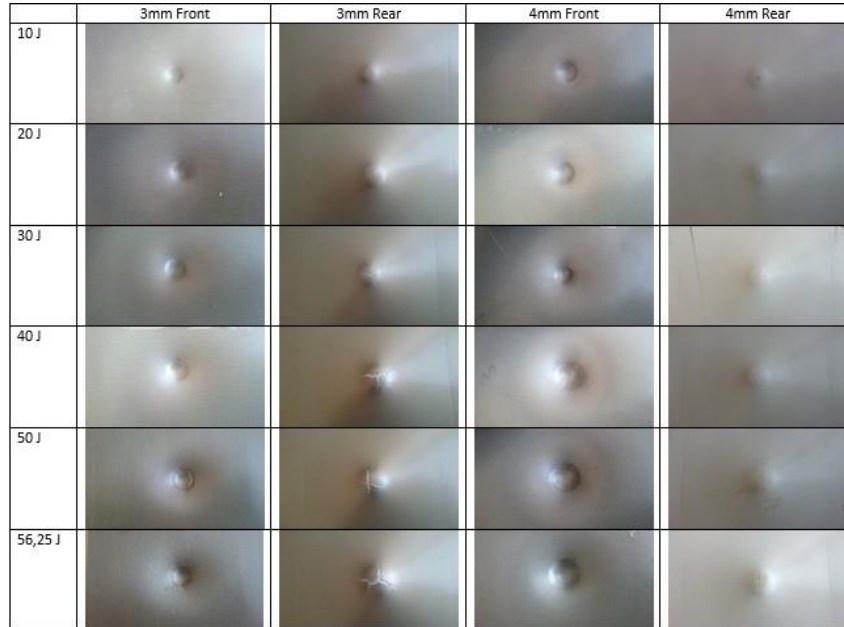


Figure 8. Views of damaged section of samples

In this study, damage to Al-PU-Al composites exposed to impact at low velocity; the graphics used to determine the impact characteristics determined by the impact test performed at different energy levels with the falling weight tester were obtained and the damage analysis was performed.

- Increasing of the absorbed energy results in increase of the impact energy.
- Each layer collapsed, but no puncture or fixation occurred.
- As the impact energy increases, amount of collapse on the plates increases.
- It has been found that the amount of collapse in the 4 mm plate is less than that in the 3 mm plate, as the rigidity is higher for the same energy level.
- For this study, the largest collapse occurred in 3 mm Al-PU-Al plate at 56,25J energy level.

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Global Necessity to Nearly Zero-Energy Buildings (Nzeb)

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Abstract: With the beginning of industrial revolution, world population living in urban areas and industrial developments cause an enormous amount of energy consumption globally. Based on reports, there is a correlation between global energy consumption and economic growth of countries. While the level of social welfare develops, environmental issues such as depletion of natural resources, climate change and global warming based on human activities increase continuously. Moreover, the increase in energy consumption leads to greenhouse gas (GHG) emissions. It is underlined in the state-of-the-art reports that the average rise in CO₂ concentration in atmosphere is about 40% compared to pre-industrial revolution. Therefore, the largest part of GHG emissions is attributed to uncontrolled energy consumption. Depending on studies, it is predicted that the rise in CO₂ emissions will be about 52% between 2005 and 2050 if no decisive precautions are taken. Electricity and heat generation sectors are called as CO₂ emission sectors and these fields are responsible for 42% of total CO₂ emissions in 2015. The increase in total energy demand between 1971 and 2015 is also given to be 150%. On the other hand, it is reported that the building sectors are responsible for 40% of total energy consumption. For this reason, major contributor of GHG emissions is expressed as building sector. CO₂ emissions due to buildings in US, China and UK are reported to be 43, 50 and about 50% respectively. On the other hand, final energy consumption in residential-buildings located in EU member countries is given to be 290 million tons of oil equivalent (mtoe) in 2012. The building sector plays a leading role in mitigating energy consumption with energy-efficient building concept which also reduces the amount of CO₂ emissions. The potential reduction in CO₂ emissions from the building sector is expected to be 30% by 2020. For this reason, through the directives of 2010/31/EU, the EPBD suggests the concept of nearly zero energy buildings (nZEBs) to improve energy performance with insulation properties, HVAC systems, the building orientation and comfortable indoor quality for both new and existing buildings in Europe. In the literature, zero emission buildings can be defined as near zero energy, zero energy, passive house, 100% renewable, carbon neutral, climate positive and positive advancement, energy plus and zero net energy. Therefore, the newly constructed buildings are aimed to have high energy performance and to generate their own energy to consume on site. The retrofitting of existing buildings toward nZEBs is really important than the newly constructed buildings since the energy efficient materials for the new buildings are commercially available on market. By looking into reports, the buildings existed from the 1960s in Europe are about 40% of all buildings in Europe today. It is widely believed that the retrofitting of the existing buildings will comprise wide range of developments including thermal insulation of building facade and roofs, upgrading the space heating and cooling systems, renovation of electrical and electronic appliances and utilising renewable energy technologies (RETs) on-site or nearby. The retrofitting of buildings reduces the GHG emissions by 40%.

Keywords: nZEB, Energy-efficient Building, Energy Demand, GHG, Renewable Energy Technologies

1.INTRODUCTION

With industrial revolution, world population and technological advancements have been increasing dramatically and these increments cause huge amount of global energy consumption (Wu, 2013). The rate of increase in urbanization is estimated to be 75% from 2015 to 2050 (in Fig.1.) (Department of Economic and Social Affairs, 2001).

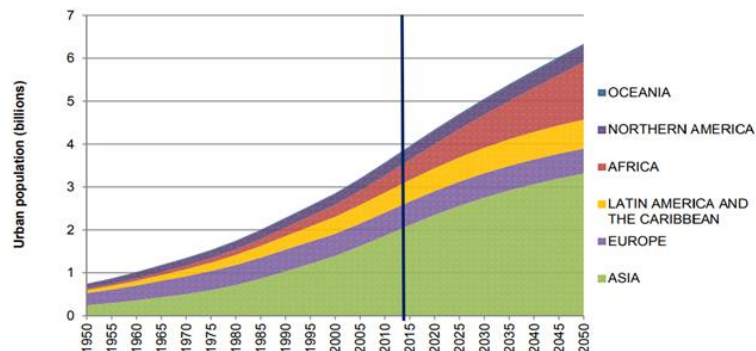


Fig. 1. Urban population by major area, 1950-2050 (Department of Economic and Social Affairs, 2001)[3].

Environmental issues based on urbanization consist of global warming, air pollution, the depletion of ozone layer and the considerable reduction of natural resources particularly in energy resources. Biotic system is deeply affected by the change in climate conditions seeing throughout the world such as the weather and the environment getting worse compared to previous centuries (Williams et al., 2016). The European Commission is aimed to reduce the GHG emission that has negative effects on natural ecosystems, urgently. The GHG emission is targeted to reduce by 25% and 60% in 2020 and 2040, respectively (Becchio, Corgnati, Delmastro, Fabi, & Lombardi, 2016).

In order to reach the target, some sectors are of vital importance to make investment such as energy, transportation, industry, and building sector as well. The building sector is getting more attention due to mitigating global energy demand, eco-friendly, in comparison with said the sector (De Boeck, Verbeke, Audenaert, & De Mesmaeker, 2015). This study can draw attention to the nearly-zero emission building(n-ZEB) for revealing the potential impacts of building sector on mitigating energy consumption.

CO₂ Emission

The remarkable increase in CO₂ emissions in the atmosphere worries scientists, in recent years. Looked into the changes from pre-industrial era to nowadays, the rising rate of carbon concentration is estimated at 40% (Stocker et al., 2013). Fig.2. illustrates the Carbon emission level since industrial revolution. It shows that the carbon emissions have been increasing unceasingly from 1870 to nowadays(International Energy Agency, 2017). According to the report belonging to Boeck et al. (De Boeck et al., 2015), between 2005 and 2050, the expectation of the increase in the emissions is to raise the level of 52% without taking any precautions.

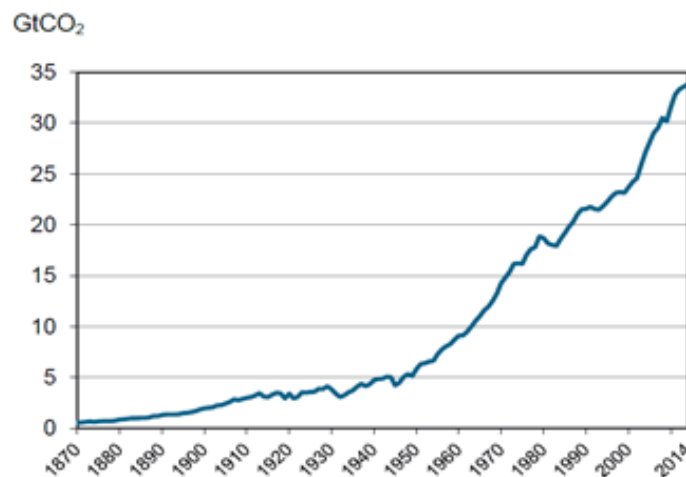


Figure 2. CO₂ emission from fossil fuel between 1870-2014 (International Energy Agency, 2017).

Electricity and heat generation accounting for 42% of the emissions is accepted as primarily responsible for carbon emissions(International Energy Agency, 2017). Based on Paris agreement, low carbon energy is of vital importance to reduce the carbon emissions. Therefore, greenery system and zero carbon technology play a key role to expand renewable energy technology (RET). With enhancing these systems, the installation cost can be affordable and the interest in applying RET is arising considerably. For example, the reduction rate in the cost of solar power is declared to be 65% in the last decades (IEA, 2016).

Building Sector

The building sector is responsible for 40% of total energy consumption in the world. it is undeniable that building sector has outstanding contributions to the reduction in total energy consumption and GHG emissions(Srinivasan, Braham, Campbell, & Curcija, 2011). Energy efficient building concepts facilitate not only mitigation of carbon emission but also preventing the depletion of energy resources. For this reason, new policies are developed by policy-makers for getting the better performance of the building. Following the improvement in energy technologies, the building performance is expected to increase by at least 10%. The peak value with regard to average energy consumption per year in 2010 is measured to be 12 MWh in OECD countries. After this value, it is realized that the increase in energy use is cutting due to a warmer winter season compared to previous years. In OECD, 45% of energy consumption in building is attributed to space heating (IEA, 2018).

The expectation of the decline in CO₂ emissions from buildings is determined to be by 30% until 2020 (Ürge-Vorsatz & Novikova, 2008). Depending on the directives of 2010/31/EU from EPBD, the concept of nearly zero energy buildings are highly recommended to improve energy performance with adopting insulation materials, HVAC and the building indoor quality for existing and new buildings without exception (European Parliament, 2010).

Moreover, 50% of the energy consumption in buildings in 1990 is expected to mitigate by improving building code and changing existing household-appliances with energy efficient ones by 2050 (Enker & Morrison, 2017).

Nearly Zero Energy Buildings (Nzeb)

In the case of taking environmental issues into consideration, buildings have promising effects on mitigating energy consumption (Enker & Morrison, 2017). With using energy efficient technology on building and building energy code, the energy used in buildings can be cut dramatically. To improve building energy performance, the concept of nearly zero carbon emission buildings is admitted as indispensable solutions.

Definitions of n-ZEB are following as;

- European Parliament (European Parliament, 2010) defines n-ZEB as renewable energy technologies meeting energy needs of buildings.
- Based on EISA, n-ZEB comprises; the reduction in energy use, the energy demand is fulfilled with zero- carbon energy technologies, mitigating the cost of renewable energy technologies (CRS, 2007).

The schematic diagram of n-ZEB is depicted in Figure 3. the generated electricity firstly meets energy demands of building systems such as heating/cooling indoor environment. There is no inconvenience to be sent the excess electricity generated from RET to the grids (European Parliament, 2009).

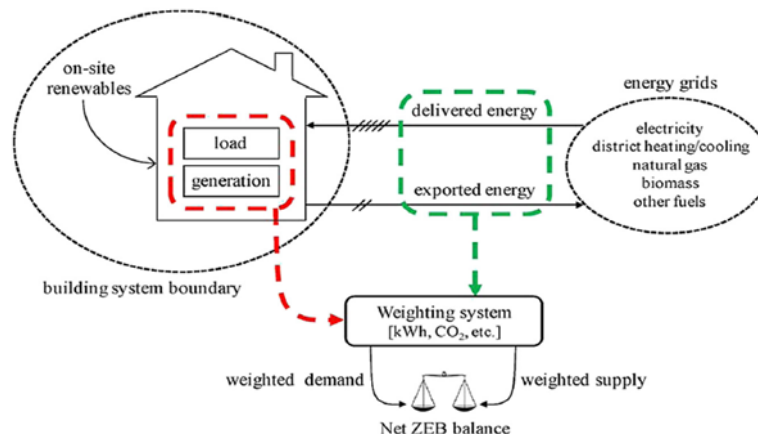


Figure 3. The schematic diagram of n-ZEB [28].

the energy consumption in an energy-efficient building is estimated to be reduced by 22% and 46% in 2020 and 2030 in comparison with 2005 (Faber et al., 2009). In another study with regard to reducing the energy demand in buildings, the reduction in GHG emission is targeted to be in the range of 40% and 60% between 2020 and 2030. These values have been found when compared to the data from 2005. RET applied to the buildings results in the considerable increase in energy saving (Wesselink & Deng, 2009).

Energy efficient buildings have profound effects on mitigating energy used in buildings. It can be examined into three main parts as follows (Li, Yang, & Lam, 2013).

- Building envelopes such as windows, wall, and roofs with thermal insulation.
- Internal conditions
- Building services systems such as HVAC, electrical services, lifts and escalators.

The increase in thermal performance of buildings with regarding to roof and facade would mitigate the emissions proportionally. Also, the reduction in the fuel consumption in the built environment with applying energy-efficient measures is expected to be about 22% and 46% (compared to 2005) in 2020 and 2030, respectively. In addition, annual savings based on benefits achieved from the renovation of the existing buildings in Europe is estimated to reach approximately €104-175 billion by 2020. The savings are divided into three categories such as lower energy bills, reduction of CO₂ emissions and enhanced indoor quality to provide healthier indoor and outdoor environments. The corresponding saving amounts for the said categories are reported to be €52-75 billion, €9-15 billion and €42-88 billion respectively.

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A Study on Autistic Spectrum Disorder for Children Based on Feature Selection and Fuzzy Rule

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Abstract: Autistic Spectrum Disorder is a mental disorder which impedes the acquisition of linguistic, communication, cognitive, and social skills and abilities. It occurs within the first three years of children and shows different symptoms. Early recognition of this disease can significantly reduce the health problems that it's caused. Unfortunately, waiting times for diagnosis of the disease are lengthy and hence the procedures are not effective. In this study, the importance of attributes are investigated and the predictive models are constructed for the detection of this disorder in children. The dataset consists of 292 instances and each instance includes 21 attributes. But, the pre-processed dataset consists of 247 instances. Experimental results clearly show that the *result* attribute is rather important. In addition, *relation*, *country_of_residence*, *age* and *ethnicity* attributes, and *Question 4 and 10* are found also important. The performances of the predictive models are evaluated within the frame of accuracy and sensitivity performance metrics.

Keywords: Autistic Spectrum disorder, feature selection, Fuzzy Rule, Logistic Regression, machine learning.

1. INTRODUCTION

Autistic Spectrum Disorder (ASD) is a mental disorder which impedes the acquisition of linguistic, communication, cognitive, and social skills and abilities (Thabtah, 2018). It occurs within the first three years of children and shows different symptoms (Shivakumar and Yamini, 2017). Early recognition of this disease can significantly reduce the health problems and so it improves the overall mental health of child (Bekerom, 2017). Unfortunately, waiting times for diagnosis of the disease are lengthy and hence the procedures are not effective (UCI Machine Learning Repository, 2018). In order to improve the decision making, different machine learning algorithms are applied to autism-related datasets. There are numerous investigations on this disorder in literature. For example, Bekerom examined the performances of machine learning algorithms which include data exploration and evaluation phrases in order to identify a set of conditions that are prove to be predictive of ASD (Bekerom, 2017). Thabtah discussed the recent studies and pros and cons of them in ASD classification. Also, the author focused on the reliability of ASD screening tools using the Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV (Thabtah, 2017). Posar and Visconti examined the main features of sensory abnormalities and the respective implications for the interpretation of several signs and symptoms of ASD. They inferred that atypical sensory reactivity of subjects with ASD may be the important factor in order to understand many of their abnormal behaviors (Posar and Visconti, 2018). Sharma et al. discussed the ASD's new diagnostic criteria, social communication impairment and restricted interests and repetitive behaviors (Sharma et al., 2018). Yates and Couteur presented an assessment framework for professionals who encounter a child with a suspected ASD (Yates and Couteur, 2016). In another study, Schlebusch and Dada examined the measurement of cognitive appraisal in the context of childhood disability in a middle-income country. They discussed the subject that how South African families appraise the impact on the family of raising a child with ASD (Schlebusch and Dada, 2018).

2. MATERIALS AND METHODS

The dataset (UCI Machine Learning Repository, 2018), which is taken from the University of California Irvine Machine Learning Repository, consists of 292 instances and each instance includes 21 attributes. The *Class/ASD* attribute is the outcome variable. These attributes are presented in Table 1.

Table 1. The information about the attributes in the dataset.

Attribute no.	Attribute name	Values
1-10	{A1 – A10} Questions	{0,1}
11	age	Continues values
12	gender	{m,f}
13	ethnicity	{Others,'Middle Eastern', 'White-European,Black,'South Asian',Asian,Pasifika,Hispanic,Turkish,Latino}
14	jundice	{no,yes}
15	austim	{no,yes}
16	contry_of_res	{Jordan, 'United States', Egypt, 'United Kingdom', Bahrain, Austria, Kuwait, 'United Arab Emirates', Europe, Malta, Bulgaria, 'South Africa', India, Afghanistan, Georgia, 'New Zealand', Syria, Iraq, Australia, 'Saudi Arabia', Armenia, Turkey, Pakistan, Canada, Oman, Brazil, 'South Korea', 'Costa Rica', Sweden, Philippines, Malaysia, Argentina,Japan, Bangladesh, Qatar, Ireland, Romania, Netherlands, Lebanon, Germany, Latvia, Russia, Italy, China, Nigeria, 'U.S. Outlying Islands', Nepal, Mexico, 'Isle of Man', Libya, Ghana, Bhutan}
17	used_app_before	{no,yes}
18	result	{0..10} numeric values
19	age_desc	{ '4-11 years'}
20	relation	{Parent, Self, Relative, Health care professional}
21	Class/ASD	{NO,YES}

Firstly, this dataset is pre-processed and shuffled sequentially. The pre-processed dataset consists of 247 instances since some instances which include missing values (?) for *ethnicity* or *relation* attributes are removed from the raw-dataset. Further, categorical information such as no/yes, m/f are converted to 0/1 categorical values. *Ethnicity* attribute includes categorical values like Middle Eastern, White-European and Black. In the same way, *country_of_residence* attribute includes categorical information such as Jordan and United States. The categorical transformation for these attributes is carried out, too. And then the significance of questions asked to patients and attributes for this disorder are investigated by utilizing Logistic Regression based feature selection method.

This method calculates the occurring and not occurring probabilities of an event. So, the effect of each independent attribute is usually explained in terms of the odds ratio. This ratio is a score in which the effect of an attribute on outcome variable (Lemeshow and Hosmer, 2000).

As can be seen in Figure 1, the *result* attribute, the sum of patients' answers to questions, is rather important. Also, *relation*, *country_of_residence*, *age* and *ethnicity* attributes, and *Question 4 and 10* are also important.

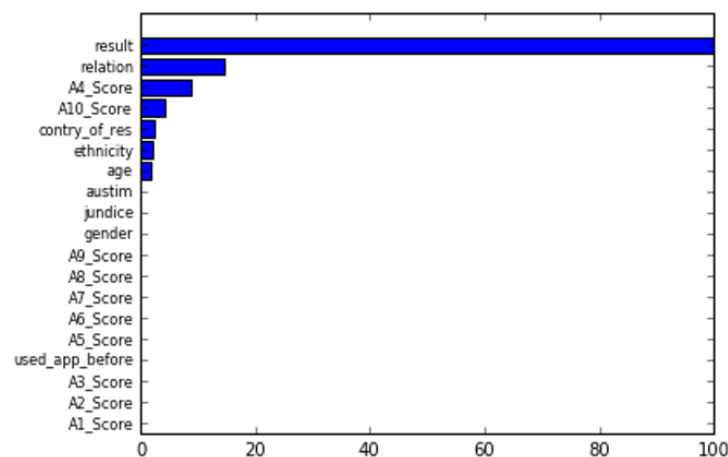


Figure 1. The importance of the attributes.

The two datasets, the pre-processed dataset and the best attributes dataset, are separated into 70-30% train and test datasets respectively. Hence, 172 train and 75 test datasets are obtained for both. The train datasets are sent as input data to the

Fuzzy Rule algorithm which is introduced in (Roubos et al. 2003) for the learning process in ASD. After then, the test datasets are sent to the predictive models for the testing process.

The performances of these models are evaluated within the frame of Accuracy (Acc) and Sensitivity (Sen) performance metrics presented below (Shaikh, 2011):

$$\text{Acc} = (\text{TP} + \text{TN}) / (\text{TP} + \text{FP} + \text{TN} + \text{FN}) \quad (1)$$

$$\text{Sen} = \text{TP} / (\text{TP} + \text{FN}) \quad (2)$$

$$\text{Spe} = \text{TN} / (\text{TN} + \text{FP}) \quad (3)$$

where TP, TN, FP and FN are the numbers of true positive, true negative, false positive and false negative instances respectively.

3.RESULTS AND DISCUSSION

The experimental results and performance measures which are obtained on the testing data are presented in Table 2. According to the results, the combination of Logistic Regression and Fuzzy Rule is better than applying only by Fuzzy Rule. Because the Acc and Sen metrics are 97.33% and 97.06% respectively for the best attributes dataset while these metrics are 92.0% and 85.29% respectively for the pre-processed dataset. In other words, the FR model classified correctly 29 out of 34 instances which are considered positive. Also, it classified correctly 40 out of 41 instances which are considered negative. The LR-FR model classified correctly 33 out of 34 instances which are considered positive. Besides, it classified correctly 40 out of 41 instances which are considered negative.

Table 2. Experimental results on the test dataset.

Models	Results		
		No	Yes
FR	No	40	1
	Yes	5	29
	Acc: 92.0, Sen: 85.29		
LR-FR	No	40	1
	Yes	1	33
	Acc: 97.33, Sen: 97.06		

ASD, a mental disorder, occurs within the first three years of children and shows different symptoms. Early recognition of this disease can significantly reduce the health problems and so it improves the overall mental health of child. Unfortunately, waiting times for diagnosis of the disease are lengthy and hence the procedures are not effective. In this study, the best attributes are investigated by using Logistic Regression method. In this context, the predictive models are constructed using Fuzzy Rule algorithm for the detection of children with ASD. Experimental results clearly show that the *result* attribute is rather important. Also, *relation*, *country_of_residence*, *age* and *ethnicity* attributes, and *Question 4 and 10* are found important but not as much as *result* attribute. Further, the combination of Logistic Regression method used for feature selection and Fuzzy Rule used for classification is better than applying only by Fuzzy Rule. Because the Acc and Sen metrics are 97.33% and 97.06% respectively for the best attributes dataset while these metrics are 92.0% and 85.29% respectively for the pre-processed dataset.

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Investigation of the Acceptance and Use of Online Social Networking Sites for Instructional Purposes

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Abstract: Online Social Networking Sites (SNSs) are the whole of social-based activities carried out by a group of users with the help of online information and communication technologies (ICT). Information technology (IT) teacher candidates' behaviors related to acceptance and use of the SNSs for teaching purposes are analyzed by gender, class, daily use times of SNSs, daily use times of SNSs for educational purposes, SNSs types used daily, SNSs type used in educational activities. The sample of the research consists of 75 students who are studying at the Kastamonu University BÖTE department. According to the results of the study, the attitudes of IT teacher candidates to use SNSs for teaching purposes are positive. When a detailed evaluation is made according to the factors, participants' intentions to use SNSs for instruction purposes are at a high level and they think that they can accomplish these intentions very easily. Both the performance expectancy and social influence factors affect the intention of participants to use SNSs for teaching purposes. According to gender, there is no statistically significant difference in all factors between acceptance and use behavior scores of instructional purposes of SNSs ($p > .05$). Twenty-six of the participants are second class, twenty-one are third class and twenty-eight are fourth grade students. Grade 3 students have adopted the idea that they will increase their professional performance when they use SNNs for teaching purposes more than students in grade 2. Approximately 73% of IT teacher candidates use SNN less than 1.5 hours for education purposes. This rate is 37% for non-educational purposes. This ratio is 37% for non-educational purposes. There were no significant differences between the acceptance and use behaviors of SNNs for teaching purposes and the duration of daily SNN use and duration of daily use of SNN for educational purposes. IT teacher candidates most use Instagram (84%), Youtube (81,4%), Google+ (52%) and Twitter (25,4%). There is a positive and weak relationship between performance expectancy factor and Facebook ($r = 0.23$, $p < 0.05$). There is also a positive and weak relationship between YouTube and social influence ($r = .265$, $p < 0.05$) and effort expectancy ($r = .279$, $p < 0.05$) subscales. IT teacher candidates use the most Google + (57.3%) and YouTube (53.3%) SNNs in educational activities. There is a positive and weak relationship between YouTube and performance expectancy ($r = 0.266$, $p < 0.05$) and social influence subscales. ($r = 0.321$, $p < 0.01$). There is also a positive and weak relationship between Google+ and social influence subscale ($r = 0.27$, $p < 0.05$). In addition, there is a positive and weak relationship between Facebook and the effort expectancy subscale ($r = 0.27$, $p < 0.05$). The social media they are most eager to using educational activity for IT teacher candidates are YouTube (57,3), Google+ (44) and Instagram (36%).

Keywords: social networking sites, acceptance and use of sns, scale of SNS, attitude towards the social media, social media

1.INTRODUCTION

Online Social Networking Sites (SNSs) are the whole of social-based activities carried out by a group of users with the help of online information and communication technologies (ICT). Information technology (IT) teacher candidates' behaviors related to acceptance and use of the SNSs for teaching purposes are analyzed by gender, class, daily use times of SNSs, daily use times of SNSs for educational purposes, SNSs types used daily, SNSs type used in educational activities. The sample of the research consists of 75 students who are studying at the Kastamonu University BÖTE department. In the collection of data, scale of the acceptance and use of SNSs for instructional purposes (SNS-IAU) developed by Bugra, Demir and Akbulut (2017) were used. The performance expectancy factor in the scale is defined as the level of belief that the individual's use of the SNSs for instructional purposes will help to improve the business performance. The social influence factor is the level of appreciation of IT teacher candidates by the individuals they attach importance to the views of the acceptance and use of SNSs for teaching purposes. The behavioral intention factor measures the degree to which IT teacher candidates tend to use SNSs for teaching purposes and integration them into their lessons in their future professional lives. The effort expectancy factor is considered as the level of physical, mental and emotional effort that IT teacher candidates predict will spend while using SNSs for instructional purposes.

2.RESULTS AND DISCUSSION

Acceptance and Usage Situations of Instructional Purposes of IT Teacher Candidates

The mean average scores of students' online social networking acceptance and use for instructional purposes (OSN-IAU) scale are shown in Table 1 according to the overall scale and factors.

Table 1. Average of the mean scores from the OSN-IAU Scale

Factor	N	Minimum	Maksimum	Mean	Std. Deviation
Performance Expectancy (PE)	75	1,73	5,00	3,85	,73415
Social Influence (SI)	75	1,70	5,00	3,69	,70210
Effort Expectancy (EE)	75	2,13	5,00	4,05	,70086
Behavioral Intention (BI)	75	2,00	5,00	4,03	,65981
Scale	75	2,26	5,00	3,91	,58704

According to Table 1, the attitudes of IT teacher candidates to use OSNs for teaching purposes are positive ($\bar{x}=3,91$). When a detailed evaluation is made according to the factors, participants' intentions to use OSNs for instruction purposes ($\bar{x} = 4,03$) are at a high level and they think that they can accomplish these intentions very easily ($\bar{x} = 4.05$). Participants' intentions to use OSNs for teaching purposes are influenced by performance expectations ($\bar{x} = 3.85$) and social influence ($\bar{x} = 3.69$). In other words, the main reason why IT teacher candidates want to use OSNs for teaching purpose is to think people in social circles will find it important and increase their job performance.

Change by Gender of IT Teacher Candidates' Acceptance and Use Behaviors of OSNs for Teaching Purposes

40 of the participants are girls and 35 are boys. According to the gender, the difference between acceptance and use behaviors of OSNs for of teaching purpose was examined by independent sample t-test. The results are given in Table 2.

Table 2. The Comparison of Acceptance and Use Behavior Scores of OSNs for Teaching Purpose by Gender

Factor	Gender	N	\bar{x}	ss	t	sd	p
PE	Female	40	3,87	0,66	,334	73	,739
	Male	35	3,82	0,82			
SI	Female	40	3,77	0,67	,960	73	,340
	Male	35	3,61	0,74			
EE	Female	40	4,04	0,57	-,167	73	,868
	Male	35	4,07	0,83			
BI	Female	40	3,95	0,59	-,182	73	,241
	Male	35	4,13	0,73			
Scale	Female	40	3,91	0,53	,011	73	,991
	Male	35	3,91	0,65			

When Table 2 is examined, there is no statistically significant difference in all factors between acceptance and use behavior scores of OSNs for teaching purposes by gender ($p>,05$).

Change by Class of IT Teacher Candidates' Acceptance and Use Behaviors of OSNs for Teaching Purposes

26 of the participants are 2nd grade, 21 are 3rd grade and 28 are 4th grade. The mean scores of the OSN-IAU scale and the ANOVA test results were given in Table 3 according to the classes of students in the study group.

Table 3. OSN-IAU Scale Score Averages and One-Way Variance Analysis (ANOVA) Results According to Classes

Ölçek	Grade	N	\bar{x}	ss	Var. S.	SS	Sd	SA	F	p	Post-Hoc Analysis
PE	2	26	3,52	0,75	Between Groups	5,185	2	2,593	5,380	,007*	2-3
	3	21	4,18	0,64	Within Groups	34,699	72	,482			
	4	28	3,90	0,68	Total	39,884	74				
	Total	75	3,85	0,73							
SI	2	26	3,47	0,52	Between Groups	2,045	2	1,022	2,138	,125	
	3	21	3,86	0,84	Within Groups	34,433	72	,478			
	4	28	3,78	0,71	Total	36,478	74				
	Total	75	3,69	0,70							
EE	2	26	4,04	0,64	Between Groups	,763	2	,381	,772	,466	
	3	21	4,20	0,67	Within Groups	35,586	72	,494			
	4	28	3,95	0,78	Total	36,349	74				
	Total	75	4,05	0,70							
BI	2	26	3,95	0,71	Between Groups	,601	2	,301	,685	,507	
	3	21	4,17	0,51	Within Groups	31,615	72	,439			
	4	28	4,00	0,71	Total	32,216	74				
	Total	75	4,03	0,66							
Scale	2	26	3,75	0,53	Between Groups	1,481	2	,741	2,220	,116	
	3	21	4,10	0,54	Within Groups	24,020	72	,334			
	4	28	3,91	0,64	Total	25,502	74				
	Total	75	3,91	0,59							

*p<0.05

When the above table is examined, the statistically significant relationship is found only among performance expectancy (PE) factor scores $F(2, 72) = 5,38; p < .05$. The Tukey test was used to determine which groups among this relationship was. According to the Tukey test result, grade 3 students ($\bar{x} = 4,18$) have adopted the idea that they will increase their professional performance when they use SNNs for teaching purposes more than students in grade 2 ($\bar{x} = 3,52$).

Change by Daily OSN Usage Time of IT Teacher Candidates' Acceptance and Use Behaviors of OSNs for Teaching Purposes

Statistical information on participants' daily use of OSN for both educational purposes and other than this purposes is shown in table 4. Approximately 73% of IT teacher candidates use OSN less than 1.5 hours for education purposes. This rate is 37% for non-educational purposes.

Table 4. Daily OSN Usage Times

Times	Daily Usage Time of OSN for Educational Purpose			Daily OSN Usage Time		
	N	\bar{x}	sd	N	\bar{x}	sd
Less than half an hour	11	4,1197	,47320	7	3,7473	,86922
Half hour - 1 hour	27	3,7152	,62135	17	3,8833	,39243
1 hour - 1.5 hours	17	4,0611	,67348	4	3,7550	,60207
1.5 hours - 2 hours	11	3,8606	,49293	6	3,7687	,98589
2 hours - 2.5 hours	3	4,2489	,53157	7	3,9436	,61711
2.5 hours - 3 hours	4	3,6663	,25979	9	4,0235	,39281
3 hours and more	2	4,2085	,29484	25	3,9705	,59196
Total	75	3,9061	,58704	75	3,9061	,58704

One-way analysis of variance (ANOVA) was used to examine whether the participants' acceptance and use behaviors for instructional purposes of OSNs changed daily according to the duration of OSN use and daily use of OSN for educational purposes. There was no statistically significant difference according to the results of variance analysis.

Change by OSN Type of IT Teacher Candidates' Acceptance and Use Behaviors of OSNs for Teaching Purposes

The types of social media used by IT teacher candidates and their frequency of use are shown in Table 5. According to this data, it can be said that IT teacher candidates use Instagram (84%), Youtube (81.4%), Google+ (52%) and Twitter (25.4%). In addition, very few participants use Facebook (18.6%), LinkedIn (0%) and Tumblr (5.3%).

Table 5. Types of social media used by participants and their frequency of use

Social media	Never		Rarely		Occasionally		Mostly		Always	
	N	%	N	%	N	%	N	%	N	%
Facebook	20,0	26,7	25,0	33,3	16,0	21,3	7,0	9,3	7,0	9,3
Google+	12,0	16,0	5,0	6,7	19,0	25,3	23,0	30,7	16,0	21,3
Tumblr	60,0	80,0	6,0	8,0	5,0	6,7	4,0	5,3	0,0	0,0
Twitter	34,0	45,3	10,0	13,3	12,0	16,0	11,0	14,7	8,0	10,7
YouTube	2,0	2,7	1,0	1,3	11,0	14,7	26,0	34,7	35,0	46,7
LinkedIn	60,0	80,0	6,0	8,0	9,0	12,0	0,0	0,0	0,0	0,0
Instagram	2,0	2,7	2,0	2,7	8,0	10,7	13,0	17,3	50,0	66,7

Correlation analysis was performed to determine the direction and severity of the relationship between the OSN-IAU scale and social media types and Pearson's correlation coefficients (r) were calculated. Generally, if $r > 0,70$ "strong relationship", if $r = 0,40$ and $r < 0,70$ "medium", if $r = 0,20$ and $r < 0,40$ "weak" and if $r < 0,20$ is considered to be a "neglectable relationship" (Örücü ve Kanbur, 2008). The results of the correlation analysis are shown in Table 6.

Table 6. Correlation analysis results between OSN type and dependent variables

Factor	Facebook	Google+	Tumblr	Twitter	Youtube	LinkedIn	Instagram
PE	,230*	,023	-,097	-,020	,190	-,011	,222
SI	,060	,132	-,084	-,120	,265*	,054	,165
EE	-,022	-,201	-,147	-,082	,279*	-,026	,055
BI	,081	-,010	-,014	-,083	,190	,081	-,017

** $p < 0.01$

* $p < 0.05$

There is a positive and weak relationship between performance expectancy factor and Facebook ($r = 0.23$, $p < 0.05$). That is, IT teacher candidates want to use Facebook for teaching purposes, and this is because they think that it will increase their professional performance. The determination coefficient (r^2) between the performance expectation dimension and Facebook is 0.053. This finding is indicative of a joint variance at 5.3%. In other words, the performance expectancy dimension describes the variance of Facebook by 5.3%. Likewise, Facebook describes the variance of the Performance expectancy dimension by 5.3%. In addition, there is a positive and weak relationship between YouTube and social influence ($r = .265$, $p < 0.05$) and effort expectancy ($r = .279$, $p < 0.05$) subscales. In other words, IT teacher candidates think that when they use YouTube for instruction, they are considered by their social circle. They also believe that they will spend little effort to use YouTube as a teaching tool.

Change by OSN Used in Educational Activities IT Teacher Candidates' Acceptance and Use Behaviors of OSNs for Teaching Purposes

Table 7 shows the types of social media used by IT teacher candidates in educational activities (lesson, curriculum, etc.) and their frequency of use. IT teacher candidates use the most Google + (57.3%) and Youtube (53.3%) OSNs in educational events. Other OSNs use very little.

Table 7. Types of social media and frequency of use that participants use for educational purposes

Social Media	Never		Rarely		Occasionally		Mostly		Always	
	N	%	N	%	N	%	N	%	N	%
Facebook	42,0	56,0	17,0	22,7	12,0	16,0	2,0	2,7	2,0	2,7
Google+	13,0	17,3	6,0	8,0	13,0	17,3	22,0	29,3	21,0	28,0
Tumblr	70,0	93,3	0		2,0	2,7	2,0	2,7	1,0	1,3
Twitter	51,0	68,0	12,0	16,0	7,0	9,3	3,0	4,0	2,0	2,7
YouTube	10,0	13,3	8,0	10,7	17,0	22,7	24,0	32,0	16,0	21,3
LinkedIn	69,0	92,0	3,0	4,0	3,0	4,0	0,0	0,0	0,0	0,0
Instagram	35,0	46,7	11,0	14,7	15,0	20,0	8,0	10,7	6,0	8,0

Correlation analysis was performed to determine the direction and severity of the relationship between the OSN-IAU scale and social media types, and Pearson's correlation coefficients (r) were calculated and shown in Table 8.

Table 8. Correlation analysis results between dependent variable and OSN type used for educational purposes

Factor	Facebook	Google+	Tumblr	Twitter	Youtube	LinkedIn	Instagram
PE	-,011	,017	-,026	,020	,266*	-,034	,114
SI	-,044	,270*	-,016	-,032	,321**	,064	,114
EE	-,270*	-,070	-,192	-,200	-,054	-,110	-,135
BI	-,130	-,008	,040	-,056	,110	,068	-,052
Scale	-,134	,063	-,059	-,079	,194	-,005	,015

** p< 0.01

* p< 0.05

There is a positive and weak relationship between YouTube and performance expectancy ($r = 0.266$, $p < 0.05$) and social effect dimensions ($r = 0.321$, $p < 0.01$). There is also a positive and weak relationship between Google+ and social influence subscale ($r = 0.27$, $p < 0.05$). In addition, there is a positive and weak relationship between Facebook and the expectation of effort ($r = 0.27$, $p < 0.05$). When these findings are evaluated, IT teacher candidates think that if they use YouTube and Google+ in educational activities, they will be appreciated by social circles, that the use of YouTube will increase the teaching performance and that Facebook will be able to use educational activities with little effort.

Table 9 also shows IT teacher candidates are likely to be able to how enthusiastic use OSN in educational activities (lessons, lessons, etc.). IT teacher candidates want to use Youtube (57,3), Google+ (44) and Instagram (36%) social media in educational events.

Table 9. OSNs that participants want to use in educational activities

Social Media	I'm not eager		I am a little eager		I am eager in the middle		I am very eager		I am completely eager	
	N	%	N	%	N	%	N	%	N	%
Facebook	38,0	50,7	9,0	12,0	18,0	24,0	4,0	5,3	6,0	8,0
Google+	19,0	25,3	3,0	4,0	20,0	26,7	17,0	22,7	16,0	21,3
Tumblr	61,0	81,3	5,0	6,7	5,0	6,7	2,0	2,7	2,0	2,7
Twitter	44,0	58,7	12,0	16,0	11,0	14,7	2,0	2,7	6,0	8,0
YouTube	10,0	13,3	4,0	5,3	18,0	24,0	13,0	17,3	30,0	40,0
LinkedIn	60,0	80,0	5,0	6,7	6,0	8,0	3,0	4,0	1,0	1,3
Instagram	25,0	33,3	8,0	10,7	15,0	20,0	10,0	13,3	17,0	22,7

In this study, Information technology (IT) teacher candidates' behaviors related to acceptance and use of the SNSs for teaching purposes are analyzed by gender, class, daily use times of SNSs, daily use times of SNSs for educational purposes, SNSs types used daily, SNSs type used in educational activities. According to the results of the study, the attitudes of IT teacher candidates to use SNSs for teaching purposes are positive ($\bar{x} = 3.91$). When a detailed evaluation is made according to the factors, participants' intentions to use SNSs for instruction purposes ($\bar{x} = 4,03$) are at a high

level and they think that they can accomplish these intentions very easily ($\square = 4.05$). Both the performance expectancy ($\square = 3.85$) and social influence ($\square = 3.69$) factors affect the intention of participants to use SNSs for teaching purposes. That is, the main reasons why IT prospective teachers want to use SNSs for teaching purposes are (i) they think they will increase their business performance, and (ii) they think that people in their social environment will find it important. According to gender, there is no statistically significant difference in all factors between acceptance and use behavior scores of instructional purposes of SNSs. Grade 3 students ($\square = 4.18$) have adopted the idea that they will increase their professional performance when they use SNNs for teaching purposes more than students in grade 2. There were no significant differences between the acceptance and use behaviors of SNNs for teaching purposes and the duration of daily SNN use and duration of daily use of SNN for educational purposes. IT teacher candidates most use Instagram (84%), Youtube (81.4%), Google+ (52%) and Twitter (25.4%). There is a positive and weak relationship between performance expectancy factor and Facebook ($r = 0.23$, $p < 0.05$). There is also a positive and weak relationship between YouTube and social influence ($r = .265$, $p < 0.05$) and effort expectancy ($r = .279$, $p < 0.05$) subscales. IT teacher candidates use the most Google + (57.3%) and YouTube (53.3%) SNNs in educational activities. There is a positive and weak relationship between YouTube and performance expectancy ($r = 0.266$, $p < 0.05$) and social influence subscales. ($r = 0.321$, $p < 0.01$). There is also a positive and weak relationship between Google+ and social influence subscale ($r = 0.27$, $p < 0.05$). In addition, there is a positive and weak relationship between Facebook and the effort expectancy subscale ($r = 0.27$, $p < 0.05$). The social media they are most eager to using educational activity for IT teacher candidates are YouTube (57.3%), Google+ (44) and Instagram (36%).

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Effect of Nanofluids on Strength Behavior of a Ch Clay

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Abstract: It is well known that nanotechnology attracts the attention of the whole world. Many studies have been performed by the researchers to improve nanotechnology and developed new nanomaterials for decades. It is fact that the usage of nanomaterials in civil engineering application is quite late due to their high costs. In recent years, parallel with the development of nanotechnology, nanomaterials can be produced at lower prices. Because of cost efficiency and reachability of nanomaterials, the researchers have started to use nanomaterials in civil engineering applications, also in geotechnical applications. The aim of this study was to investigate the effect of nanofluids on a high plastic (CH) clay. In the experiments, SiO₂ and Al₂O₃ nanoparticles were used for preparing nanofluids. The nanofluids having 0.5, 1 and 2 wt% were prepared by using two-step method. For this purpose, the nanoparticles with certain weight were firstly added to the de-ionized water and this suspension was continuously stirred for 10 min at magnetic stirring. Then, the nanofluids was gently mixed with CH clay. The prepared nano-mixtures (i.e., SiO₂-CH clay and Al₂O₃-CH clay mixtures) were compacted at their own optimum water content in accordance with ASTM D-698. In order to determine the strength parameters of the nano-mixtures, the unconfined compression test (UCS) was performed on all mixtures. It was assumed that nanoparticles filled the pores between clay particles and have a positive effect on strength behavior CH clay. However, the results showed that the addition of nanofluids into CH clay decreased the UCS values of the nano-mixtures. As a result, both SiO₂ and Al₂O₃ nanofluids had no effect on strength parameters of the mixtures.

Keywords: Nanofluid, Nanoparticle, Nano-mixture, CH clay, Unconfined compression strength

1. INTRODUCTION

Soil reinforcement is one of the most important issue in geotechnical applications. A wide range of reinforcement materials has been used to improve soil performance. Increasing the soil strength has caused increased interest in identifying new accessible resources for reinforcement. Due to offering faster, more effective and more economical solution, these kinds of materials are preferred when compared with conventional methods. In the literature, metal strips (Fragaszy and Lawton, 1984), metal bars (Huang and Tatsuoka, 1990), rope fibers (Akinmusuru and Akinbolade, 1981; Yetimoglu et al., 2005), geotextiles (Guido et al., 1986; Ghosh et al., 2005) and geogrids (Omar et al., 1993-a and 1993-b; Yetimoglu et al., 1994; Adams and Collin, 1997; Patra et al., 2006) are usually used as soil reinforcement materials. On the other hand, some waste materials have been used in soil reinforcement applications. Tulek, 2007; Coruh et al., 2013; Kutuk-Sert and Kutuk, 2013 investigated the usability of borogypsum in soil reinforcement. Also, Degirmenci et al., 2007; Yilmaz and Civelekoglu, 2009; Shen et al., 2009 studied the phosphogypsum. The effect of fly ash on soil reinforcement was explored by Prabakar et al., 2004; Kolias et al., 2005; Edil et al., 2006; Chauhan et al., 2008; Brooks, 2009; Cristelo et al., 2012.

It is well known that nanotechnology attracts the attention of the whole world. Many studies have been performed by the researchers to progress nanotechnology and developed new nanomaterials for decades. It is fact that the usage of nanomaterials in civil engineering application is quite late due to their high costs. In recent years, parallel with the development of nanotechnology, nanomaterials can be produced at lower prices. Because of cost efficiency and reachability of nanomaterials, the researchers have started to use nanomaterials in civil engineering applications, also in geotechnical applications. Ghasabkolaei et al. (2017) has been mentioned that large steps have been taken in the field of nanotechnology, and many nanotechnology-based breakthroughs have been made in geotechnical engineering. It is apparent that nanomaterials will be used to improve the geotechnical properties of soils in the near future, extensively.

In this study, the usability of nanofluids as reinforcement materials in fine-grained soil was investigated. In the experiments, SiO₂ and Al₂O₃ nanoparticles were used for preparing nanofluids. Fine-grained soil was mixed with nanofluids at different ratios. The effect of nanofluids on strength behavior was evaluated.

2. MATERIALS AND METHODS

The high plastic clayey soil used in these experiments was obtained locally landfill area and has been classified as CH according to the Unified Soil Classification System (USCS) with ASTM D2487. Some geotechnical properties of this clayey soil are summarized in Table 1.

Table 1. Some properties of clayey soil used in tests.

Properties	Value
Liquid limit ¹ , w_L (%)	120.0
Plastic limit ² , w_P (%)	30.4
Plasticity index, I_P (%)	89.6
Optimum water content ³ , w_{opt} (%)	30.0
Maximum dry unit weight ³ , γ_{dmax} (kN/m ³)	13.9
Soil class (USCS)	CH

¹ w_L per BS 1377 (Part 2-1990)

² w_P per ASTM D 4318-00 (2000)

³ Obtained from Standard Proctor Tests (ASTM D 698-78).

In the experiments, SiO_2 and Al_2O_3 nanoparticles were used for preparing nanofluids. The nanofluids having 0.5, 1 and 2 wt% were prepared by using two-step method. For this purpose, the nanoparticles with certain weight were firstly added to the de-ionized water and this suspension was continuously stirred for 10 min at magnetic stirring. Then, the nanofluids was gently mixed with CH clay. After mixing, the prepared nano-mixtures (i.e., SiO_2 -CH clay and Al_2O_3 -CH clay mixtures) were compacted at their own optimum water content in accordance with ASTM D-698. The nano-mixtures were compacted in three layers into a 38 mm diameter and 76 mm high cylindrical mold at optimum water content (Sridharan and Sivapullaiah, 2005).

The unconfined compression test was performed according to ASTM D 2166. Unreinforced and reinforced samples were tested in an unconfined compression machine with 0.8 mm/min loading rate.

3.RESULTS AND DISCUSSIONS

The stress-deformation curves of reinforced and unreinforced samples are given in Figure 1.

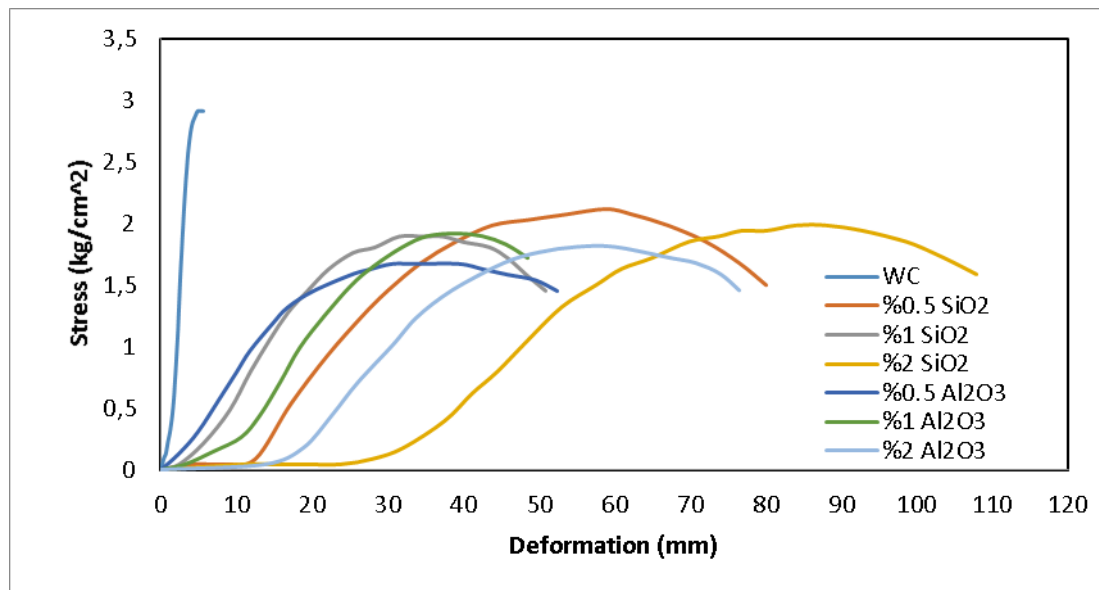


Figure 1. Stress-deformation curves of samples.

It is seen in Figure 1 increment in nanofluids generally decreases the peak shear stress. The reinforced samples tend to show lower shear stress than the unreinforced samples, however, the reinforced samples collapse at large strains.

The photos of reinforced SiO_2 -CH clay and unreinforced samples after unconfined compression test are illustrated in Figure 2. It has been observed in parallel to the findings available in literature that, the reinforced samples exhibit more ductile behavior than unreinforced samples. Also, the reinforced Al_2O_3 -CH clay and unreinforced samples after unconfined compression test are illustrated in Figure 3.



Figure 2. Unconfined compression test reinforced SiO₂-CH clay and unreinforced samples

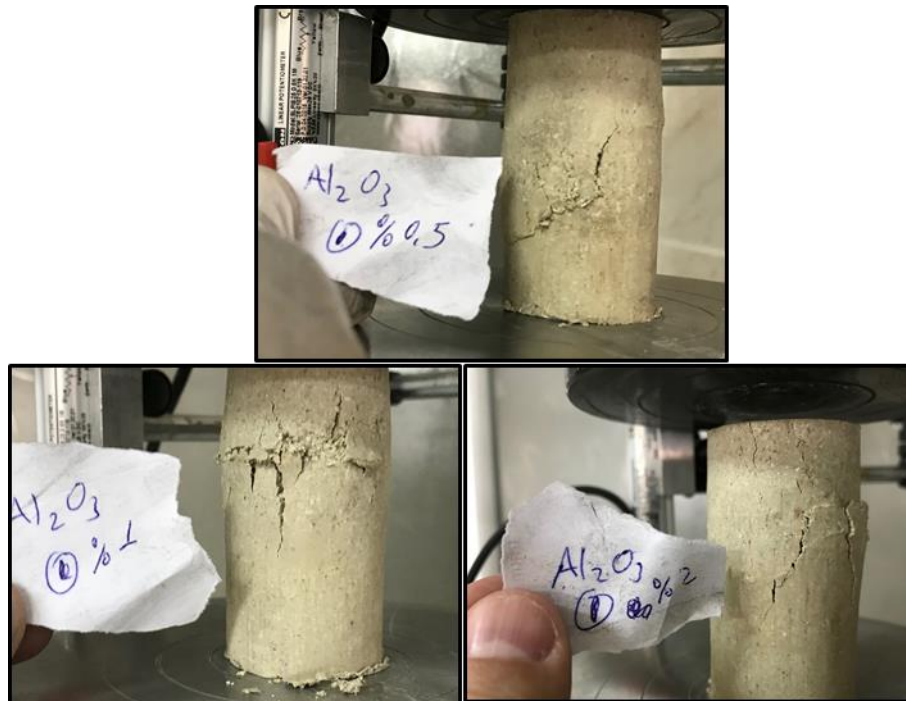


Figure 3. Unconfined compression test reinforced Al₂O₃-CH clay and unreinforced samples

The peak stress values are used to calculate the undrained strength (q_u) of the reinforced and unreinforced samples. The relationship between q_u and nanofluids content is shown in Figure 4. It is clearly seen in Figure 4 that a considerable decrease was observed in q_u with increasing nanofluids at two types. It was assumed that nanoparticles filled the pores between clay particles and have a positive effect on strength behavior CH clay. However, the results showed that the addition of nanofluids into CH clay decreased the UCS values of the nano-mixtures. As a result, both SiO₂ and Al₂O₃

nanofluids had no effect on strength parameters of the mixtures. It may be attributed the fact that nanofluids could not be react with soil particles. In other words, the nanofluids have no pozzolana reaction.

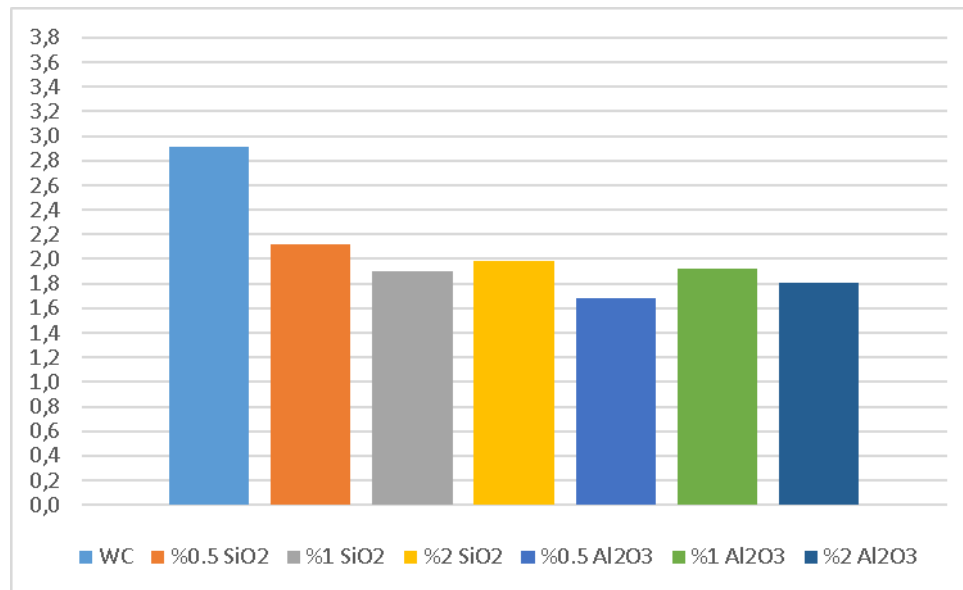


Figure 4. Nanofluids vs. undrained strength

In this study, a series of unconfined compression were conducted in laboratory in order to observe the strength behavior of CH clay reinforced with nanofluids in different ratios. The general results from the experiments are as follows:

- The results indicate that the nanofluids mixed with clayey soils cannot be used in soil reinforcement.
- Increment in nanofluids ratio generally decreases the peak shear stress.
- The reinforced samples tend to exhibit lower shear stress at large strains when compared with the unreinforced samples.
- The reinforced samples exhibit more ductile behavior than unreinforced samples.

In order to achieve more realistic judgments on the subject, experiments are recommended to be continued for further studies with different soil types

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A Research on the Usability of Forest Roads for Ecotourism

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Abstract: Functionally based management plans are being implemented in our country to provide multi-purpose benefits from forest areas. Today, with the increasing demand for recreational use of forest resources, the General Directorate of Forests distinguishes socio-cultural functional areas for the benefit of nature. The forest roads, which are the most important infrastructure facilities for the success of these plans, provide a great social and cultural benefit by transporting the raw materials of wood, personnel, materials and equipment, meeting the road needs of the forest villages, serving also to meet recreational demands. In addition to providing access to a variety of cultural and natural resources, the use of these forest roads for walking, running, strolling, horse riding, cycling and similar recreational purposes will contribute positively to ecotourism. Within the scope of this study, usability forest roads that can provide transportation to ecotourism-oriented areas such as nature parks, recreation areas, wetlands, natural monuments, forest resting places and urban forests, bird and wildlife observation points, has been examined in order for this purpose, designed with different standards and specifications. The technical standards of the forest roads to be used for recreational purpose are determined by topographic structure, estimated usage intensity, usage pattern (walking / cycling etc). In addition, drainage is important on these roads and weak ground conditions should be avoided as much as possible. It should be safe, comfortable, relaxing, entertaining, informative and attractive according to its aesthetic properties. In this direction, identification plate and signs should be placed on the roads. The forest roads in this property, which can also provide access to natural resources and cultural assets within the forest, should offer opportunities for activities such as scenic views, resting points, camping and picnicking. The roads should be connected to the roads by means of highways and other roads and the parking areas should be planned for these areas and the existing forest roads should be contributed to the ecotourism of the country.

Keywords: Socio-cultural function, Forest road, Recreation, Ecotourism

1.INTRODUCTION

Ecotourism forms a subdivision of sustainable tourism. Ecotourism is one of the sustainable forms of tourism, and sometimes it is used synonymously with sustainable tourism (Avcıkurt 2007).

Forest management plans are being made in order to plan the future of our country's forests. Exploring the interest of humans in ecotourism, the General Directorate of Forests distinguishes functional areas for the benefit of people from the ecosystem (OGM 2014).. Forest Recreation; they are confronted as recreational resources that adequately carry the basic conditions necessary for outdoor recreation, in which the collective recreational service can be offered in the most common and convenient way (Akesen, 1998).

The forest roads, which are the most important infrastructure facilities for the success of these aims, provide a great social and cultural benefit by transporting the raw materials of wood, personnel, materials and equipment, meeting the road needs of the forest villages, serving also to meet recreational demands. In addition to providing access to a variety of cultural and natural resources, the use of these forest roads for walking, running, strolling, horse riding, cycling and similar recreational purposes will contribute positively to ecotourism (Hasdemir and Demir 2000).

Usda Forest Service published a book named "Road Analysis Mt. Hood National Forest" in 2003. The areas of use of forest roads are summarized in five subheadings (USDA 2003):

1. Recreational road use
2. Production of forest products
3. Special use: Forest roads are used to provide access to private areas and other special purpose areas within the forest. These uses can be listed as follows; - Providing the installation and maintenance of structures such as dams, drainage structures and pipelines, - Providing access to private accommodation areas and camping areas, - Providing access to sportive activity areas,
4. Administrative use :Forest roads are used extensively by the forestry administration in order to ensure the sustainability of the forest and to ensure that the forestry practices required to achieve this continuity are effective.

These applications can be listed as follows;

- Examination of ecological and biological situation of forest,
- Planning of forestry practices, - Care of campsites and hiking trails, - Administrative practices,
- Fire fighting,
- Silvicultural arrangements and maintenance,
- Search and rescue work,
- Scientific research,
- Access to fire safety gates,
- Access to seed gardens,
- Providing the installation and maintenance of structures such as dams, drainage structures, pipelines,
- To provide access to in-forest fish farms

Usability of Forest Roads for Ecotourism

Forest recreation roads meet the recreational needs of people as well as wood and wood-based production functions. A pleasurable driving source is mostly forest-based recreational activities. This includes driving, camping, hunting, skiing, etc.. The source of access to these areas also goes through the forest roads. The forest road system includes Forest Enterprise Roads, which provide technical forestry work for the sustainability of the forest, as well as Recreational Roads for recreational activities such as walking, running and resting (Akgül 2004).

Forest recreation roads are be planned and constructed for including recreational uses such as walking, running, hunting, horse riding, cycling and similar recreational uses in forest recreation areas such as nature park, forest recreation area and urban forests. The topographic structure, the comfort of the people and the usage density of these roads are effective determination of the technical standards of forest roads to be used for recreational purposes. These roads consist of pedestrian roads, bicycle roads, horse roads, disabled roads, and so on. All these roads must be safe, comfortable, relaxing and attractive in terms of the recreational activities of the person. In this respect; be planned and constructed in accordance with technical, aesthetic and functional standard (Akgül 2004, Akbaş 2016).

Within the scope of this study; forests such as Forest resting place and urban forests, Nature park, recreation places, Nature monuments, Waterfall areas, Bird and wildlife observation points, Camp areas can provide access to heavily ecotourism areas in order to be able to provide appropriate service in this way the design and usability of different standards and specifications have been examined.

2.CONCLUSION

Acceptable road standards;

- Provide positive contribution to external recreation and environment,
- Sensitive to natural and cultural heritage,
- It should be able to meet user needs.

Drainage is important on these roads and should be avoided as much as possible from poor ground conditions.

It should be safe, comfortable, relaxing, entertaining, informative and attractive according to its aesthetic properties. In this direction, identification signs and signs should be placed on the roads.

The forest roads in this property, which can also provide access to natural resources and cultural assets within the forest, should offer opportunities for activities such as scenic views, resting points, camping and picnicking.

The roads should be connected to these roads by means of highways and other roads and the parking areas should be planned for these areas to contribute to the ecotourism of the country with the existing forest roads.

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Alternative to Antibiotic Use in Livestock: *Probiotic Microorganisms*

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Abstract: During the past years health promoting microorganisms have been increasingly included in food and agricultural products. Probiotics is recognized as an alternative therapy which is used to protect intestinal microbial balance with the beneficial effects for humans and animals. Recently an alternative and effective approach to antibiotic administration to livestock is the use of probiotics, which can help to improve gut microbial balance and therefore the natural defence of the animal against pathogenic bacteria. The aim of this study is to give an overview of the main areas of recent *agricultural applications of probiotic* microorganisms as alternatives to antibiotics, particularly in *organic livestock for improvement of animal welfare*.

Keywords: *Probiotic, Agriculture, Organic Livestock, Animal Welfare*

1. INTRODUCTION

Various stress factors including nutritional, environmental and weaning, etc., at different stages of life affect the animal productivity and health. Natural and synthetic chemicals such as antibiotics, disinfectants, parasiticides, probiotics, and other feed additives have become indispensable inputs for treatment and prevention of bacterial and parasitic infections as well as for improvement of water quality, and/or promoting growth (Scallan et al. 2011; Seal et al. 2013).

Veterinary uses of antibiotics in livestock production include not only the therapeutic and prophylactic uses, but also the administration at subtherapeutic levels to stabilize the gut microbiota and enhance animal growth performance (Guerra and Castro, 2009). Because the subtherapeutic use of antibiotics can promote animal growth performance and, therefore, many antibiotics that are used in this regard are referred as antibiotic growth promoters (AGP). However, there are two major concerns regarding the use of AGP for farm animals. One is the chemical residues from such antibiotics, like other chemical food additives, which may be found in animal products as foreign substances. These residues have no place in the food chain and constitute a potential hazard for human consumers. The other is that the antibiotics used for animals are the same as those used in human medicine, and the continued application of compounds such as antibiotics has been associated with the development of drug-resistant bacteria. The more an antibiotic is used, the more likely are resistant populations to develop among pathogens (Cromwell, 2002; Dibner and Richards, 2005; Guerra and Castro, 2009).

Since the use of such antimicrobials has been questioned and the European Union and USA have implemented bans or restricted their use it has been the greatest challenge to farmers to rear healthy livestock devoid of antibiotic supplementation. Therefore, in search of better alternatives to antibiotics or antibiotic growth promoters, the focus is rather on another family of feed additives, probiotics for addressing safe animal produce as well as improved growth and productivity and profitable livestock farming (Dibner and Richards, 2005; Hossain et al. 2017).

The Potential Benefits of Probiotics in Animal Production

Probiotics are defined as “viable microorganisms that provide health benefits to the host when consumed in a sufficient quantity”. They are non-pathogenic, mono- or mixed-culture preparations that could be formulated in different products, i.e. foods, drugs, and dietary supplements, and could favorably influence the host health by improving the stability of microorganisms residing in gastrointestinal tract when consumed in any form at high concentrations. They are classified by the US Food and Drug Administration (FDA) as “generally recognized as safe (GRAS)” ingredients (Saarela et al. 2000; Socol et al. 2010; Seal et al. 2013).

In farm animals probiotics substitute in-feed chemotherapeutics in order to enhance the animal health, improve resistance to specific pathogens, modulate the immune system of animal by enhancing the systematic antibody response to soluble antigens in the serum, confer good intestinal health (stimulate the growth of a healthy microbiota, prevent intestinal colonization of enteric pathogens, reduce faecal noxious gas emission, produce antimicrobial substances, improve digestive ability and antibody mediated immune response) and improve production parameters (increased growth, carcass weight, protein content, milk production; enhanced quality of animal products, and reduced cholesterol content (Figure 1) (Seal et al. 2013; Amara and Shibl, 2015; Hanczakowska et al. 2016; Hossain et al. 2017).

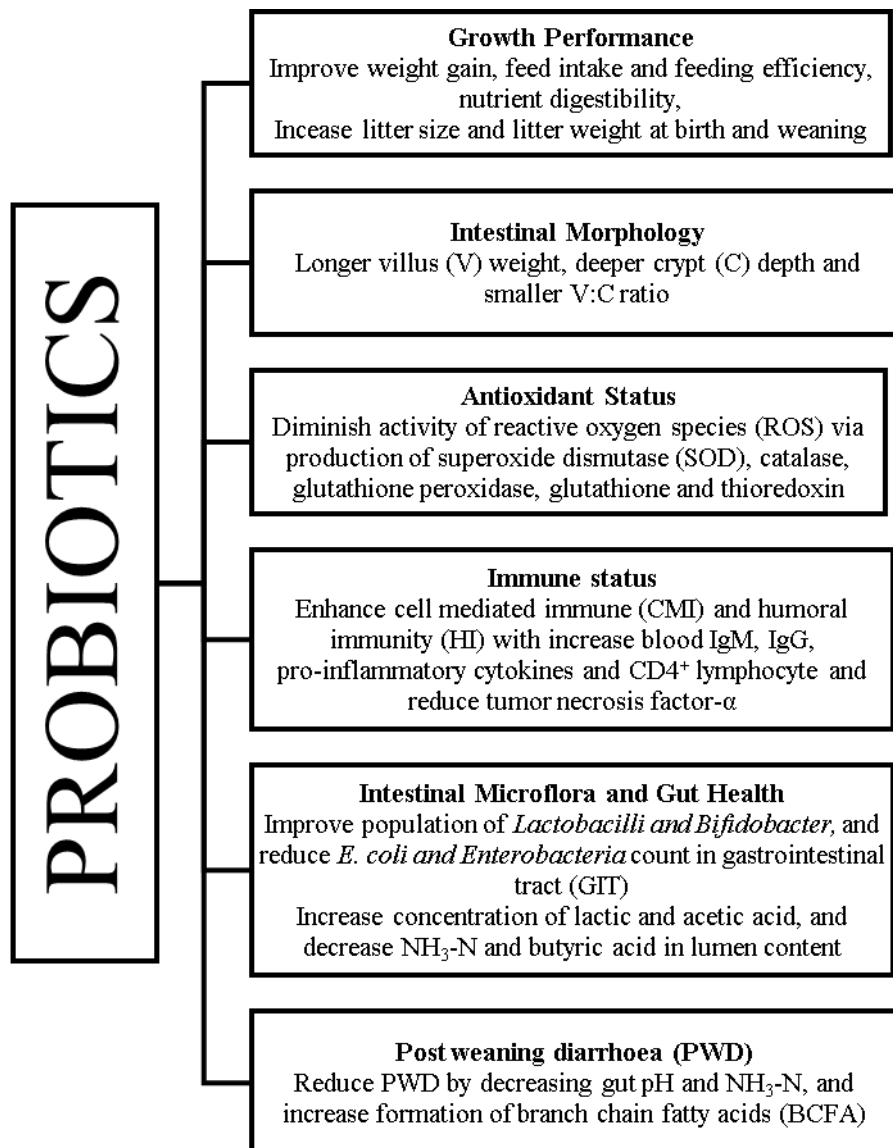


Figure 1. Why probiotics are used in animal welfare (Dowarah et al. 2017).

The primary function of the gastrointestinal tract is to digest and absorb nutrients, thus a well-balanced stable gastrointestinal microflora that could serve as a vital barrier to prevent the entry of potentially harmful pathogens and other environmental antigens are “must” for optimal animal welfare (Ewing 2008; Veizaj-Delia and Pirushi 2012).

As far as known, the gut microbiota could be manipulated by dietary means using feed additives such as organic and inorganic acids, enzymes, antibiotics, prebiotics, probiotics, mold inhibitors and botanical products (Veizaj-Delia and Pirushi 2012, de Lange et al. 2010; Le Bon et al. 2010).

Since being known as “health friendly bacteria” probiotics exhibit several beneficial properties by modulation of the “gut-brain”; such as development of the intestinal microbial balance, prevention of gastrointestinal disorders and pre-digestion of anti-nutritional factors present for higher feed efficiency and improved utilisation of nutrients, contribution to immune system stimulation (Krehbiel et al. 2003; Soccol et al. 2010).

Enhancement of the feed efficiency (the efficiency of converting feed mass into body mass), which is very critical for a profitable production, relies on a healthy gastro-intestinal tract since only a healthy gut can result in a better feed digestion and a better nutrient absorption via its epithelial membranes (Ewing 2008; Willing et al. 2012, Veizaj-Delia and Pirushi 2012).

Lactobacillus and Bifidobacterium are mostly used bacterial species as probiotics. However, different microorganisms like *Enterococcus faecalis*, *E. faecium*, *Sporolactobacillus inulinus*, *Propionibacterium freudenreichii* and *Saccharomyces cerevisiae* are also known to exert probiotic activities, especially in animal products (Table 1). The most stable probiotic strains are by far the Bacillus species classified as saprophytic gram-positive bacteria common in soil, water, dust and air. They enter the gut by being associated with food and are considered to be allochthonous. Their spores are heat-resistant and can stay viable during long-term storage. They are also involved in food spoilage (Lara-Flores et al. 2003; Kühle et al. 2005; Musa et al. 2009; Seal et al. 2013).

Probiotics can be supplemented to livestock through either direct addition to feed or water or by oral gavage (Lio, Shengfa and Nyachoti 2017, Modesto et al. 2009; Karimi-Torshizi et al. 2010).

Table 1. Probiotic microorganisms commonly used as animal feed (Yirga 2015).

BACILLUS	B. AMYLOLIQUEFACIENS, B. CEREUS, B. COAGULANS, B. LICHENIFORMIS, B. MEGATERIUM, B. MESENTRICUS, B. POLYMYXA, B. SUBTILIS, B. TOYONENSIS
BREVIBACILLUS	<i>B. laterosporus</i> ,
BIFIDOBACTERIUM	<i>B. adolescentis, B. animalis, B. bifidum, B. bifidus, B. infantis, B. lactis, B. longum, B. pseudolongum, B. thermophilum</i>
CANDIDA	<i>C. pintolepesii, C. utilis</i>
CLOSTRIDIUM	<i>C. butyricum</i>
ESCHERICHIA	<i>E. coli</i>
ENTEROCOCCUS	<i>E. faecium, E. faecalis</i>
LACTOBACILLUS	<i>L. acidophilus, L. amylovorus, L. brevis, L. bulgaricus, L. casei, L. cellobiosus, L. curvatus, L. farciminis, L. fermentum, L. gallinarum, L. jensenii, L. lactis, L. paracasei, L. plantarum, L. reuteri, L. rhamnosus, L. salivarius, L. sobrius, L. thermophilus</i>
LACTOCOCCUS	<i>L. lactis</i>
LEUCONOSTOC	<i>L. citreum, L. lactis, L. mesenteroides</i>
MEGASPHAERA	<i>M. eisdanii</i>
PEDIOCOCCUS	<i>P. acidilactici, P. parvulus, P. pentosaceus subsp. pentosaceus</i>
PREVOTELLA	<i>P. bryantii</i>
PROPIONIBACTERIUM	<i>P. acidipropionici, P. freudenreichii, P. jensenii, P. shermanii</i>
SACCHAROMYCES	<i>S. boulardii, S. cerevisiae, S. pastorianus (S. carlsbergensis), S. cerevisiae</i>
STREPTOCOCCUS	<i>S. bovis, S. cremoris, S. diacetylactis, S. faecalis, S. faecium, S. gallolyticus, S. infantarius, S. intermedius, S. thermophilus</i>
ASPERGILLUS	<i>A. oryzae, A. niger</i>

2.CONCLUSION

Animal feed companies have been looking for alternative products and strategies that can help to maintain animal gut health in order to prevent or reduce the prevalence of pathogens in the food chain. In this scenario, latest reports indicate probiotic supplementation seems to be a better alternative to antibiotic use addressing the safe and profitable animal produce as well as to combat economic losses.

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The Effect of Winding Angle on Hoop Tensile Characteristics of the Glass Fiber Reinforced Composite Pipes

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Abstract: In today's world, polymer-based composites have been developed by scientists since they can be alternative for classical engineering materials by providing more economical usage and technical requirements. In order to obtain them, there are some manufacturing methods such as hand layup, pultrusion, filament winding, resin transfer molding, injection molding according to the desired product. Among them, filament winding is the most reliable production method which is recommended for obtaining round shapes. Nowadays, it has been used for fabrication of high pressure vessels, high pressure piping systems, oxygen and fire extinguisher tubes, helicopter rotor, wind turbine blades, transmission shafts, bus shafts, aircraft body parts, ship body parts, space shuttles. The method consists of fiber reinforcement and resin matrix which are the main components composing the composite material and its products may have different design parameters such as the desired winding angle, fiber type, mandrel diameter, resin type etc. The required design according to the field of application is easily passed on with the specified parameters. The aim of this study is to investigate the hoop tensile strength and modulus characteristics of the glass fiber reinforced and epoxy based matrix composite pipes which are fabricated by filament winding technique. Five specimens for each winding angle configuration (40°, 55° and 70°) were prepared and tested according to ASTM D2290 standard. Also, fiber mass fractions were obtained from the analysis of ignition loss tests in accordance with ASTM D2584 standard. The results show that winding angle has a significant role on determination of hoop tensile properties of filament wound composite pipes.

Keywords: Filament winding, Glass fiber, Winding angle, Hoop tensile, Composite material

1. INTRODUCTION

In today's world, polymer-based composites have been developed by scientists since they can be alternative for classical engineering materials by providing more economical usage and technical requirements. Pipes obtained from composites are another important products that are used in many engineering application and daily life. In order to obtain them, there are some manufacturing methods such as hand layup, pultrusion, filament winding etc according to the desired product. Among them, filament winding is the most reliable production method. Nowadays, it has been used for fabrication of high pressure vessels, high pressure piping systems, oxygen and fire extinguisher tubes, helicopter rotor, golf clubs, wind turbine blades, transmission shafts, bus shafts, aircraft body parts, ship body parts, space shuttles. The method consists of fiber reinforcement and resin matrix which are the main components composing the composite material and its products may have different design parameters such as the desired winding angle, fiber type, mandrel diameter, resin type etc. The required design according to the field of application is easily passed on with the specified parameters.

The history of filament winding has been based on 1940s years (Peters, 2011). Therefore, many studies related with filament winding technique and its products can be seen in the literature (Mertiny et al, 2004; Tarakcioğlu et al., 2005; Meijer & Ellyin, 2008). The thermal stability and hoop tensile behavior of glass fiber reinforced composite pipes have been investigated (Srebrenkoska et al., 2015). SEM Analysis were performed to examine failures as fiber debonding. The hoop strength of carbon fiber composite rings by applying split-disk test method has been investigated (Abed et al., 2014). They stated that the hoop strength increased by about 51% by reducing the number of wound layers by half. The examination of apparent hoop tensile strength of glass/polyester composite pipes has been studied (Rafiee, 2013).

The aim of this study is to investigate the hoop tensile strength and modulus characteristics of the glass fiber reinforced and epoxy based matrix composite pipes having 6 layers which are fabricated by filament winding technique. Five specimens for each winding angle configuration (40°, 55° and 70°) were prepared and tested. Also, fiber mass fractions were determined from the analysis of ignition loss tests. The results show that increase in winding angle results with stiffer material.

2. MATERIAL AND METHODS

Materials

The roving E-glass fiber reinforcement having 2400 tex and 2.6 g/cm³ density, shown in Fig. 1., was procured from Plasto Limited Company, Turkey. Also, epoxy resin (MOMENTIVE-MGS LR160) and hardener (MOMENTIVE-MGS LH260S) used in matrix content were supplied from DOST Chemical Industrial Raw Materials Industry, Turkey. Epoxy resin and hardener were stirred homogeneously according to ratio of epoxy-hardener mixture as 100:35.



Figure 1. E-glass roving fiber reinforcement.

Specimen Fabrication

Composite pipes were manufactured by filament winding machine as shown in Fig. 2. The machine has 2 axes movement as carriage linear and mandrel rotational motions. Fibers are directed and wetted using rings and resin bath on the carriage and wrapped on the mandrel.

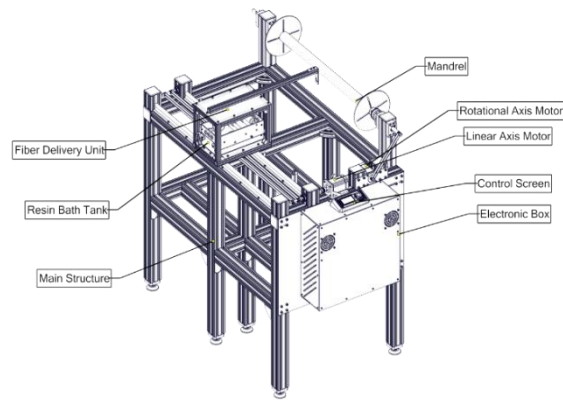


Figure 2. Schematic representation of the filament winding machine.

Equation (1) was used to evaluate mathematical relationships between winding angle, carriage and mandrel velocities;

$$\tan \alpha = (N_m \pi D) / V_c$$

(1)

α : Winding angle (degree)

V_c : Carriage velocity (mm/min)

N_m : Mandrel velocity (rpm)

D : Mandrel diameter (mm)

The curing process was applied by using heat gun after the winding process. Finally, the specimens were drilled by end milling and cut by sawing processes shown in Fig. 3. The thickness values of the specimens are measured as 3.00 ± 0.25 mm.



Figure 3. Specimens at different winding angle before test; a) 40°, b) 55°, c) 70°.

Ignition Loss Tests

The specimens were kept on high capacity furnace at 650°C for 1.5 hour to conduct ignition loss experiments according to ASTM D2584 standard. After disappearing matrix, the weight of the remaining part as only fiber reinforcement was measured, and results were calculated from Eq. (2):

$$\%wt = ((W_1 - W_2) / W_1) * 100$$

(2)

where W_1 , specimen weight (fiber reinforcement + matrix) before test, W_2 , the remaining part (fiber reinforcement) weight after test. Four specimens were used for each configuration.

Split-Disk Method

The ring specimens having geometry, as shown in Figure 4a., for the split-disk method to determine hoop tensile characteristics of the specimens having 6 layers were prepared according to ASTM D2290. All tests with 12.5 mm/min loading rate were conducted on Shimadzu AG-X Series Universal Testing Machine as shown in Figure 4b. At least five specimens were tested for each winding angle.

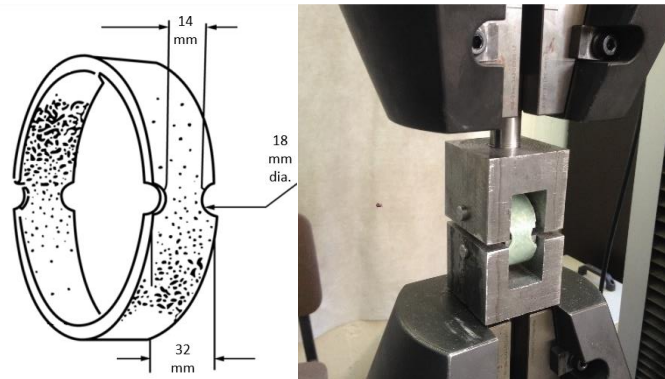


Figure 4. a) Specimen geometry, b) Split-Disk method.

The values of hoop tensile strength, σ and modulus, HTM were calculated by the following formulas given in the relevant standard.

$$\sigma = F / 2A$$

(3)

$$HTM = (0.1257 r_{mean}^3) / (wt^3) * (F / \Delta)$$

(4)

where, F and A are the maximum load and reduced cross sectional area in Eqn. (3). And r_{mean} , w , t and Δ in Eqn. (4) represents the mean radius, width, thickness and displacement values, respectively.

3.RESULTS AND DISCUSSION

Fiber Mass Fractions

To achieve percentage weight basis components of the composite pipes, ignition loss tests were performed. The specimens, as shown in Fig. 5., were prepared as 625 mm² minimum cross-sectional area.



Figure 5. Examples of ignition loss specimens; a) before test, b) after test.

Table 1. Fiber and matrix mass fractions

Winding Angle (°)	Glass Fiber (%)	Matrix (%)
40	71.26	28.74
55	71.37	28.63
70	71.74	28.26

Hoop Tensile Characteristics

Split-disk method was used to determine the hoop tensile strength of the specimens. From the results representing in Figure 6., there is a proportional relationship between hoop tensile strength and winding angle. Maximum hoop tensile strength is obtained from 70° winding angle as 469.58 MPa.

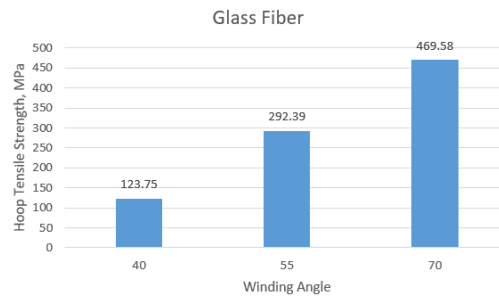


Figure 6. Hoop tensile strength

Hoop tensile strength-strain diagrams are given in Fig. 7. It is stated that the biggest strain can be found 40° configuration while it has lowest hoop tensile strength values.

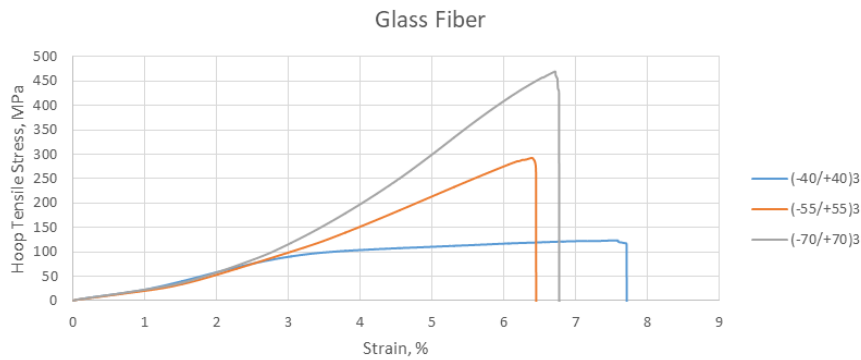


Figure 7. Hoop tensile strength-strain diagrams

Hoop tensile modulus results, as shown in Fig. 8., have similar trend with the strength results. This trend can be directly related with the fiber approaching to loading direction since fibers have maximum strength values in their direction. Also, it is stated that increasing in winding angle results with the stiffer material as expected.

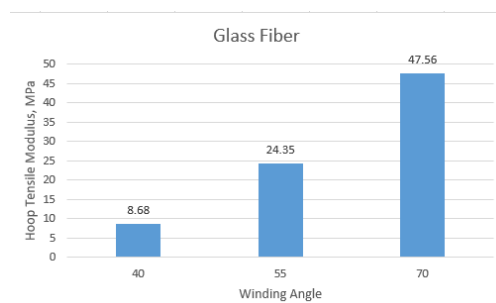


Figure 8. Hoop tensile modulus

Failure shapes of the specimens after tests can be seen in Fig. 9. All of them have showed failure in fiber direction.



Figure 9. Specimens after test; a) 40°, b) 55°, c) 70°.

4.CONCLUSION

In this study, the effect of winding angle (fiber orientation) on the hoop tensile properties of the glass fiber reinforced composite pipes fabricated by filament winding technique were investigated. According to results;

- Fiber weight fractions were found as 71.5 ± 0.25 %.
- Maximum values of HTS and HTM were obtained from 70° winding angle as 469.6 MPa and 47.56 GPa, respectively.

It is observed that increasing the winding angle of the specimen showed the better strength and modulus since fiber orientation approaching to loading direction. As a result, the winding angle has a crucial importance on the hoop tensile behaviors of composite pipes.

Acknowledgements

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On the Tensile and Flexural Behavior of Basalt/Epoxy Fiber Reinforced Composite Laminates Having Nanoclay

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Abstract: In recent years, the increasing competition on the global market has made the necessity that production and use of higher strength, more functional, lighter and less costly materials such as composites in industrial applications. With the increasing usage of the composite materials in engineering application, some studies to improve mechanical characteristics of them has been performed by trying to improve the properties of polymer based composite materials by adding various particles to the polymer structure. It has been observed that the addition of various additives to the polymeric body improves the various mechanical properties of the polymer such as strength, fatigue, vibration damping and fatigue. The current study presents the effects of nanoclay particle addition on the mechanical behaviors of basalt/epoxy fiber reinforced composite laminates having $(0^\circ/90^\circ)_6$ configuration fabricated by vacuum assisted resin transfer molding (VARTM). In this context, four different nanoclay percentage (0%, 1%, 2% and 3% wt.) were used to observe tensile and flexural characteristics of the specimens. The experimental tests were performed according to ASTM D638 and ASTM D790, respectively. The results showed that the maximum increase in tensile strength has been obtained from 2% nanoclay addition as 57.6%. However, 1% nanoclay inclusion has given the best result as 269.92 MPa in flexural strength of the specimens. The nanoclay particles has crucial effects on the characteristics of the basalt/epoxy fiber reinforced composites.

Keywords: Composite material, Fiber orientation angle, Tensile, Flexural

1. INTRODUCTION

In recent years, the increasing competition on the global market has made the necessity that production and use of higher strength, more functional, lighter and less costly materials in industrial applications. Especially the fiber reinforced composite polymeric materials have become a popular alternative to metallic components and find place in numerous engineering applications like sporting goods, household appliances, marine, automotive, aerospace industries, and defense. With the increasing use of fiber reinforced polymeric composites, the determination and enhancement of performance of fiber reinforced polymeric composites under varied loading conditions like axial, flexural, torsional and impact loading turn into a crucial challenge for the engineering applications and becomes a popular research topic among the engineers and scientists. Nowadays, enhancement of the composite material characteristics has been a popular subject in scientific world. One of the recently developed procedures to enhance the mechanical characteristics of fiber strengthened composite materials is the addition of particle into matrix as a second strengthener phase.

There are many studies (Ku et al., 2011; Cheng et al., 2009; Jain et al., 1992) examining the effect of nano inclusion on the mechanical behaviors of composite materials in the literature. Examination of the effect of graphene nano-pellets on mechanical (tensile, flexural and impact) properties of basalt/epoxy reinforced composite laminates has been performed (Bulut, 2017). The influence of the interface between the plies on the mechanical characteristics of the laminates has been studied (Keusch et al., 1998). This study showed that the type of sizing has a strong influence on the mechanical characteristics of the UD laminates this as the tensile strength and shear strength. A comparison between characteristics of varied fiber types was carried out (Lopresto et al., 2011). It was shown that basalt fiber laminate has 35-42 % more than Young's modulus as well as a best compressive flexural and strength behavior than E-glass fiber strengthened plastic laminates.

The current study presents the effects of nanoclay particle addition on the mechanical behaviors of basalt/epoxy fiber reinforced composite laminates having $(0^\circ/90^\circ)_6$ configuration fabricated by vacuum assisted resin transfer molding (VARTM). In this context, four different nanoclay percentage (0%, 1%, 2% and 3% wt.) were used to observe tensile and flexural characteristics of the specimens.

2. MATERIALS AND METHODS

The 12 layers of Basalt fiber fabrics having $(0^\circ/90^\circ)_6$ fiber orientation and epoxy resin (MOMENTIVE MGS L285) with hardener (MOMENTIVE MGS H285) were used and procured from Dost Chemical Industry Raw Materials, Turkey. Basalt fiber is an eco-friendly material and obtained from extrusion of molten basalt rocks in volcanic lava deposits. It has higher melting point to glass fibers, lower cost to carbon and higher durability to steel materials. Nanoclay particles were supplied from Grafen Chemical Industry, Turkey. Density and thickness values belong to these raw materials are

presented in Table 1. The weight mixture ratio of the epoxy resin and hardener was taken as 100:40 by considering 1 wt.% nanoclay particles inclusion to obtain resin. All materials used in composite laminate are given in Fig. 1.



Figure 1. Basalt fiber reinforcement and matrix content.

Table 1. Physical properties of materials.

Constituent	Density	Thickness
Basalt fabric	200 g/m ²	0.17 mm
Nanoclay	200-500 kg/m ³	1-10 nm
Epoxy	1.18 g/m ³	-
Hardener	0.95 g/m ³	-

Four different nanoclay addition as 0%, 1%, 2% and 3% were investigated to see effect of nanoclay on the tension and flexural properties of the basalt fiber reinforced composite laminates. The laminates were fabricated by vacuum assisted resin transfer method (VARTM) as shown in Fig. 2. The curing of laminates was performed at room temperature for 8 hours under 700 mm-Hg vacuum pressure. The thickness values of all laminates were measured as 2.20 ± 0.2 mm.

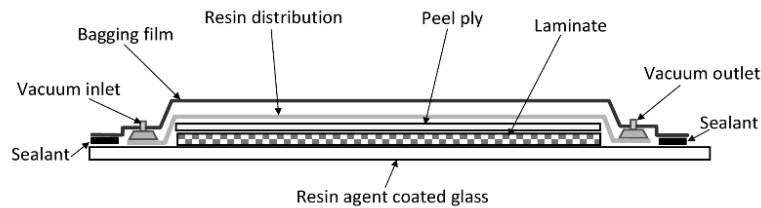


Figure 2. Vacuum assisted resin transfer molding.

To determine mechanical behaviors of the laminates, tensile and three point bending experiments, as shown in Fig. 3., were conducted on the Shimadzu AG-X Series universal testing machine according to ASTM D638 and ASTM D790 standards, respectively.

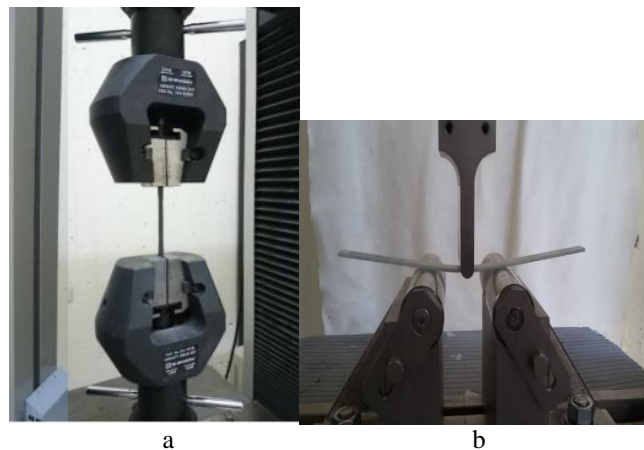


Figure 3. Mechanical Tests; a) Tensile test, b) Three point bending test.

2 mm/min for tensile and 3 mm/min for three point bending tests loading rate was used in the experiments. At least five number of specimens were tested for each nanoclay percentage. Specimen geometries belong to related tests are given in Fig. 3.

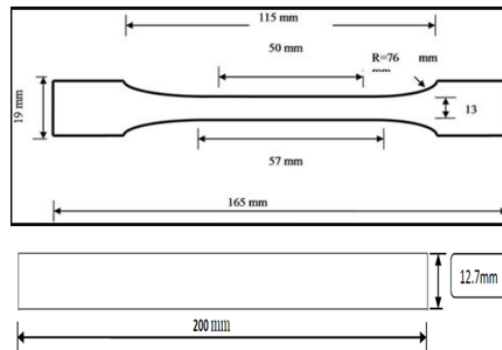


Figure 4. Specimen geometries for a) Tensile test, b) Three point bending test.

3.RESULTS AND DISCUSSION

The maximum tensile strength values and stress-strain diagrams are given in Figure 5. Maximum improvement for tensile strength of the laminates were obtained from inclusion of 2% wt. nanoclay inclusion as 57.6% increase. Pure specimens have higher strain, but lower tensile strength. After the 2% nanoclay inclusion, decreasing trend was seen in the results. This situation can be explained by the agglomeration of the nanoparticle additive in the resin mixture.

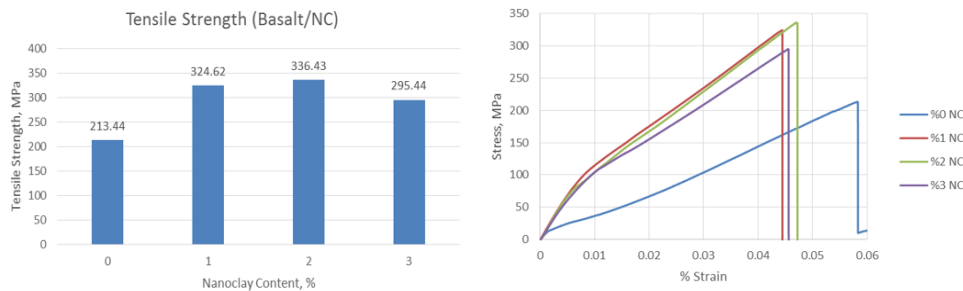


Figure 5. Tensile strength and stress-strain diagrams.

Fracture shapes can be seen in Fig. 6. Fiber breakage, delamination and pull outs have been observed for different configurations.

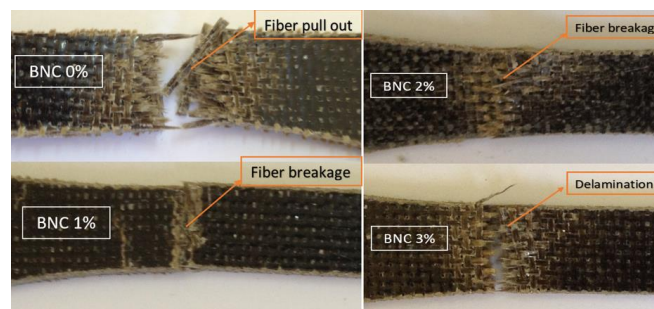


Figure 6. Specimens after tensile tests.

According to flexural strength and modulus results as seen in Fig. 7., there is no significant difference between the configuration results. However, the lowest strength and modulus was obtained from 2% nanoclay inclusion. So, it can be said that the material having 2% nanoclay particle was getting stronger in 1 and weaker in 2 direction.

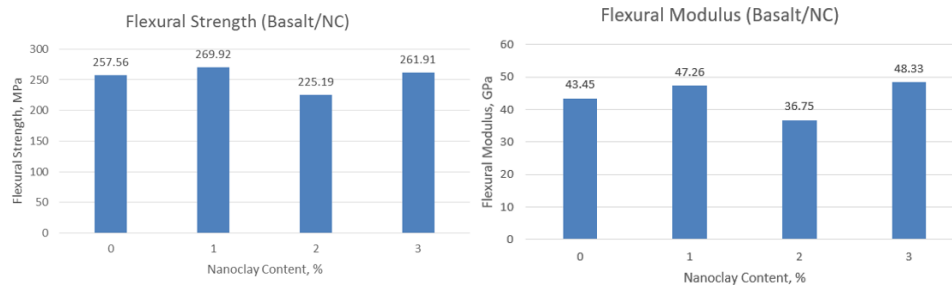


Figure 7. Flexural strength and flexural modulus.

From the load-displacement curves, shown in Fig. 8., the long curve stroke indicates less flexural stiffness.

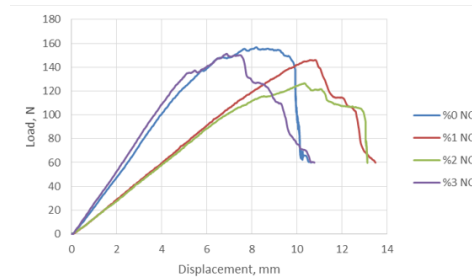


Figure 8. Load-displacement curves.

Also, specimens after three point bending tests can be seen in Fig. 9. All specimens have same fracture shapes.

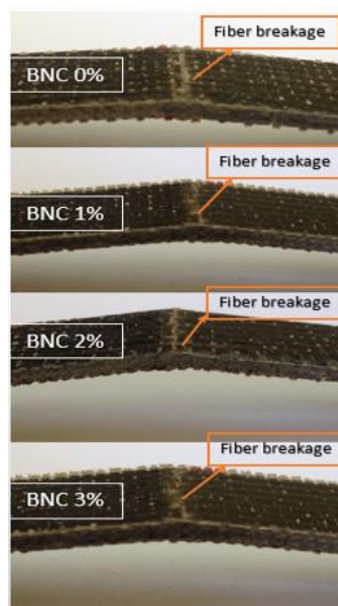


Figure 9. Specimens after three point bending tests.

4.CONCLUSION

In this study, effect of nanoclay addition on the tensile and flexural behavior of basalt/epoxy reinforced composite laminates having $(0^\circ/90^\circ)_6$ orientation has been investigated. From the tensile tests; all configuration showed the improvement on the tensile characteristics of the specimens. The maximum improvement was obtained from 2% nanoclay addition as 57.6% increase in tensile strength (336.43 MPa). However, strain value of the specimens has influenced negatively. From the flexural tests; the nanoclay addition does not show significant difference compared the pure specimens. In conclusion, nanoclay has proved the crucial role in tensile characteristics of the basalt/epoxy fiber reinforced composite laminates.

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One-Step Microwave Energy-Based Nano-Manufacturing of a Hybrid Electrode Material and Its Use in Energy Storage

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Abstract: A hybrid electrode material (HEM) for supercapacitors (SCs), composed of carbonized conducting polymer (CP), i.e. polypyrrole nanofibers (PPy NFs), nanostructured zinc oxide (nano-ZnO) and carbon nanotubes (CNTs), was successfully prepared in one-step via a hassle-free, rapid and highly efficient microwave (MW) energy-based approach. The overall morphology and content of the nano-ZnO and CNT compounds could be altered by simply changing the process parameters, i.e. ratios in the feedstock mixture or the MW process time. The morphological features of the as-prepared HEM were thoroughly investigated by using relevant characterization methods such as scanning electron microscopy (SEM) tests. It is aimed that by synergistically blending the high conductivity from CNTs, the ultra-high porous surface area from carbonized NFs and the abundant pseudo-capacitive features from nano-ZnO in its structure, the as-synthesized HEM would afford to exhibit promising capacitive performance along with the excellent long-term charge/discharge cycle stability and high energy/power densities for SC applications.

Keywords: conducting polymer, carbon nanotube, zinc oxide, microwave energy, supercapacitor

1. INTRODUCTION

The growing global demand for clean and renewable energy¹, the gradual exhaustion of natural fossil fuel sources² and common concerns about the air pollution and global warming issues³ have stimulated the academic and industrial societies² to spend intense research efforts on both the development/improvement of efficient energy storage devices and on sophisticated energy conversion systems from alternative sources³. In this context, SCs have attracted a great deal of attention²⁻⁸ and in recent years, they have gained great technological significance⁹ by emerging as an ideal frontline technology¹⁰ to meet the above mentioned needs in energy field. As a rising star among common electric double-layer carbon-based materials (EDLCs), CNTs have been widely utilized as the electrode material for SCs with respect to their unique physicochemical features such as excellent long-term stability, high conductivity, electrolyte accessibility and ultra-high specific surface area^{3, 6-7, 11}. On the other hand, ZnO has also attracted a worldwide research interest as the PC component of hybrid SCs besides its various prominent uses in bio-sensors, light-emitting diodes and organic solar cells^{6-8, 10-12, 15-19}, due to its promising features such as high energy density (650 A/g)^{3, 5, 9, 11, 15}, wide band gap (3.37 eV)^{15, 17-18}, good electromechanical performance^{1, 3, 5, 7}, affordability¹⁰ and eco-friendly nature^{3, 5, 12} compared to its similar equivalents such as RuO₂^{2, 5-7, 11-12}. Similarly to ZnO, PPy has also been widely investigated as another PC-type hybrid SC component simply because of its reversible doping/dedoping mechanism, easy and affordable synthesis at ambient conditions with high yield and long-term environmental stability¹². In order to fully benefit from all three components, i.e. CNTs, nano-ZnO and conducting PPy NFs in one hybrid nano-architecture, in this study, a HEM with accrued¹⁰ advantages of having EDLC property of CNTs and PC properties of nano-ZnO and PPy NFs was prepared via one-step MW energy-assisted approach.

2. MATERIALS AND METHODS

Materials

The materials used in this study include; pyrrole (98%, Alfa Aesar), ammonium peroxydisulfate (APS, 98%, (NH₄)₂S₂O₈, Alfa Aesar), ferrocene (99%, Fe(C₅H₅)₂, Alfa Aesar), zinc acetate dihydrate (ZAD, Zn(CH₃COO)₂ · 2H₂O, EMD Chem. Inc.), HCl (J.T. Baker), acetone (J.T. Baker), colloidal graphite paste (isopropanol base, Electron Microscopy Sciences) and potassium hydroxide (KOH, J.T. Baker). V₂O₅ sol-gel NF seeds were prepared based on a previously reported method by using ammonium metavanadate (NH₄VO₃, 99.5%, Acros Organics) and Dowex Marathon (H) ion exchange resin (Sigma Aldrich) in DI water.

One-Step Synthesis of the Acid-doped PPy NFs

Based on a well-established and previously reported method, 1 mL of pyrrole monomer was gently added into 60 mL of 1M aq. HCl under magnetic stirring. In order to obtain the homogenous dispersion of monomers, the medium was kept stirred for 10 min at ambient conditions. Next, 1 mL of V₂O₅ sol-gel NF seeds was gently introduced. This triggered the formation of well-dispersed nanofibrous oligomers upon the preliminary oxidative interactions between monomers and V₂O₅ seeds at their interface. Within 30 s of V₂O₅ seeds addition, 1.15 g of APS was finally added into the mixture and instantly darkened its color as a clear triggering indication of the oxidative polymerization reaction. After 4 h of polymerization reaction time under magnetic stirring at ambient conditions, the resulting dark precipitate of PPy NFs was suction filtered through a Buchner funnel while getting washed with copious amounts of HCl (3 × 100 mL) and acetone

(3 × 100 mL), respectively. The damp, PPy NF mesh was collected on a filter paper, placed in an oven at 80 °C and left there overnight for drying purposes. A typical yield of PPy NF powder from this experiment was ~ 300 mg.

One-Step MW Energy-Assisted Fabrication of Carbonized NF/CNT/ZnO HEM (Figure 1)

In a standard process, firstly, 70 mg of the as-synthesized HCl-doped PPy NF powder and 70 mg ferrocene were placed in a capped 10 mL plastic cup and blended with a speed mixer at ~ 3500 rpm for 2 min. Next, this mixture was flatly laid at the bottom of a glass vial and then its surface was homogenously powdered with a 100 mg of fine ZAD in the form of a secondary white layer. After that, the glass vial was loosely capped and placed into the MW chamber for a heat treatment which lasted for 30, 60 or 120 s (Figure 1). Within 10 s of the heating process the mixture was started smoking and arcing, respectively, and then continuously glowed red hot for the rest of the process time inside the glass vial^{23-25, 29}. Eventually, the darkened glass vial was taken out of the MW and left to cool down to room temperature. Finally, the dark residue with a grayish tint was gently collected from the glass vial bottom and then mixed for 5 min by using speed mixer to achieve homogeneity in the final product. The as-obtained mixture was then stored for further structural and electrochemical characterization steps.

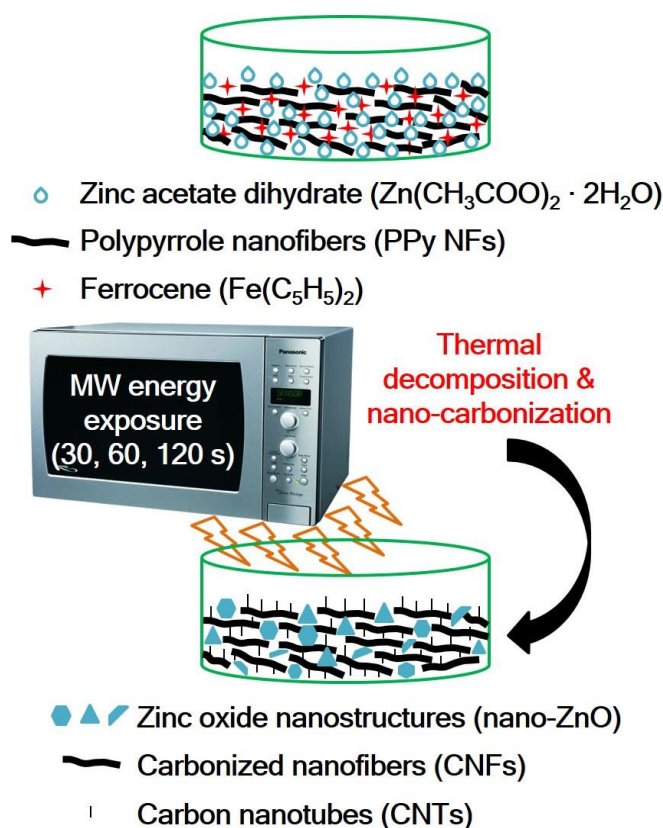


Figure 1. Illustration of the one-step HEM synthesis via MW energy-based approach

Structural Characterization of the CNF/CNT/ZnO HEM

The overall morphological features, elemental composition and the crystalline nature of the as-synthesized HEM were analyzed on a JEOL JSM-7000F scanning electron microscope (SEM) equipped with an energy dispersive X-ray (EDX) detector, respectively.

3.RESULTS AND DISCUSSION

The as-prepared nanostructured HEM's morphological SEM characterization results are shown in Figure 1. The acid-doped conducting PPy nanostructures can be clearly observed from Figure 1A. Here, the dominant morphology is composed of densely packed, microns long NF web decorated with nano-granule clusters. Both NFs and nano-granules are seemed to be ~ 200 nm, in diameter. This result is in good agreement with the ones obtained from previous relevant studies. This sample was firstly mixed with an equivalent amount of fine ferrocene powder and then used as the base for HEM's preparation. After short-term (30, 60, 120 s) MW energy exposure of this mixture with ZAD powder, an entangled CNT forest along with nano-ZnO granules' growth was observed on the surface of CNFs which are indicated in

rectangular areas in Figure 1B. Based on this image, the as-grown CNTs are seemed to span over several microns in length, and 200-250 nm in diameter. Moreover, as previously observed in similar studies, morphological features of these CNTs also conform the tip-growth mechanism for their formation, during which; the precursor ferrocene firstly gets decomposed into its iron and cyclopentadienyl components upon the rapid temperature increase caused by the intense PPy NF/MW interactions, and then, these components serve respectively as the catalyst and carbon source for the CNT growth, and finally, CNTs grow with reactive iron nanoparticle (Fe NP) clusters at their stem tips (Figure 1C inset). As the MW process time was elongated from 30 s to 60 s, the as-grown CNTs' morphological appearance had distinctively changed from randomly entangled bulk groups to matchstick-like separated individuals (Figure 1C and inset). Here, not only their growth pattern but also their sizes were also changed. Based on the measurements taken, it can be observed that such CNTs had become twice as large (450-500 nm avg. diameter) than the previous ones. This phenomenon can be explained with the "supporting growth template role" of the initially grown carbon nanostructures at the early stages (up to 30 s) of the MW process. Thanks to the increased process time, the iron catalyst core could remain its activity longer to direct more thin layers' growth from the carbon shell surrounding it. In good agreement with this situation; thicker (up to $\sim 2 \mu\text{m}$) and longer ($> 10 \mu\text{m}$) earthworm-like CNTs were grown on the same material, which was exposed to MW energy for 120 s, as can be seen in Figure 1D.

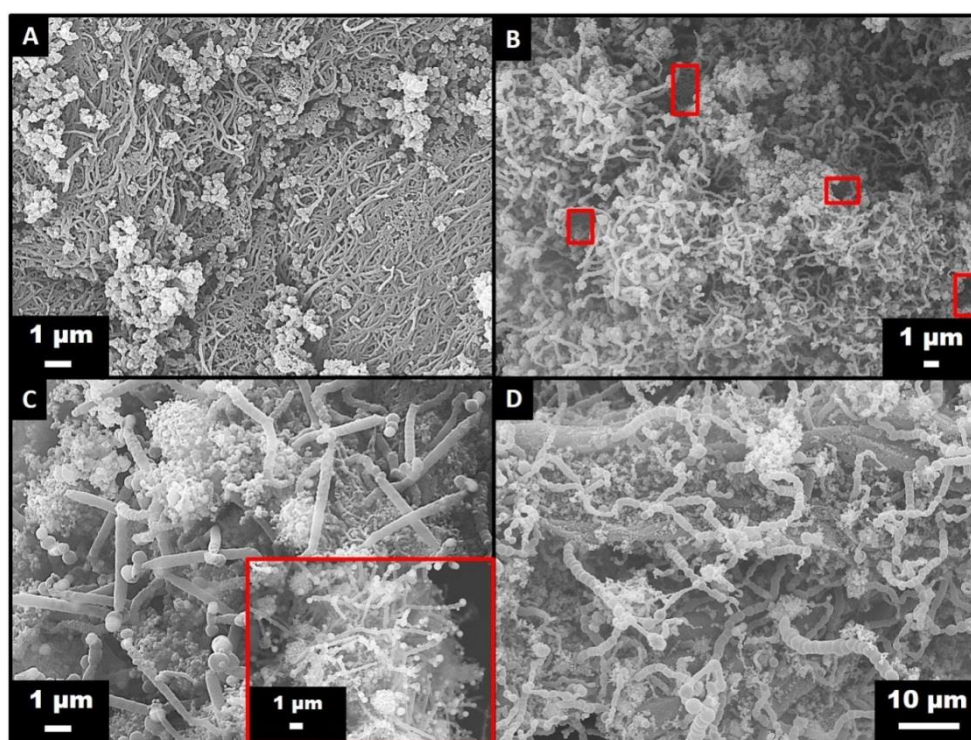


Figure 1. SEM images of; (A) acid doped PPy NFs, and (B) 30 s MW, (C) 60 s MW (inset: the as-grown CNTs with Fe catalyst NPs trapped at their tips), (D) 120 s MW CNF/CNT/ZnO HEM samples

4.CONCLUSION

In conclusion, nano-sized HEM samples that are composed of CNF/CNT/ZnO were successfully manufactured via one-step, facile and efficient MW energy-based approach for SC applications. It is aimed that by synergistically blending the high conductivity from CNTs, the ultra-high porous surface area from carbonized NFs and the abundant pseudo-capacitive features from nano-ZnO in its structure, the as-synthesized HEM would afford to exhibit promising capacitive performance along with the excellent long-term charge/discharge cycle stability and high energy/power densities for such applications.

Acknowledgements

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A Comparison of Fatline Widths

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Abstract: Fatlines are widely used tool in computer aided geometric design for calculation of the curve intersections. Performance of the curve intersection algorithm directly depends on the fatline width. The narrower widths result in better convergence of the algorithm. In this manuscript comparison of the fatline width formulas are presented. Illustrative examples are presented for insight into the formulations.

Keywords: fatline, Bezier, curve, intersection, fatline algorithm

1. INTRODUCTION

In the computer aided geometric design community, fatline is a popular algorithmic tool used for calculating intersections of any two curves [1]. The fatline tool in calculation of the curve intersections was first described by 1990 [2]. It may be argued that even though the idea has a solid foundation a satisfactory literature is lacking in its reasoning and implementation. Also, certain efficiency improvements in the field are still possible. In this manuscript fatline construction procedures are analyzed, some recent improvements and illustrative examples are presented. It is intended to present the underlying idea of the fatline in an illustrative form so that the theory makes better sense to the newcomers of the field.

As a preliminary we briefly review the Bezier curves. As it is described in the sequel, Bezier curve formulation is an essential component of the fatline analysis because the fatlines are defined for the curves that are in Bezier form. The Bezier curve is a parametric curve model used widely in computer graphics. This model, introduced originally by P. F. de Casteljau and improved by P. Bezier, parametrizes certain curves in a powerful way [1]. Its popularity in computer aided design community is due to its ability of manipulating geometric shapes in a computationally efficient way. Its detailed history and underlying philosophy are discussed in [1,3]. Cubic Bezier curves, due to its computational efficiency and its performance in representing circular arcs [4], form a particularly interesting class of the Bezier curves family. A cubic Bezier function on a plane $P(t) = (x(t), y(t))$ is a vector polynomial with a range defined for $0 \leq t \leq 1$. A cubic Bezier function is completely specified with four control points (C_0, C_1, C_2, C_3) corresponding to the parameter values $(0, t_1, t_2, 1)$. The P values corresponding to these t values are denoted by (P_0, P_1, P_2, P_3) . By definition of the cubic Bezier curves, the control points C_0 and C_3 equal P_0 and P_3 . The other control points C_1 and C_2 are not necessarily equal to P_1 and P_2 respectively. However, these control points have geometric meanings involving the points P_0 and P_3 and their neighboring points as follows: The control points C_1 and C_2 are on the tangent lines passing through P_0 and P_3 respectively. More specifically, C_1 is the direction of the curve at P_0 , and the tangent at P_3 comes from the direction C_2 . The algebraic description of a cubic Bezier curve is as follows:

$$P(t) = (1-t)^3 C_0 + 3(1-t)^2 t C_1 + 3(1-t) t^2 C_2 + t^3 C_3, t \in [0,1] \quad (1)$$

In the above expression, $t^n(1-t)^{3-n}$, $n = 0,1,2,3$, are called Bernstein basis polynomials for a cubic Bezier curve.

Finding intersections of two Bezier form curves P_1 and P_2 is achieved by solving $P_1(t_2) = P_2(t_2)$, $t_1, t_2 \in [0,1]$. For many real time applications, straightforward numerical solution methods come with unsuitably big computational burden. Bezier clipping algorithm is widely used as an efficient solution method [2]. In this method one of the curve, for example P_1 , is confined between two parallel lines, where the region between them is called fatline, and checked whether it intersects with the curve P_2 . To make the process fast and computationally in low cost, convex hull of the distance curve for P_2 is used. Points for which P_2 lies outside the fatline correspond to its points with distance larger than that of bounding lines to the centerline. Such points are clipped away. Resulting sub-curve P_2 is smaller and can be confined in a much thinner fatline itself. The next process is the checking of this fatline, whether it intersects with the curve P_1 . Repeating this procedure few times, the fatlines get thinner, and generally gives a fairly accurate intersection point if an intersection exists. In the case of no intersection exists between two curves this is found out in the first steps.

For the Bezier clipping algorithm, besides fatlines formed by parallel boundary lines fat arcs are also being utilized [5]. It is reported that the algorithm using fat arcs converges cubically. An alternative method for detection of curve intersection points is proposed by [6] where curves are represented by their control polygons and similar roles of fatlines are assumed by the control polygons.

Having a background in Bezier curves and the Bezier clipping algorithm, the fatlines can be introduced in a better clarity. The fatline definition and its construction, together with justification of its certain steps are presented in the next section. In the third section some efficiency improvements are proposed. Conclusions take place in the last section.

2. MATERIALS AND METHODS

Fatlines

For a curve in a plane, fatline is defined as a bounding strip. For a better performance in the Bezier clipping algorithm the fatline is chosen as tight as possible while keeping its construction arithmetic as satisfactorily simple [2]. The fatline construction consists of two steps [2]:

1. Forming the centerline, a straight line L , that passes through the ends of the curve.
2. Determining line or lines parallel to L to bound the curve. In this step, depending on a curve, one or two parallel lines are used for the bounding.

Considering the Bezier Clipping Algorithm, a major application of the fatlines, it is desired to construct the tightest possible fatline while keeping the computational burden low. There is a trade of between tightness and the computational work. A designer is supposed to make decision on this issue considering the available hardware and the problem under consideration. Below various solutions to the problem are presented on an example.

As an example, let the Bezier curves P_1 and P_2 have the control points $\left(\begin{bmatrix} 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 2 \\ 4 \end{bmatrix}, \begin{bmatrix} 5 \\ 1 \end{bmatrix}, \begin{bmatrix} 3 \\ 4 \end{bmatrix}\right)$ and $\left(\begin{bmatrix} 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 3 \\ 0 \end{bmatrix}, \begin{bmatrix} 5 \\ 1 \end{bmatrix}, \begin{bmatrix} 3 \\ 4 \end{bmatrix}\right)$ respectively. Considering expression (1), algebraic representation of P_1 and P_2 are

$$P_1(t) = (1-t)^3 \begin{bmatrix} 1 \\ 1 \end{bmatrix} + 3(1-t)^2 t \begin{bmatrix} 2 \\ 4 \end{bmatrix} + 3(1-t)t^2 \begin{bmatrix} 5 \\ 1 \end{bmatrix} + t^3 \begin{bmatrix} 3 \\ 4 \end{bmatrix}, t \in [0,1] \quad (2)$$

$$P_2(t) = (1-t)^3 \begin{bmatrix} 1 \\ 1 \end{bmatrix} + 3(1-t)^2 t \begin{bmatrix} 3 \\ 0 \end{bmatrix} + 3(1-t)t^2 \begin{bmatrix} 5 \\ 1 \end{bmatrix} + t^3 \begin{bmatrix} 3 \\ 4 \end{bmatrix}, t \in [0,1] \quad (3)$$

The curves corresponding to P_1 and P_2 are shown in Figure 1. Notice that P_1 has part on both sides of the line connecting its endpoints; on the other hand P_2 has all parts on one side of the connecting line. These two cases have different computational features to be discussed in the sequel.

As the first step the centerline passing through the ends of a curve is represented in the form $y - y_0 = m(x - x_0)$ where $C_i := \begin{bmatrix} x_i \\ y_i \end{bmatrix}, i = 0,1,2,3$ and $m = \frac{y_3 - y_0}{x_3 - x_0}$. Noting that each of P_1 and P_2 has the same endpoints, the centerline for each of them is $y - 1 = \frac{3}{2}(x - 1)$. Figure 2 shows the Bezier curves with their centerlines.

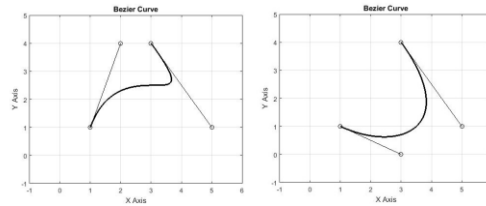


Figure 1. Bezier curves corresponding to P_1 and P_2 (from left to right respectively)

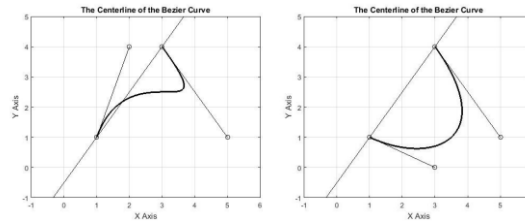


Figure 2. P_1 and P_2 with their centerlines

A well-known property of the Bezier curves is that the curve is completely contained in the convex hull of its control points [Far]. This leads to a simple formulation of the fatlines. In the case where the control points C_1 and C_2 are on different sides of the centerline, the parallel lines passing through C_1 and C_2 form the fatline. However, if both C_1 and C_2 are on the same side of the centerline then the centerline and the straight line passing through the farthest of C_1 and C_2 to the centerline form the fatline.

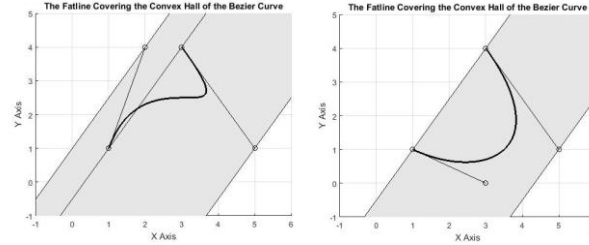


Figure3. The fatlines of P_1 and P_2 based on the convex hull property of the fatlines

For computation of convex hull based fatline, a normalized representation of the centerline L in the form of $ax + by + c = 0$ with $a^2 + b^2 = 1$ is useful. For each of P_1 and P_2 under consideration corresponding representation is $\frac{1}{\sqrt{13}}(3x - 2y - 1) = 0$. Using this representation a signed distance $d(x, y)$ between L and a point (x, y) is defined as $ax + by + c$. This leads to the signed distances of the control points $d_i := d(x_i, y_i)$. The signed distances (d_0, d_1, d_2, d_3) for the curves P_1 and P_2 are $(0, -0.8321, 3.3282, 0)$ and $(0, 2.2188, 3.3282, 0)$ respectively. The fatline for each of P_1 and P_2 is described by $\{(x, y): d_{min} \leq d(x, y) \leq d_{max}\}$ where $d_{min} := \min\{d_0, d_1, d_2, d_3\}$ and $d_{max} := \max\{d_0, d_1, d_2, d_3\}$. Such formed fatlines for P_1 and P_2 are shown in Figure 3. It can be noticed that if the signed distances of the control points are not alternating, i.e., $d_1 d_2 > 0$, then the centerline becomes one of the bounding parallel line of the fatline. Otherwise, i.e., $d_1 d_2 < 0$, the centerline is strictly in the interior of the fatline.

A fatline based on the convex hull property of the Bezier curves contains the curve completely, however, it is not tight enough for practical purposes. Below we discuss a tighter fatline construction proposed in [2]. This construction utilizes the tightest fatline formulation where a given curve fits in it exactly. It will be seen that the tightest fatline construction is not preferred due to its bulky computational requirements.

The distance between any point on the curve and the centerline corresponding to a given parameter t is $d(t) = 3t(1-t)[(1-t)d_1 + td_2]$. This can be shown by substituting first and second components of $P(t)$ in (1) for x and y in the previously mentioned distance formula $d(x, y) = ax + by + c$ [7]. One may verify that $(t, d(t))$ is also in a

Bezier curve form [2]. It has two extrema if $d_1 d_2 < 0$ which are achieved at $t_1 = \frac{2d_1 - d_2 + \sqrt{d_1^2 + d_2^2 - d_1 d_2}}{3(d_1 - d_2)}$ and $t_2 = \frac{2d_1 - d_2 - \sqrt{d_1^2 + d_2^2 - d_1 d_2}}{3(d_1 - d_2)}$. For this case, the fatline is the region between the parallel lines whose distances to the centerline are d_{min} and d_{max} . These two quantities are expressed in terms of $d(t_1)$ and $d(t_2)$ as $d_{min} = \min\{d(t_1), d(t_2)\}$ and $d_{max} = \max\{d(t_1), d(t_2)\}$.

In the remaining case where $d_1 d_2 > 0$ the curve has one extremum which is achieved at $t_1 = \frac{d_1}{2d_1 - d_2 + \sqrt{d_1^2 - d_1 d_2 + d_2^2}}$.

Therefore, for the case $d_1 d_2 > 0$, the fatline is the region between the parallel lines whose distances to the centerline are d_{min} and d_{max} . These two quantities are expressed in terms of $d(t_1)$ as $d_{min} = \min\{0, d(t_1)\}$ and $d_{max} = \max\{0, d(t_1)\}$.

In the example under consideration, for P_1 , we have $d_1 d_2 < 0$. Using the formulas above $t_1 = 0.0945$, $t_2 = 0.7055$, $d(t_1) = -0.1127$, and $d(t_2) = 1.3108$ can be obtained. For the curve P_2 , we have $d_1 d_2 > 0$. Corresponding formulas yield $t_1 = 0.5486$ and $d(t_1) = 2.1005$. The exact fatlines obtained for P_1 and P_2 are shown in Figure 4.

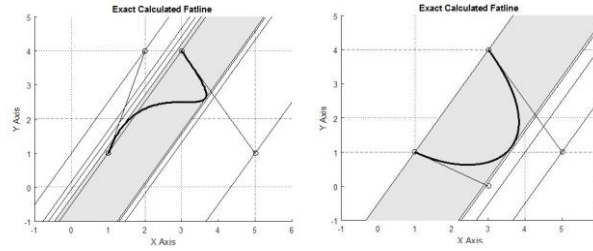


Figure 4. The exact fatlines for of P_1 and P_2

One may easily see that the amount of computational work, consequently the execution time, is large for practical purposes. Sederberg et al. proposed a simplified formula for the fatlines in the expense of relaxing the tightness [2]. Their formulas are in terms of d_1 and d_2 as follows:

$$\text{For } d_1 d_2 \geq 0 : d_{min} = \frac{3}{4} \min\{0, d_1, d_2\} \text{ and } d_{max} = \frac{3}{4} \max\{0, d_1, d_2\} \quad (4)$$

$$\text{For } d_1 d_2 < 0 : d_{min} = \frac{4}{9} \min\{0, d_1, d_2\} \text{ and } d_{max} = \frac{4}{9} \max\{0, d_1, d_2\} \quad (5)$$

For the curves P_1 and P_2 , Sederberg formula for the (d_{min}, d_{max}) pairs are $(-0.3698, 1.4792)$ and $(0, 0.8320)$ respectively. Corresponding fatlines are shown in Figure 5.

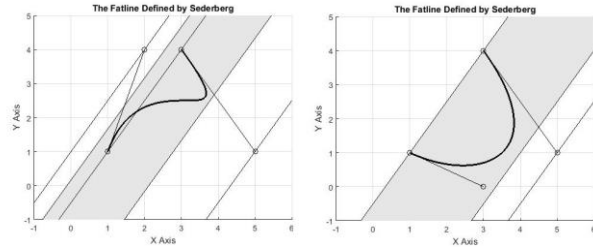


Figure 5. Fatlines for P_1 and P_2 by Sederberg's formula

3.RESULTS AND DISCUSSION

Construction of Tighter Fatlines

The fatline formulas (4) and (5) appeared in the literature in 1990 [2]. The level of tightness was satisfactory for the Bezier clipping algorithm for a wide variety of cases. Because the simplicity of the formulas was so alluring, no improvement for further tightness has come for decades. Next a tighter fatline construction formulas are presented in Table 1 [8].

It has to be noted that even though the fatline formulas tighter in Table 1, their implementations have slightly higher cost compared to Sederberg formulas (4) and (5). In Sederberg formulas, regarding the sign of product $d_1 d_2$, there are two cases. However, the tighter fatline formulas presented in Table 1 have four cases which regard the signs of d_1 and d_2 in pairs. The main similarity between the Sederberg formulas and those presented in Table 1 is that they both use simple decimal arithmetics in their implementations. It is practically assumed that the constant terms can be approximated decimally. The main difference is in terms of the tightness where the formulas in Table 1 are superior. This is illustrated for the examples under consideration, in Figure 6.

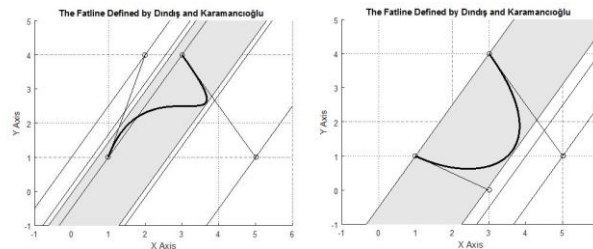


Figure 6. Tighter fatlines for P_1 and P_2 using formulas in Table 1

The graphics in Figure 6 has tighter fatlines, therefore, they are more suitable for finding curve intersections by Bezier Clipping algorithm.

Table 1. Dımdış fatline formulas for a cubic Bezier curve in terms of d_1 and d_2

Case	$d_1 < 0$	$d_1 \geq 0$
$d_2 < 0$	$d_{min} = \begin{cases} K_s d_1 + K_{d0} d_2; & \text{for } d_1 < d_2 \\ K_s d_2 + K_{d0} d_1; & \text{for } d_2 < d_1 \end{cases}$ $d_{max} = 0$	$\begin{aligned} & \left. \begin{aligned} d_{min} &= K_{d1} d_2 \\ d_{max} &= K_s d_1 + K_{d2} d_2 \end{aligned} \right\} \text{for } (-d_2) < d_1 \\ & \left. \begin{aligned} d_{min} &= K_s d_2 + K_{d2} d_1 \\ d_{max} &= K_{d1} d_1 \end{aligned} \right\} \text{for } (-d_2) \geq d_1 \end{aligned}$
$d_2 \geq 0$	$\left. \begin{aligned} d_{min} &= K_{d1} d_1 \\ d_{max} &= K_s d_2 + K_{d2} d_1 \end{aligned} \right\} \text{for } d_2 < (-d_1)$ $\left. \begin{aligned} d_{min} &= K_s d_1 + K_{d2} d_2 \\ d_{max} &= K_{d1} d_2 \end{aligned} \right\} \text{for } d_2 \geq (-d_1)$	$d_{min} = 0$ $d_{max} = \begin{cases} K_s d_1 + K_{d0} d_2; & \text{for } d_1 > d_2 \\ K_s d_2 + K_{d0} d_1; & \text{for } d_2 < d_1 \end{cases}$
Definitions: $K_s := \frac{4}{9}$, $K_{d0} := \frac{11}{36}$, $K_{d1} := \frac{\sqrt{3}}{6}$, $K_{d2} := \frac{4}{9} - \frac{\sqrt{3}}{6}$.		

4.CONCLUSION

Construction of the fatlines, the main computer aided geometric design tool for curve intersection calculation, is presented. It is observed that the simplest formula, which results in a wide fatline, is obtained by using the convex hull property of the Bezier control points. This formula is evolved into Sederberg and Dımdış formulas which yield tighter and tightest fatlines respectively. Visual presentation of tightness is provided through illustrative examples.

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A Test Bench for Electrical Motor and Propeller Components of a Lightweight Quadcopter

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Abstract: Electrical motor and propeller efficiencies are of primary importance in quadcopter design. Unfortunately, catalogue information for these products are not reliable in a significant number of cases. In this article a test bench for comparison of given motors and propellers is introduced.

Keywords: Quadrator, BLDC, propeller, thrust, efficiency

1.INTRODUCTION

Quadcopters (quadrotors) have become widespread due to their vertical take off and landing and hovering abilities. Their hardwares -as well as their softwares- are key factors in efficiency of their operations. In this manuscript a test bench for two main components of the hardware, electrical motors and propellers, is introduced.

Operating the quadrotor is not simple due to the demand for continuous and simultaneous speed adjustment of the four propellers. Since the first functional quadrotors appeared in early 2000s, several different internal and external test setups for the quadrotors were created by various working groups. Some of them are the Austrian National University X4 flight prototype [1,2], Stanford University STARMAC quadrotor [3], and Sweden Federal University Institute OS4 aircraft prototype. But many of them are only suitable for flights with 3 degrees of freedom. Bouabdallah and his colleagues designed a new quadrotor, OS4, with a Newton-Euler-based dynamic model as two sub-systems and offered a Lyapunov-based control law. In addition, they attempted to operate the controller successfully in a 3-axis locked test bench [4]. In 2005, researchers used the Whiteman training stand to finish quadrotor tests. The foot used allows the quadrotor to rotate vertically around the nose deviation, nose up and down and sideways axis, and the training stand can rotate around the base. Thus, 5 degrees of freedom can be observed in the test stand [5]. In 2013, Vanin established the Arducopter quadrotor, then linearized its Newton-Euler model. Through the motion capture cameras placed around the lab, the quadrotor collected the angle of attack against the gas input data. He then used the predictive error method (PEM) to describe the quadrotor's linear output error (OE) model, but its performance was rather limited [6].

Aerodynamic force, namely the thrust, in quadrotors are generated by propeller rotations. Propellers, actuated by motors, move the surrounding air to generate a thrust. There is a significant correlation between performances of propellers and actuating motors. Therefore, both electrical motors and propellers have vital responsibilities in generating thrust that moves the quadrotors. For a comprehensive survey of quadrotor research that contains major works in guidance, navigation, and control areas one may refer to [7]. For a review of various control techniques for attitude stabilization, angular and position tracking control of a quadrotor [8] may be referred. Next, before introducing the test bench, these components are described briefly.

A common electrical motor type used in quadrotors is the brushless direct current (BLDC) motor. In a BLDC, rotor is a permanent magnet, and coils are on the stator. Coils do not need to move, so that, brushes and commutators are not necessary. This feature of BLDC brings numerous advantages to the overall system. These advantages may be briefly listed as (a) energy efficiency, (b) simple control circuitry, (c) durability, and (d) low electrical noise. A detailed account of these issues can be found in [9].

The other hardware component that is tested in the test bench is the propeller. It moves the surrounding air, consequently, it is responsible for the aerodynamic forces acting on the quadrotor. Controlling these forces appropriately a quadrotor can move in any direction as well as it hangs in the air. There are two main parameters for its functioning: diameter and pitch. Diameter is the length of propeller between its opposing ends. It is primarily responsible for the thrust efficiency. Pitch is defined as the displacement a propeller makes in a one complete rotation. There is analogy between propeller pitch and screw pitch where, for instance, a screw with 1 mm of pitch advances 1 mm for one turn. The propellers are described by a notation which is in the form of (a / b) in this text where the value of "a" is the diameter of the propeller and "b" is the measure of the pitch of the propeller in inches. For more details on propellers the source [10] can be referred.

In [11] a test bench consisting of ESC unit, dc motor, and propeller is designed and implemented. In the experimental setting the V018-113 load cell is used for the torque measurement and optical sensor is used for speed measurement. At various operating conditions power, thrust, speed, density, and weight factor are measured. In [12] some BLDC motor

and propeller models are validated. It was concluded that independent validation of the motor and propeller models by decoupling them and studying the results separately is not possible.

The test bench under consideration is a part of master's thesis study [13] and supported by an institutional grant[14]. Its photograph is shown in Figure 1. In the configuration shown, a weighing scale is designed to measure the force applied on it, where the force is proportional with the thrust generated by the propeller. The configuration is described further in the next section. The third section contains the tests and their results. Conclusions take place at the end of the manuscript.



Figure 1. A photograph of the motor and propeller test bench

2.MATERIALS AND METHODS

Description of the Motor and Propeller Test Bench

The test bench consists of a fixed pole physically based on an aluminum plate. A rigid bar, whose center is pivoted by the tip of the pole, has propellers at its two ends (Fig. 1). The structure of quadrotor consists of three main elements responsible for the formation of thrust necessary for the vehicle to fly. These components are electronic speed controller (ESC), electric motor and propeller. Each of the propellers is actuated with a BLDC motor. As a propeller at one end lifts up due to the thrust, the other end of the rigid bar moves downward and applies proportional force on the weighing scale. In the experimentation process the scale readings and electrical power delivered to the BLDC motor are analyzed to reach a conclusion about suitability of the BLDC motor and propeller pair being tested.

A block diagram of the testing process is given in Figure 2. In the block diagram it is seen that the BLDC motor's input signal is provided by the ESC unit. ESC is an electronic module with three signal outputs that generates pwm signals at these outputs in a certain sequence to operate the BLDC motor. Regarding the sequence of the operations, the BLDC motor shafts are connected to the propellers so that they actuate the propeller. This rotation produces the thrust and torque used to push the rotor. Because of the high efficiency, quiet operation and high torque production, the propellers are rotated preferably using the BLDC motors. ESCs are used to control BLDCs. The speed of a brushless motor is controlled by an ESC. It adjusts the engine speed by changing the voltage to the motor by PWM method. The PWM method works by quickly switching the input current of the ESC on and off. The average voltage value depends on how much current flows through the unit and how long the current does not pass. By setting this value, motor speed control is carried out. In addition to these components, a 24 bit analogue to digital converter HX711 load cell amplifier was used to measure the force. By connecting this sensor to the microcontroller, the changes in the resistance of the load current were read and the necessary calibrations were made to provide weight measurement and the thrust values of the propellers were obtained. The INA219 current sensor is used to monitor the current and power drawn by the motors. The INA219 is an existing shunt and power monitor with an I²C or SMBUS compatible interface. The device monitors the shunt voltage drop and bus supply voltage via programmable conversion times and filtering. A programmable calibration value, when combined with an internal multiplier, allows the current to be read directly in amps.

The readings come from the load cell amplifier and the current sensor are processed by external MCU which communicates with the STM32F4 Cortex M4 based 32 bit microprocessor card by serial communication and transfers

the sensor data to the computer environment via serial communication. This card supports C programming language. The microprocessor sends duty cycle to the ESC card and transfers readings to a PC through a serial communication bus. The PC that receives the measurement signals uses MATLAB software for processing the incoming data. Graphics presented in the sequel are generated at this end of the block diagram.

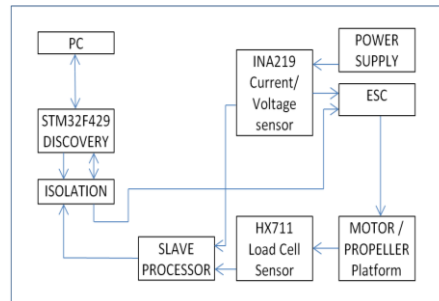


Figure 2. Block diagram of the testing process

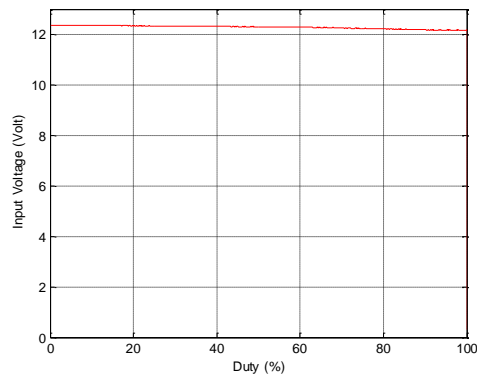
The used external MCU communicates with the STM32F4 card by serial communication and transfers the sensor data to the computer environment via serial communication. A MATLAB algorithm has been developed to obtain the data. Performance data based on the PWM size of the PWM input is obtained via MATLAB from the data transferred to the PC environment.

3.RESULTS AND DISCUSSION

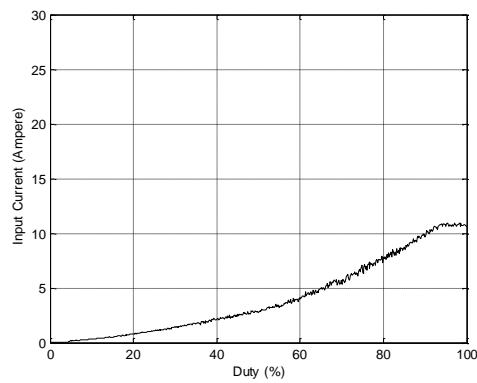
Experimental Results

To fly a quadrotor in hanging position the vertical component of thrust must equal the weight of the quadrotor. Maneuvering the quad, to go from one place to another will require some extra thrust forces. This requirement might be substantially high for the high performance flights and even higher when fluctuations like wind-forces exist. A lifting force that does not meet the weight of the quadrotor does not provide enough power to keep the device in the air. The choice of the appropriate engine and propeller pair is of prime importance in ensuring this efficiently. When larger propellers are connected with engines with higher KV values, the engine tries to rotate the propeller quickly, thus drawing more current and producing more heat in the process. This can inevitably lead to overheating of the motor and the copper windings in the motor remain short-circuited. When choosing the engine and propeller it is important to establish a balance between rpm and torque.

A typical simple test for a BLDC motor and propeller combination is done by just acquiring current, voltage, and thrust data from the related sensors by each incremental PWM output. Graphics shown in Figure 3 (a) and (b) belong to an EMAX 2212 BLDC motor with a 10 inch diameter propeller with a 4.7 inch pitch ratio (10/4.7). Then, measured information is used to obtain the power graphics shown in Figure 4 and it is more useful to us when efficiency is the main concern. The thrust-force graph of the same setup is shown in Figure 5 (a). Finally, as a result, the input power vs thrust force ratio graph for incremental PWM inputs can be obtained as shown in Figure 5 (b). In a sense, it gives us a good information about the motor and propeller combination. The area where the slope is smallest gives us best efficiency, so we will know the thrust force created will be less costly in terms of battery power. On the other hand, since we can see how much lift it can create per unit power, it is easy to predict how long the battery will last. Since manufacturer data doesn't include this information it is to be figured out by a quadrotor designer. Besides, some randomly obtained second hand motor or propellers will not even have manufacturer information.



(a)



(b)

Figure 3. Voltage and current graphics for EMAX 2212 820KV BLDC motor and 10/4.7 size propeller

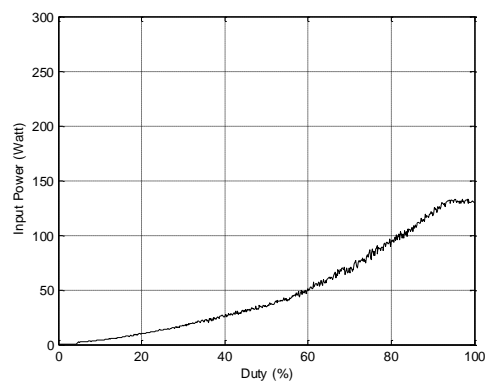
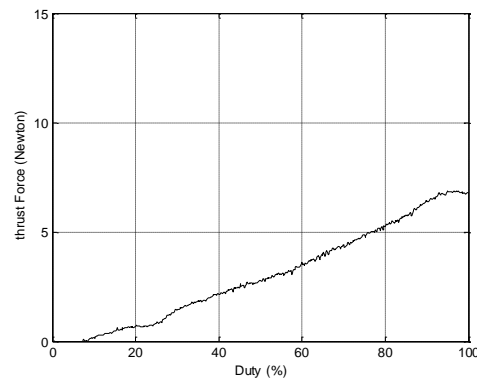
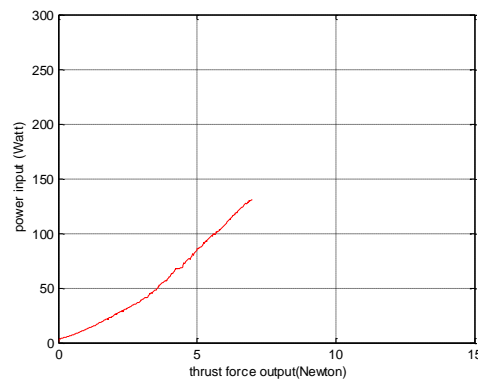


Figure 4. Power graphics for EMAX 2212 820KV BLDC motor and 10/4.7 size propeller



(a)



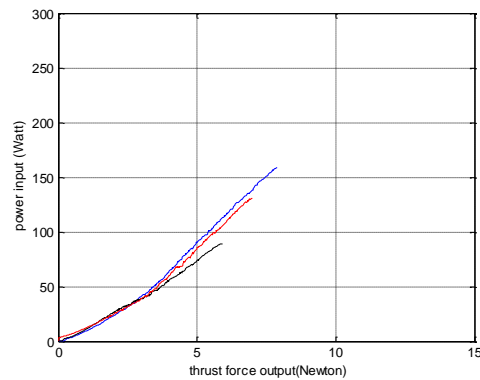
(b)

Figure 5. Thrust force (a) and power vs thrust (b) graphics for for EMAX 2212 820KV BLDC motor and 10/4.7 propeller

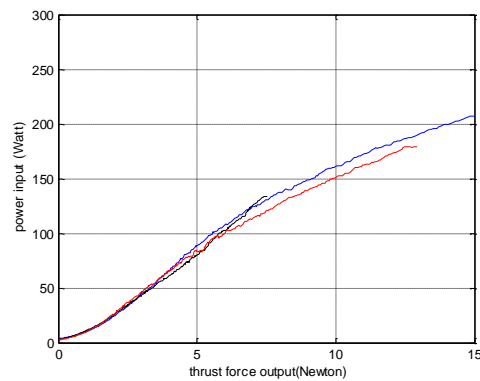
For comparison purposes two BLDC motors and three propeller types have been tested in the test bench to see the results. For each of the motor types, tests are performed with 3 sizes of propellers and graphics are analyzed to see how propeller sizes effect the performance. Used motors are described as EMAX-2212-820KV BLDC and EMAX- 2212-980KV BLDC motors. Propellers are 9 inch dia by 4.7 inch pitch, 10 inch dia by 4.5 inch pitch, and 12 inch dia by 4.5 inch pitch respectively.

Results for 820KV motor demonstrated that 9 inch propeller gave the best results in terms of efficiency but as seen in Figure 6 (a), max. thrust was limited at about 6 Newtons. If a quadrator is designed with four of these motor-propeller combinations total weight should be evaluated for adequate acceleration. If 15% to 20% extra thrust is needed 10 inch or 12 inch propellers may be considered. 12 inch propellers on the other hand, when exceeding 140 Watts power consumption, needs proper cooling. Higher input voltage is required to if 9 inch propeller size must be used.

Results for 980KV motor demonstrated that 10 inch propeller gave the best results among others in terms of efficiency. Considering the over-heating at high ranges, with proper cooling, this propeller seems to be a best choice for the overall range. When the graphics in Figure 6 (b) is examined, it is noticed that even with 100% PWM duty 9 inch propeller's thrust was limited to around 7.5 Newtons, since the motor reaches its maximum speed for the given voltage input.



(a)



(b)

Figure 6. power/thrust ratio graphics for EMAX 2212 (a) 820KV and (b) 980KV BLDC motors with 12/4.5 (blue), 10/4.5 (red) and 9/4.7 (black) propellers

Another test attempt made for a 1400KV motor and 8/4.5 size propeller. Towards the end of the test, the ESC module reached the current limit and abruptly stopped the power. With sudden power cut, the propeller could not stand the stress and the wings were dismantled from near the center. Tests at larger diameters may yield similar results, so testing is not continued as it would not be appropriate to perform the test under the limited conditions. The test bench's capacity limitations can be extended by using larger power supply and high current capacity electronic speed control (ESC) units for the larger size motors. Adding different sensors to the system for speed, vibration, temperature etc. will definitely increase the test bench's value.

4.CONCLUSION

To sum up, experiments have shown that battery efficiency can drop too low with incorrect motor-propeller selections, and that the engines also heat up to a damaging level. This shows that making propeller and motor selection play essential role in quadrotor design. To design an efficient quadrotor, a propeller-motor test bench is designed. Moreover, this test bench can be used for educational purposes so that the students understand effects of changing mentioned parts of quadrotor. In the test bench, thanks to INA219 and Hx711 sensors force to power ratio results are taken. By checking the graphics drawn in the MATLAB environment, the appropriate apparatus for the desired PWM ranges can be chosen. As a result of this, energy requirements of a quadrotor can be optimized for a specified purpose. Thus, it is possible to select the appropriate motor and propeller types for the quadrotor to be designed by pre-evaluating the choices.

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Student Attendance Systems Supported by Intelligent Mobile Telephones

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Abstract: Student attendance have been taken on sheet by signature in the past. In this study, it is developed a student attendance system with intelligent cellular telephones. BLE beacon devices with low energy technology are increasingly used in many fields such as commerce, home, events, transportation, delivery, etc. because of their low energy consumption and operating system support. Smart devices such as BLE beacons can be detected by mobile telephones when they arrive the area where the pointer devices are located. Many distance and proximity sensitive applications can be developed. The aim of this study is to provide a student polling system with intelligent mobile phone application that interacts with the markers' features. As a result, the developed system is compared with a traditional way.

Keywords: Education, intelligent, distributed systems, BLE beacon.

1.INTRODUCTION

The monitoring of the students' course attendance is important in terms of the student regulations and academic success of both students' and lecturers'. The control of students' attendance is a considerable waste of time when it was done by the lecturer. The lecturer needs to check whether a particular student is in the class or not. This control takes a considerable waste of time even if it is done quickly. Since new improvements of computer and automation technologies, computerized control systems have been used in many fields recently. These studies provide a Bluetooth Low Energy (BLE) markers and intelligent mobile telephones to take attendance checks. This system takes less time to spend polling of the students as long as students have intelligent mobile telephones that support BLE technology.

The door was controlled with RFID in (Bektas, 2015, Pala et al 2007, Yuksel et al 2009). iBeacon technology was discussed in (Burzacca et al, 2014, Köhne 2014). Wireless student assignment system was developed by (Cakir et al 2011). Some of the internet links related to Beacon are given in the references.

Beacon Equipment with Bluetooth Low Energy Technology

Beacon devices are low power and low cost electronic transmitters that equipped with BLE technology known as Bluetooth 4.0 or Bluetooth smart. Those beacon devices are shown in Figure 1.



Figure 1. Pointer Device

Pointer device specifications:

The indoor area should be within the range of 5 meters to 20 meters.

Remote settings and updates are required.

The low battery life should be at least 2 years.

The signal transmit power should be between 4 dBm and -20 dBm.

Support Bluetooth radio version 4.0.

Supports exchangeable package structure and UUID information.

Supports iOS (iBeacon) and Android (Eddystone) operating systems.

Must be able to operate in a temperature range of -10 to +50 degrees.

Bluetooth® Smart / Bluetooth Low Energy support.

EN300328 must comply with EN301489 standards.

iBeacon should have security criteria.

Student Attendance System

The system architecture and system components used in the student polling automation are shown in Figure 2. Positioned pointers as mark 1, broadcasts of positioned markers as mark 2, mobile applications that catch broadcasts as mark 3, server and database as mark 4, and web services that provide communication as mark 4 are represented in Figure2.

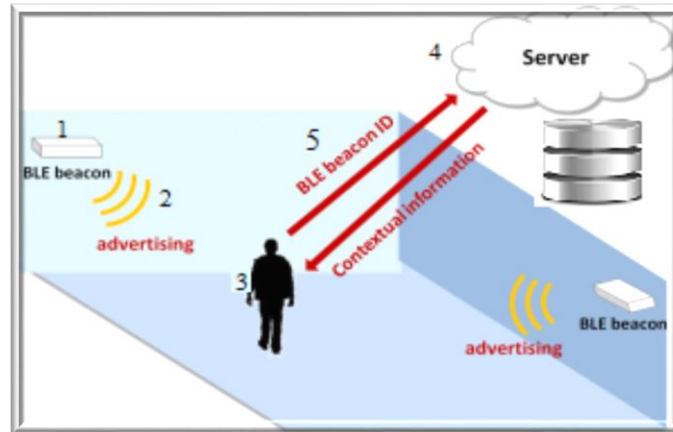


Figure 2. System Architecture

Architecture

The functioning of the student attendance automation should be initiated through the web site of first checking the course. Later on, users need to search for mobile applications on the mobile device. The markers found in the search result will be selected. After the selection process, the user has to click on the sign button after entering the student numbers and passwords. In order for these transactions to be successful, the conditions are stated below.

1. The lecturer should open the attendance.
2. The marking distance must not exceed 20 meters.
3. The pointer must be searched and the correct pointer must be selected.
4. Student number and password must be entered.
5. The student number and password must be correct and taking lesson.
6. The mobile application should only have e-signature on its behalf.
7. Smart device should have internet connection.
8. Student should be in class. (Breaks the blocked pointer broadcast)

Signatures may be signed in accordance with the above conditions. Otherwise, signing is not possible. The general architecture of the attendance system is summarized in Figure 3.

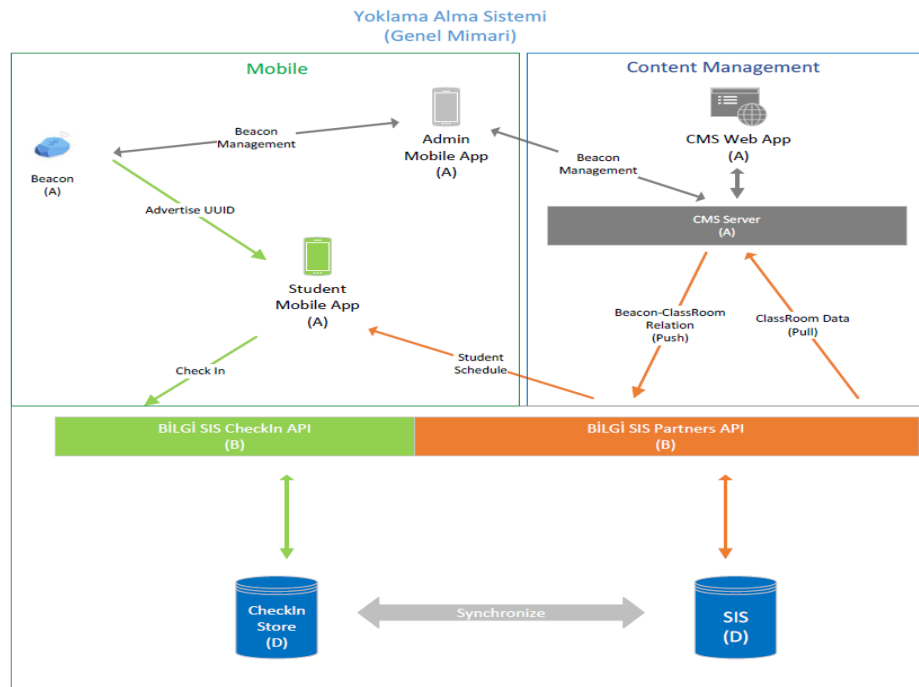


Figure 3. General Architecture Model

Application size

- average (student) x (number of courses) throughout the school days for the week
- Daily average (teacher) x (number of courses)
- Most students are in classes starting at 09:00 during the week. The number of students between Min 3,000 and max 8,000 is reached.
- Daily Average number of classrooms used and the number of courses are very high.

In Figure 4, a database model of the student survey automation is presented. The relational database model is used to provide data integrity of MySQL database. There are 10 tables in total.

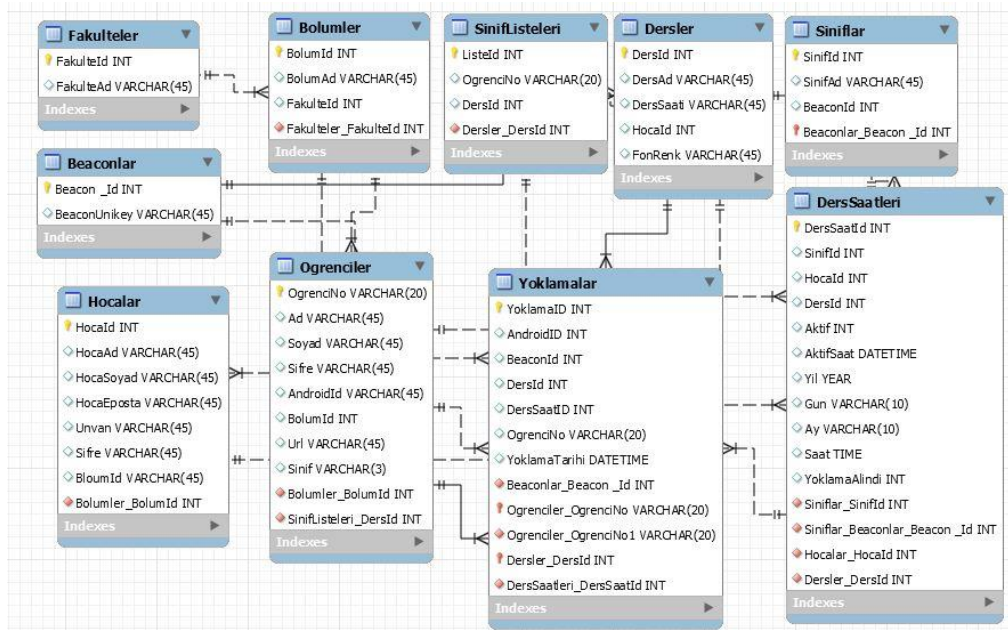


Figure 4. Database Model

Android based mobile attendance application

The mobile application has also been made in Android studio editor. By developed mobile application, users are able to sign the courses that are auditioned by capturing the signals that the markers placed in the classrooms are coded. The developed application is shown in Figure 5.



Figure 5. Android Application Interface

After the beacon search button found on the homepage of the Android application, the Android application captures the markers found in this environment. The student number and password must be entered in order to sign after the marker is captured. After student number and password are entered, e-signature (electronic signature) button should be clicked to sign. If the e-signature (electronic signature) button is clicked and the system satisfies the conditions listed in the architecture, the signature is successfully thrown.

Web based attendance system

Web-based attendance software aims to provide follow-up and monitor student attendance. Php, html, bootstrap technology are used to develop this software design. The teacher logs in to the web-based attendance system with the user name and password information through the interface shown in Fig 6.

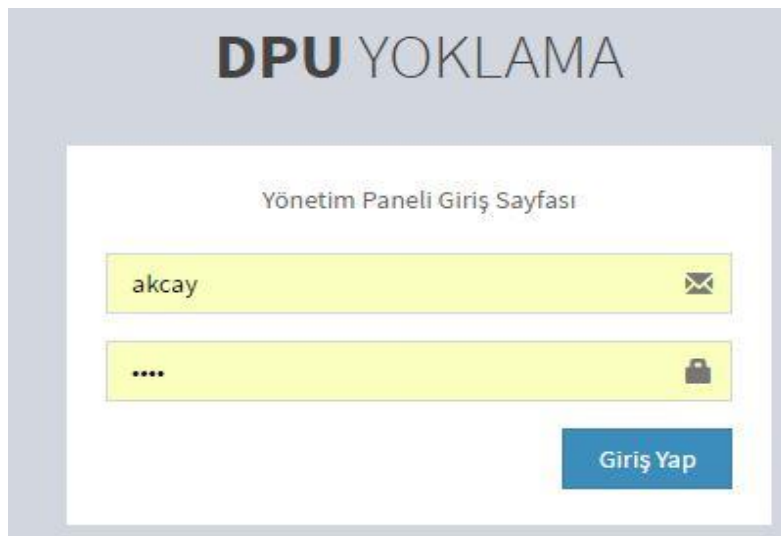


Figure 6. Teacher Login Screen for Web-based Attendance Software

The teacher also sees the information that the web-based attendance software gives to the students when they log in (Figure 7). The interface in Figure 8 comes in when any course is selected via this interface. Figure 8 shows the absenteeism rates of the students who take the selected course.



Figure 7. Web-based Attendance Software Screen for Teacher

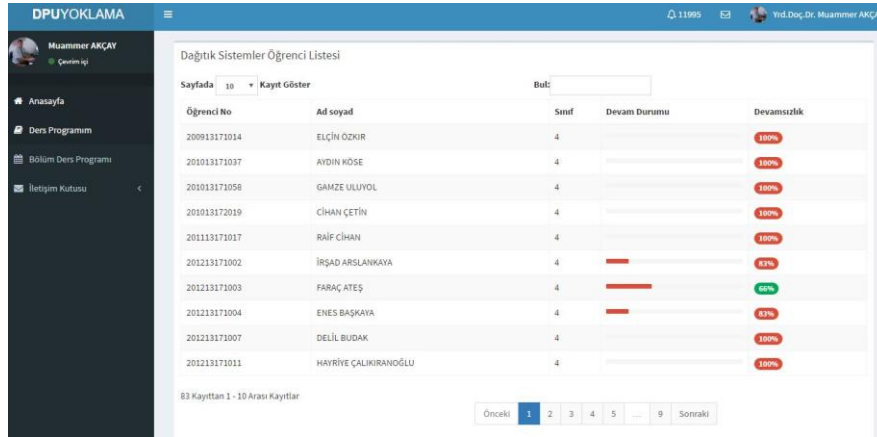


Figure 8. Absence Rate of Students Taking Web Based Attendance Software

After log in the web-based attendance software, lecture schedule and department schedule are in the main page. My schedule is shown in Figure 9. The schedule of the entered teacher is shown in the screen.

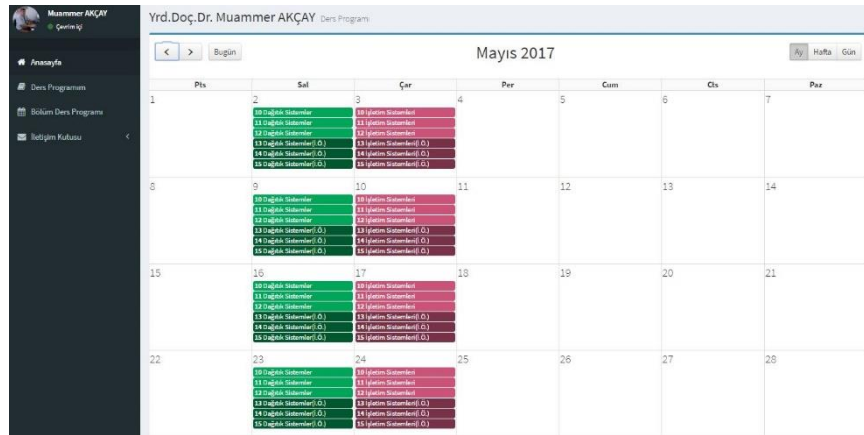


Figure 9. Teacher's course schedule

Figure 9 shows the course schedule of the given by the teacher. In this page, the lessons are divided into year, month, day, and hour. In order to open the attendance of the entered course, the time of the selected course should be given and it appears in according to Figure 10. The time period of attendance of the selected course will be selected and attendance will be opened.



Figure 10. Web Based Course Attendance Page

In Figure 10, the icons of the students who signed in during the given period of time are shown in green. If the mobile side is unable to sign within the given period of time, the teacher page can also make the student exist. Students can see absenteeism on the mobile application as in Figure 11.



Figure 11. Students' Course Continuity

2.CONCLUSION

Mobile users with iOS and Android operating systems receive services such as application execution, content delivery, etc. when the markers using BLE wireless communication technology enter into the field of interaction (interaction). Signers offer a wide range of applications such as advertising, logistics, product, historical artifacts, and navigation. In this study, attendance and participation system developed based on markers, which is rapidly becoming popular and is an up-to-date technology, is presented. The developed system allows users to track their participation according to the location and duration of interaction with the markers. Thus, it is possible to monitor which time zone the student has left and what time the student left. The developed student attendance system can also be used in meeting and evaluation processes of corporate firms with small changes. Company proprietors or project managers will be able to report attendance times at the meeting.

The biggest disadvantage of the developed system is the use of mobile devices with BLE technology. The fact that most of today's new devices are offered as standard in most BLE technology shows that this disadvantage will be eliminated quickly.

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***In Vitro* Inhibition of Azithromycin and Amikacin Sulphate Used as Anti-infective Drug on Human Serum Paraoxanase 1 Enzyme Activity**

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Abstract: We studied *in vitro* effects of two different drugs (azithromycin and amikacin sulphate) which are often used as anti-infective on human serum paraoxanase1 (PON1) enzyme activity. The drugs decreased the *in vitro* PON1 activity. The inhibition mechanism of azithromycin was competitive whereas amikacin sulphate was a noncompetitive inhibitor. The IC₅₀ values for azithromycin and amikacin sulphate were calculated to be 0.363 mM, and 4.92 mM, respectively, and the K_i constants were calculated to be 0.343 mM, and 5.90 mM, respectively. These results showed that azithromycin is more effective than amikacin sulphate. We propose a prediction scheme for the interaction of azithromycin with the PON1 active site because we thought that azithromycin interacts with the amino acids which are in the PON1 enzyme active site. The results we found showed that these drugs *in vitro* inhibit the activity of the enzyme with different inhibition mechanisms at low doses.

Keywords: Azithromycin, amikacin sulphate, paraoxanase, enzyme, inhibition

1.INTRODUCTION

Paraoxonase (PON) (arilesterase, [EC 3.1.8.1]), synthesized in liver, capable of hydrolysis paraoxone, active metabolite of parathion which is an insecticide in organophosphate, is a serum esterase due to calcium (Ca²⁺) [1-4]. Ca²⁺ is required for not only the enzyme activity but also the enzyme stability. Ca²⁺ shows its effect by taking place in direct catalytic reactions, or by ensuring proper conformation of the enzyme active site [5]. First discovered in 1946 by Abraham Mazur, enzyme is today defined as the human serum PON [6]. PON1 synthesized in liver and released into blood in humans, having a molecular weight of 43 kDa, is a protein of 354 amino acids and is physically linked with high-density lipoprotein (HDL) [4, 7-9]. PON has two main functions: Participation in detoxification of organophosphate compounds such as paraoxon which is a pesticide and protection of low-density lipoprotein (LDL) from oxidation through hydrolysis of lipid peroxides [10]. PON is known to have antioxidant property with free sulfhydryl group (cysteine 284) in its structure [11]. Due to the fact that PON1 is an antioxidant enzyme, it is thought to play a protective role in avoidance of many diseases such as diabetes, cardiovascular disease, sepsis, Alzheimer and Parkinson [12]. Environmental and genetic factors that influence serum PON1 levels, also effect the protection capacity of oxidation from HDL to LDL (due to atherosclerosis) [13].

It is clear that PON1 has significant effects on living organisms. Therefore, further study on interactions of PON-drugs is needed. Previous studies related to purification of some protein and protein-chemical or protein-drug interactions are carried out regularly. [14-16]. In this study, we studied *in vitro* effects of two different drugs (azithromycin and amikacin sulphate) which are often used as anti-infective on human serum PON1 enzyme activity.

2.MATERIALS AND METHODS

Materials

Paraoxon, chemicals for electrophoresis, and protein assay reagents were purchased from Sigma Chem. Co. All other chemicals were analytical grade and obtained from Merck. Fresh human serum was taken from the Blood Center of the Mengücek Gazi Education and Research Hospital at Erzincan University.

Paraoxonase Activity Assay

Paraoxonase activity of PON has been identified with paraoxone (1 mM) in 50 mM glycine-NaOH (pH 10.5) buffer including 1 mM CaCl₂ at 25 °C. Enzyme activity assay is based on spectrophotometrically measurement of p-nitrophenol at 412 nm. The molar extinction coefficient of paranitrophenol ($\epsilon = 18,290\text{M}^{-1}\text{cm}^{-1}$ at pH 10.5) is used for calculation of the activity. One enzyme unit was defined as the amount of enzyme that catalyzes the hydrolysis of 1 μmol of paraoxon at 25 °C [10].

In Vitro Inhibitor Studies

We investigated the inhibitory effects of different inhibitor concentrations of two drugs: azithromycin and amikacin sulphate. All drugs were attempted three times at each concentration. PON activities were determined at different drug concentrations. Control activity was measured without inhibitor and presumed 100%. Percentage activity against drug

concentration graph was drawn for each drug (Fig. 1). Lineweaver-Burk curves were used for identification of K_i values and inhibition type (Fig. 2) [17].

3.RESULTS AND DISCUSSION

The *in vitro* effects of azithromycin (1) and amikacin sulphate (2) drugs on paraoxonase activity of PON1 were shown in Table 1. IC_{50} values were determined as 0.363 mM, and 4.92 mM, respectively (see Table 1). K_i values and inhibition types of the drugs were given in Table 1.

Table 1. From % Activity- [I] and Lineweaver-Burk graphs obtained IC_{50} and K_i values for anti-infective drugs.

Inhibitor	IC_{50} (mM)	K_i (mM)	Type of inhibition
Azithromycin (1)	0.363	0.343 ± 0.111	Competitive
Amikacin Sulfate (2)	4.92	5.90 ± 0.14	Noncompetitive

Compared with the IC_{50} and K_i values of the drugs, azithromycin is more effective than amikacin sulphate. The drugs which are often used as anti-infective decreased the *in vitro* PON1 activity. Both drugs inhibited the enzyme by different inhibition mechanisms. Azithromycin showed competitive inhibition, whereas amikacin sulfate showed non-competitive inhibition.

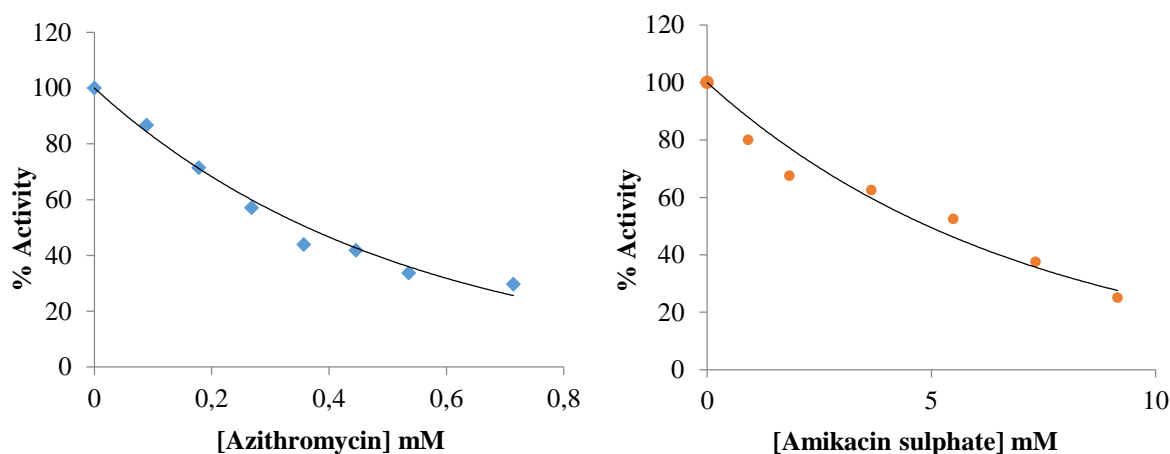


Figure 1. *In vitro* effect of azithromycin (1) and amikacin sulphate (2) at different concentrations on PON1 activity.

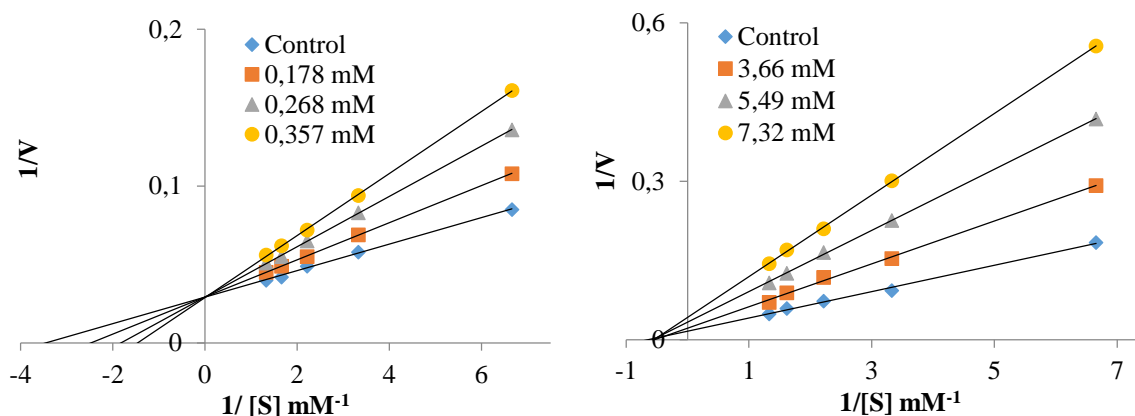


Figure 2. Determination of inhibition types and K_i values for the drugs (azithromycin (1) and amikacin sulphate (2), respectively) using Lineweaver-Burk curves.

PON enzyme possesses anti-atherogenic and antioxidant effects in living metabolism. Because the enzyme is associated with HDL, it hydrolyses lipid peroxides in oxidized lipoproteins. Protection of HDL, LDL and macrophages against oxidative stress determines anti-atherogenic property of PON1 [18, 19]. This property is adversely related with oxidative stress in macrophages and serum [20].

In our previous study, we evaluated the impacts of some antibiotics such as netilmicin sulfate, oxytetracycline hydrochloride, clindamycin phosphate, streptomycin sulfate, and lincomycin hydrochloride on PON 1 from human serum. IC_{50} values were found as 0.2 mM, 3.73 mM, 18.30 mM, 35.80 mM, and 56.30 mM, respectively [15].

Researches on interaction of some chemicals with enzymes and enzyme-drug interactions started to gain importance. The number of these studies is increasing day by day throughout the world [14, 21-23]. Taken into the body and interacting with enzymes, drugs and toxic substances generally exhibit biological effects. Some drugs used as anti-infective are thought to interact with PON1 enzyme. Therefore, we investigated the *in vitro* effects of the drugs azithromycin (1) and amikacin sulphate (2) on PON1 activity and found IC_{50} values as 0.363 mM, and 4.92 mM, respectively (Table 1). IC_{50} values obtained in our study should be taken into account during the treatment. K_i values were calculated from the Lineweaver–Burk plots for these drugs (Table 1). It was found that azithromycin (1) inhibited competitively, and amikacin sulphate (2) inhibited noncompetitively paraoxonase activity of this enzyme. The table 1 suggests that azithromycin (1) had the most effective inhibitor. Inhibitory effect of the inhibitors according to the order from the strongest to the weakest is as follows: azithromycin (1) > amikacin sulphate (2). Because azithromycin (1) inhibits enzyme competitively, we thought that it interacts with the amino acids in the active site. According to our results, we can say that azithromycin binds to the active site of the enzyme, and that amikacin sulfate binds to a different region outside the active site of the enzyme.

4.CONCLUSION

In a study investigating the active site of the PON, some histidine residue as His154 was considered to be more important not for PON 1 activity but for protein folding or stability of PON 1 [24]. Looking at the active site of the enzyme, it is seen that the catalytic Ca^{2+} was connected to His (115 and 134) amino acids. In this study, where we interacted azithromycin (1) with enzyme *in vitro*, we saw that it inhibited competitively paraoxonase activity of this enzyme. Therefore, we believe that azithromycin (1) interacted with the active site of the enzyme. Amikacin sulphate (2) can be attached only to the enzyme-substrate complex because they inhibit enzyme noncompetitively.

Consequently, the process after the drug enters the body is very important. Drugs interactions outside the target should also be considered. After obtaining pure PON1 enzyme, we investigated the *in vitro* effects of the relevant drugs used as anti-infective on the enzyme activity.

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Effect of Using Different Hypotonic Solution for Chromosome Preparation from Embryonic Tissues of Rainbow Trout (*Oncorhynchus mykiss*) Larvae

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Abstract: The most effective preparation technique developed in this study has provided an excellent chromosome metaphase spread from fin tissues and whole body of larvae of the rainbow trout (*Oncorhynchus mykiss*). This study investigated the dependency of chromosome preparation parameters including colchicine exposure duration (5, 7 h), three different hypotonic solution (distilled water, 0.075 M KCl solution and 1.1% Sodium citrate) to rainbow trout at 6 dph (days post-hatch) larval ages. The yolk sac and debris of the larvae were carefully removed using a sharp scalpel after colchicine treatment. After this, tissues were hypotonized in hypotonic solutions to find out the most effective hypotonic treatment. The best treatment parameters for preparing good chromosome spreads from rainbow trout were optimized as 0.05% concentration of colchicine for 7h, hypotonic treatment 40 minutes with 1.1% sodium citrate, fixation with carnoy solution at 3:1 ratio and a concentration of 4% Giemsa for 20 minutes.

Keywords: Rainbow trout, Chromosome, Hypotonic solution, Karyotype, Colchicine

1.INTRODUCTION

Salmonids are the best karyologically studied fish group in terms of the number of species, populations, individuals and material (adults and embryos) analysed. Karyotyping is the process of pairing and ordering all the chromosomes of an organism, thus providing a genome-wide snapshot of an individual's chromosomes. Cytogenetic methods, such as taxonomic works, and karyological analysis are essential in providing basic information on fish breeding programs such as inter-specific hybridization (Crego-Prieto et al. 2013), chromosome manipulation techniques (Christopher et al. 2010; Gilna et al. 2014), and genetic improvement of commercial fish stocks (Gui and Zhu 2012). To date, a variety of karyotyping techniques such as tissue cultures (Lomax et al. 2000), squashing techniques (Armstrong and Jones 2003), and cell suspensions of the tissues undergoing mitosis (Fan and Fox 1990; Henegariu et al. 2001) have been developed to visualize chromosomes of fish at different developmental stages.

2.MATERIALS AND METHODS

Chemicals

Colchicine, methanol (99 % HP grade), glacial acetic acid, KCl and Sodium citrate were purchased from Sigma-Aldrich and Giemsa stain from Merck. Distilled water (HPLC grade) was produced daily in the laboratory.

Fish

6 days post-hatch (dph) larvae of *Oncorhynchus mykiss* were obtained according to Karami et al. (2010).

Chromosomal Preparation Procedure

In this study; investigated the dependency of chromosome preparation parameters including colchicine exposure duration (5, 7 h), three different hypotonic solution (distilled water, 0.075 M KCl solution and 1.1% Sodium citrate) to rainbow trout at 6 dph (days post-hatch) larval ages. The yolk sac and debris of the larvae were carefully removed using a sharp scalpel after colchicine treatment. After this, tissues were hypotonized in hypotonic solutions to find out the most effective hypotonic treatment.

3.RESULTS AND DISCUSSION

Results

Colchicine concentration and duration, hypotonic solution, cell suspension density, Giemsa stain concentration and duration were optimized according to the following results.

The effect of colchicine duration to number of metaphase chromosome spreads were significant ($P<0.05$). Effects of different treatments on the number of clear and identifiable metaphase chromosome spreads due to hypotonic solutions were showed that %1.1 sodium citrate was the most effective hypotonic solution (number of chromosome spread:15). Regardless of the duration of incubation, using a Giemsa stain at concentrations lower than 4 % produced non-visible chromosomes in all the treatments. In contrast, using 10 % and particularly 14 % Giemsa caused sedimentation, dark background and filled the space between chromatids. In general, in both species desirable results were achieved when the spreads were stained with 4 % Giemsa for 20 min making chromosome spreads suitable for karyotyping.

Discussion

This study proved the necessity of modifying colchicine concentration and incubation period, and the type of hypotonic solution according to the fish and the larval age. In *O. mykiss*, the number of clear metaphase chromosome spreads was significantly increased when sodium citrate was used compared to KCl and dH₂O. Using KCl caused extensive cell burst and chromosomal loss.

4.CONCLUSION

This study proved that depending on the fish species and the age of larvae, colchicine concentration and/or exposure duration, and/or hypotonic solution must be altered to achieve clear metaphase chromosome spread. Furthermore, the Giemsa stain concentration and incubation period proved to be independent of species and larval age. Probably significant differences on the amount of yolk content and its rate of absorption, and the differences on the rate of cell division among larvae of different fish species are responsible for differences among chromosome preparation protocols.

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From Past to the Present Small Ruminant Husbandry in Kastamonu

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Abstract: Kastamonu played on the historical Northern Anatolian Silk Road, has become an important agricultural and commercial centre from the past to the present. It is known as the region where the animal existence is the most after Konya and Erzurum in the pre-Republican Empire period. It is reported that the existence of the small ruminant for Kastamonu in this period is about twice as much as the large animal existence. In the 1909 census of agriculture, the population of Kastamonu was 326 thousand heads, while the number of mohair goat was 298 heads, the presence of sheep 150 thousand heads, total milk production 14 thousand tons, mohair production 252 tons and hair production 7 tons. From the first years of the republic until the 1970s, raised the number of small ruminants on the shore and the production of milk, meat and especially wool and mohair produced accordingly showed a linear increase. For example, in 1964, the number of mohair and hair goats were 682.500 and 39.000 heads, respectively. So that the total number of goats grown in the province exceeded 720 thousand. In the same year, the production of mohair reached 700 tons and 500 tons of this amount were exported. The remaining 200 tons of mohair were used to meet domestic needs with Tosya interwoven textile industry. The number of sheep in 1965 reached its highest level and recorded as 340.780 heads. The amount of fleece produced during this period was 230 tons. However, due to the livestock policies implemented especially after the 1980s, the small ruminant in Kastamonu has suffered a great deal and a very dramatically decrease in both the numerical and the production values has occurred. For example, the number of sheep fell to 46 thousand in the 2017 year. In terms of mohair, the situation is even worse. With a dramatic decline in the number of mohair goats approaching 700 thousand in the 1964 year, the production of mohair dropped to 3000 head in 2010 and 3 thousand. Mohair exports have fallen to 3 thousand. It can be said here that the period was declared by the Ministries of Forest to be the most important factor in the declaration and prohibition of goat as an "enemy of the forest". However, based on previous data from the past 40 years, it is obvious that Kastamonu has a very high animal production, especially the production potential of small animals such as sheep and goats. From here, the policies applied in recent years have been changed a little and incentives and support for small ruminant husbandry has been increased. As a result, an increase in the number of sheep and goats has begun to be observed. According to TURKSTAT 2017, the presence of Kastamonu sheep continues to decrease, whereas a slight increase in the number of mohair and hair goats are observed. In this study, it was investigated how the past production values can be reached by evaluating the high potential of Kastamonu province small ruminant husbandry, causes of the decline of small ruminant, strengths, and weaknesses, prominent problems and solution proposals using about one hundred years data.

Keywords: Kastamonu, small ruminant husbandry, hair and mohair production

1. INTRODUCTION

Kastamonu, which was governed by the province of Anatolia until the 19th century, was included in the Bolu Mission in 1841 under the framework of the restructuring of the provincial organizations starting with the Tanzimat declaration. Kastamonu, which was converted to the province by the arrangement in 1846, became a province after the order of 1867. In this period, the provincial banners consisted of Kastamonu center, Bolu, Sinop and Çankırı (Şahin, 1992, 2001). At the end of the 19th century, the province of Kastamonu determined the situation and needs in many areas and tried to evaluate the subjects requested to be done by the state. Kastamonu is located in the Black Sea region and is located on the Black Sea coast, bordered by Sinop, Çorum, Çankırı, Karabük and Bartın. Kastamonu is one of the most important illusions of the Black Sea Region famous for its cultural richness and natural beauties. The city is a city with a history of 7000 years. Kastamonu, one of the most beautiful corners of the world, is a holiday region that offers many alternatives with canyons, lakes and rivers, sea and lush forests.

The most important sector dominating the provincial economy is agriculture. Agricultural activity is based on vegetative breeding and forestry because the country occupies a rich forest footprint. 64 % of the province's total land cover forest areas. The agricultural area covers only 28% of the total land of the province. Produced agricultural products; wheat, barley and fries. Sugar beet, hemp, garlic are also produced as an industrial plant. The garlic production in Kastamonu consist of 14 % in Turkey and the annual output is approximately 16,000 tons (Yıldız, 2013).

According to 2007 data, the population of the province is 360 366. The provincial population constitutes approximately 0.5% of the country's population. 176 of the population (48%) live in the city center, the rest live in the districts. When the population structure of Kastamonu is examined, it is observed that the city population increased by 6.13% and the

village population decreased by 12.40% in the same period. The county in Kastamonu province is 20. There are 21 municipalities and 1071 villages in the province of Kastamonu including the center. It ranks second in terms of number of villages in Turkey. There are also 2,558 settlement units connected to the villages. State Planning Organization located in Kastamonu by the socioeconomic development of his province in 2003, ranking # 51 in 81 provinces in Turkey, Black Sea region is located between the provinces. According to national per capita income, it is in the 31st place. The total public investment in the province in the year 2002 30.019 billion in the year 2003 22.286 billion, while in 2004 is 45 680 billion, public investment in the said year for Turkey in general 15,533,564 billion with total order, 16,009,223 billion TL 16,093,343 billion TL. Kastamonu in public investment, the highest percentage in Turkey was in 2004 with 0.28%. 96% of the province of Kastamonu is made up of forests and platelets, and the majority of the breeders have animals in the range of 9-10 months. In order to benefit from these advantages, it is necessary to increase the herd size and make more profit for the farmers. 70 % of the growers do not have an additional feeding. In order to increase productivity, coach participation, goat feeding, supplemental feeding before and after the birth should be encouraged. Particular emphasis should be placed on this topic in breeding trainings. (Yakupoglu, 2001)

Kastamonu province is inadequate knowledge on hygiene and sanitation. Limited budgetary possibility in fighting with diseases and harmful, Sometimes in animal movements, there is a lack of information on hygiene and sanitation, While there are strong aspects such as veterinary and animal health database, the existence of adequate technical staff, membership of national and international organizations, Inadequate legislation on welfare practices in farm animals, Inadequate facilities for waste management, control and storage, and the lack of adequate quarantine centers for illegal animals constitute weaknesses for livestock. In this article; The structure of small ruminant for Kastamonu province was examined using the data of TURKSTAT for 1934-2017. The obtained data are summarized in schedules and technical and economic suggestions about the problems are presented.

Agriculture in Kastamonu Before the Republic of Turkey

Plant production

The population of Kastamonu was 326 thousand in the 1909 agriculture census. In this time the total amount of cultivated land was 1 million 402 thousand acres. The number of households engaged in agriculture at that time in the district was 53,744. In terms of this feature, it was second only to Trabzon province for the year, which is mentioned in the country. The average size of the business is 26 decares. Generally, land size varies between 10 and 50 decares. Grain production in Kastamonu was an important activity during the mentioned period. More than two thirds of the cereal crops were divided into wheat and barley cultivation, and the remaining crops were evaluated for the cultivation of rye, millet, maize, brass and rice (Aktaş, 2015). Kastamonu is known as an important rice production centre especially during the mentioned periods. Beans, beans, lentils and potatoes are among the important products. In the mentioned period, production of 626 tons of flax fiber and seed was another remarkable product. Kastamonu region is one of the most important apple production areas of the Ottoman period (Ortaylı, 1977). 18 % of the total apple production, 12% of the chestnut production, 5% of the walnut and Kastamonu region are grown.

Animal production

Kastamonu is known to be the most important bovine animal production after Konya and Erzurum in the Ottoman period. Beef cattle, buffaloes, oxen and racing horses have become one of the leading illusions in existence (Yakupoglu, 2001). In the mentioned period, the small ruminant existence in Kastamonu is more than 2 times bigger than large animal. Especially with 298 thousand mohair goats and 150 thousand sheep (Anonymus, 2015). In other words, Kastamonu constitutes two-thirds of the ostrich's small animal existence. In the same period, 14 thousand tons of milk, 7 tons of goat and 252 tons of lint were produced depending on the number of animals (1909 census of agriculture). In the same period, poultry farming is also an important activity area and 454 thousand poultry assets are mentioned. It was found that silkworm cultivation was performed less in the poultry farm. The results of the census of 1909 showed us that the potential for agricultural and animal production of Kastamonu in the Ottoman period was quite high (Baydil, 2005).

Agriculture in Kastamonu Today

Land existence and plant production

Kastamonu is located in the Western Black Sea Region between 41 ° 21 'North latitude and 33 ° 46' East longitudes. Altitude from sea level is 775 meters. Its surface area is 13108 km² and it constitutes 1.7 % of the country's land. Sinop in the east, Çankırı in the south, Bartın in the north-west, Black Sea in the north, Karabük in the west, and Çorum in the southeast (İskender, 2005). 74.6 % of the surface area of Kastamonu is mountainous and forested, 21.6 % is composed of plateau and 3.8 % is composed of ruby. It can be understood from the distribution, there are no large areas suitable for cultivation (Hayta and Yücel, 2001). However, the small plains around the valleys are striking. The most important ones are the Gökırmak, which includes the plains of Daday and Taşköprü, and Devrez Vadis, which covers the Tosya agricultural area. There are also planting and planting areas near the Car Cide and Devonian tea beds. The area of the

province is 1310,810 hectares, of which 67.5 % is used for the production of field crops, while 16.4 hectares is not suitable for agriculture. The forest and shrubbery area is 774.806 hectares, while the meadow-pasture area is 87.087 hectares (Anonymus, 2017). The amount of unutilized and unused land is 6.8 % (Table 1). According to 2007 statistics, 33.087 ha of forage crops were produced. In 2008, 19.494 ha of forage crops were produced under the support of forage plants. 84 % of this production is made by one year, 3 % by perennial forage crops (Güzey, 2001). The silage corn-planting rate is 12 % (Şahin, 2001).

Table 1. Distribution of land assets in Kastamonu province

Area Using Types	Area (ha)	Rate (%)
AGRICULTURAL AREA	Production area of crop products	242.577
	Production area of vegetable products	4098
	Fallow land	37.951
	Production area of fruits	11.093
	Poplar-willow	4656
	Non-agricultural area	58.851
Total agricultural areas	359.226	27.4
Forested and heathy areas	774.806	59.1
Meadow and pasture areas	87.087	6.6
Non-agricultural areas	89.691	6.8
Total	1.310.810	100.0

Source: TUIK, 2016

Sheep and goat breeding

Change of animal population according to years

One of the important livelihoods of Kastamonu is animal production. Small ruminant was extensively raised as large animal. The sheep and mohair goats were the most abundant among small ruminant (Yozkatlı, 2002; Altınbaş, 2014). The variation of Kastamonu province small ruminant numbers according to years are given in Table 2 and Figure 1. While the presence of sheep was 84 thousand heads in 1934, this number increased to 340 thousand heads in 1965. However, due to the applied livestock policies in 2017 it has decreased to 47 thousand head. In other words, the share of the sheep has been fluctuating by 31 % (1934) to 79.80 % (2005) (Figure 2). When the hair goat was examined, it was eleven thousand head in 1934 and this value reached up to the highest value of 55 thousand in 1965 (Anonymus, 2008, 2015a, 2016). Similarly, in 2005 the number of beaches declined to 9000 and rose to 31000 in recent years. The situation was worse in terms of mohair. The number of mohair goats, which were an imported animal and had a lot of preliminary designation, increased to 536 thousand in 1961, and tended to decline rapidly after 1991. In 2010, with the support and incentives made to the mohair feathers that fell to 3000 heads, the figure rose to 5000 heads in 2017 (Tüfekçi and Oflaz, 2015; TUIK, 2018).

Table 2: The Change Sheep and goat numbers in Kastamonu province

THE CHANGE SHEEP AND GOAT POPULATION IN KASTAMONU

Year	Sheep's presence (domestic) (head)	Share in total number of sheep (%)	Hair goat presence (head)	Total number of small ruminants share (%)	Angora goat presence (head)	Share in total number of small ruminants (%)	Total small ruminants presence (head)
1934	84.306	31.90	11.829	4.48	168.108	63.62	264.243
1950	221.434	73.42	39.728	13.17	403.418	13.30	664.580
1961	336.434	36.80	52.657	5.76	525.210	57.44	914.301
1964*	280.000	27.96	39.000	3.89	582.500	68.14	1.001.500
1965	340.780	36.54	55.660	5.97	536.470	57.50	932.910
1970	286.220	39.14	39.610	7.38	286.780	53.47	536.341
1991	209.951	73.01	17.035	5.92	60.576	21.07	287.562
1995	132.381	71.36	18.000	9.70	35.120	18.93	185.501
2000	93.897	69.36	22.430	16.57	19.040	14.07	135.367
2005	80.754	79.80	9.983	9.86	10.462	10.34	101.199
2010	54.569	77.67	12.255	17.44	3.437	4.89	70.261
2017	43.644	60.47	22.680	31.42	6.192	8.11	72.516

* Kastamonu ili iktisadi yapı araştırması raporu, 1964.

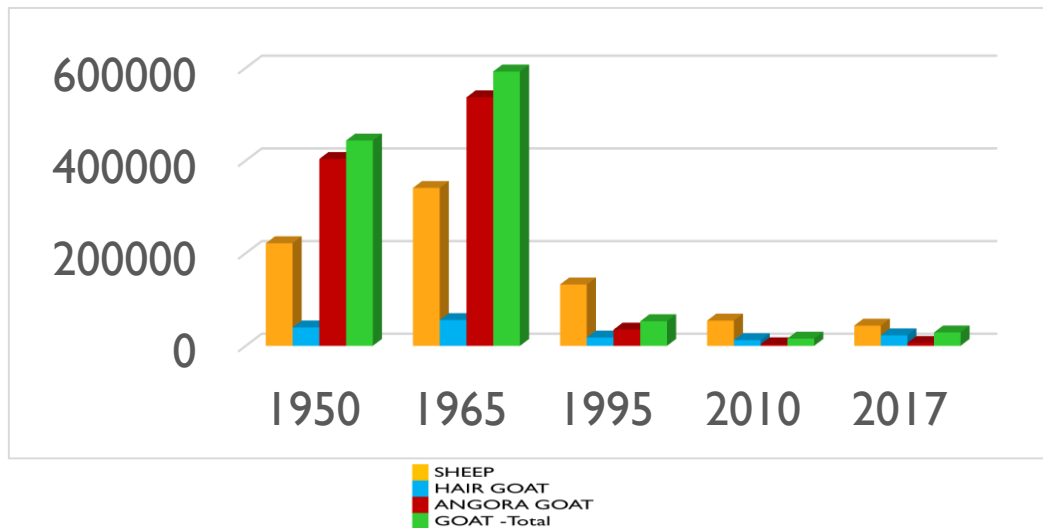


Figure 1. The Change of Sheep and goat numbers in Kastamonu province

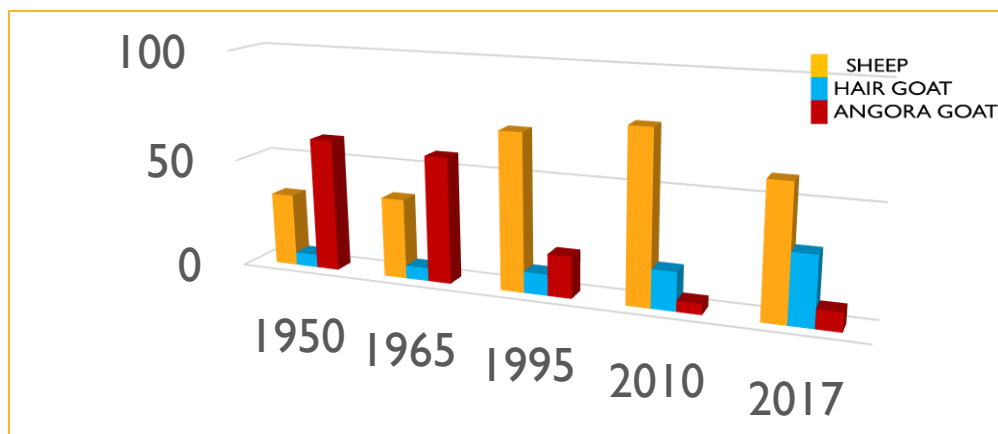


Figure 2. Percentage of small ruminants in Kastamonu province

Sheep and goat milk production

The annual change in milk production in Kastamonu province is given in Table 3. In 1934/38, while the number of sheep breeding was 32 thousand, this value increased to 75 thousand in 2017. The highest number of sheep was reached in 1970 with 121 thousand heads. Sheep milk production increased significantly from year to year and reached 1332 tonnes (2017) from 362 tonnes (1934/38 years) (Anonymus, 1933, 2018) (Figure 3 and 4).

Table 3. Sheep and Goat Milk Production in Kastamonu province

Sheep and Goat Milk Production in Kastamonu

Years	Number of milking sheep (head)	Sheep milk production (ton)	Production per Sheep (kg)	Number of milking goat (head)	Hair goat milk production (ton)	Production per goat (kg)	Total milking number of sheep and goats (head)	Total milk production of small ruminants (tonnes)
1934/38	32.932	362	10,99	4723	34	7,2	37.655	396
1950	50.198	552	10,99	9660	174	18,01	59.858	726
1961	-	7230	-	-	1011	-	-	8241
1965	-	5580	-	-	1020	-	-	6600
1970	121.400	5460	44,98	11.650	875	75,11	122.050	6335
1991	111.321	4452	39,99	30.528	738	24,17	141.849	5190
1995	67.702	2686	40,27	15.286	495	43,77	82.988	3181
2000	43.246	1730	36,12	14.284	526	45,23	57.530	2108
2005	28.137	2139	76,02	7279	432	59,35	35.416	2571
2010	54.569	1412	25,87	4.572	328	76,99	59.121	1740
2017	75.278	1323	17,58	10.982	793	75,13	86.260	2116

Source:TUIK, 2018.

SHEEP NUMBER AND MILK MANUFACTURING

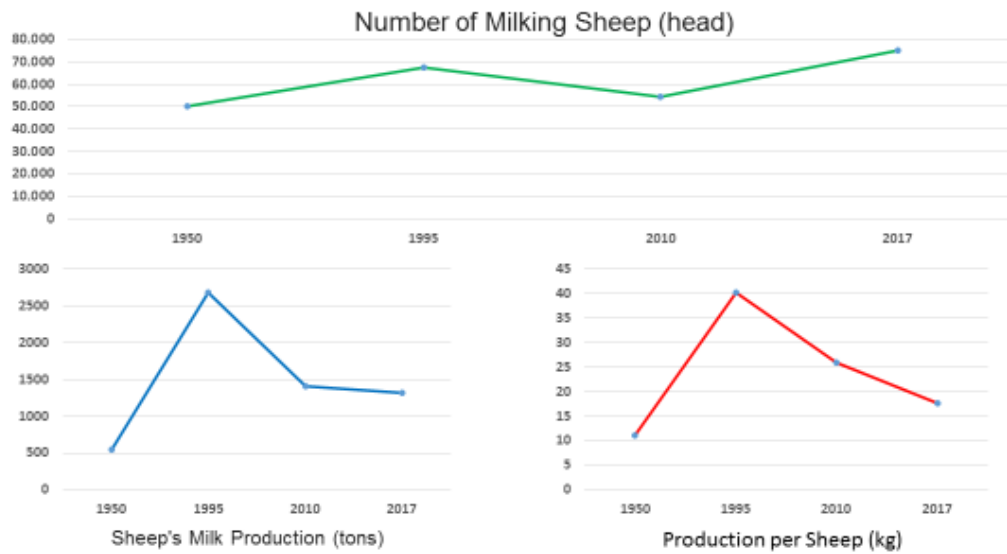


Figure 3. Sheep number and milk production in Kastamonu province

GOAT NUMBER AND MILK MANUFACTURING

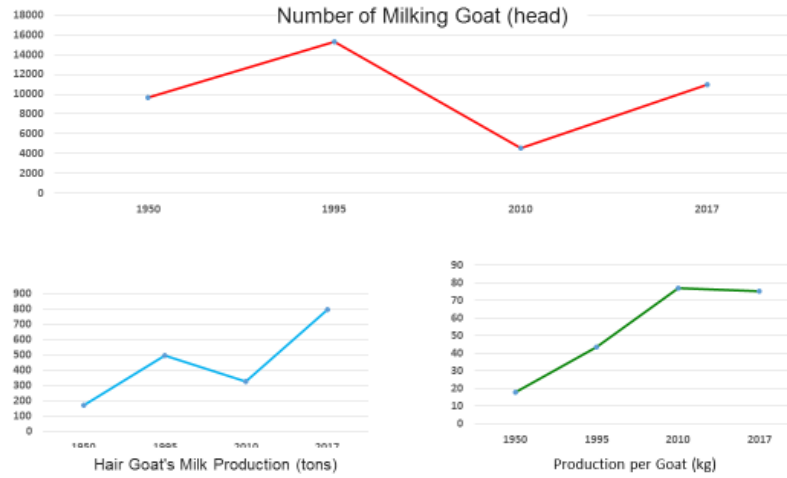


Figure 4. Goat number and milk production in Kastamonu province

Sheep and goat meat production

The annual change for sheep and goat meat production in Kastamonu province is given in Table 4. In 1934/38, while the production of sheep and lamb meat was 192 thousand, this value decreased to 55 thousand in 2009. The highest production value for sheep and lamb meat was reached in 2000 with 350 tonnes. Goat and kid meat production was 19 tonnes in 1934-1938. The highest production value for goat and kid meat was reached in 1991 with 44 tonnes (Figure 5 and 6).

Table 4. Sheep and Goat Meat Production in Kastamonu province

SHEEP AND GOAT MEAT PRODUCTION

Years	Number of sheep and lambs cut (head)	Sheep and lamb meat production (ton)	Share of sheep and lamb in total small ruminants meat production (%)	Number of goats and kids cut (head)	Goat and kids meat production (ton)	Share of goat and kid in total small ruminants meat production (%)	Total small ruminants meat production (ton)	Total number of small ruminants litters (head)
1934/38	20.796	192	68.57	13.333	19	6.78	280	34129
1950	-	238	85.30	41	14.69	279		
1970	20.680	230	59.74	6580	85	26.98	315	27.260
1991	25.875	376	77.61	2628	44.64	10.61	420.64	28.503
1995	10.810	143.7	90.06	720	15.78	9.89	159.55	11.530
2000	21.222	350	92.93	1576	26.63	7.07	376.63	22798
2007	6140	110	76.41	1797	33.95	23.58	143.95	7937
2009	2511	55,11	73,85	781	19,51	26,15	74,62	3292

Source: TUIK, 2016

Change of Sheep and Lamb Meat Production According to Years

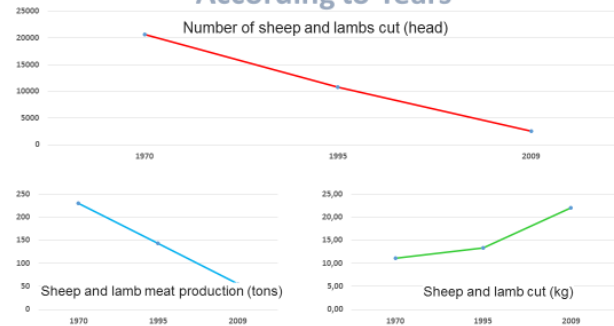


Figure 5. Sheep and Lamb meat production in Kastamonu province

Change of Goat and Kid Meat Production According to Years

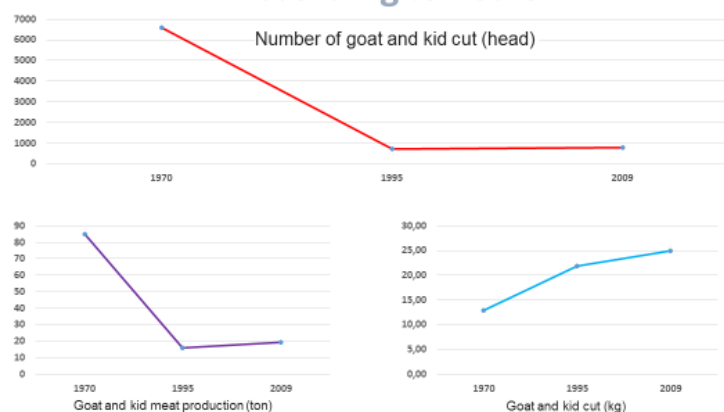


Figure 6. Goat and kid meat production in Kastamonu province

The year up to the place of production in the world with 3 thousand tons in 1988. Turkey annual lint production volumes in 2000 decreased to 421 tonnes, but Premium and Direct Support Payments (DRS) with applications in Turkey have been prevented Angora goat stop production. Despite the implementation of Premiums and Direct Support Payments, the decline in production continued after 2000. In 2008, an increase trend was entered again and this increase is continuing. By 2017, production was 356 tonnes and the total number of lint combs was 201 thousand. Until 1988, our country, which

is unrivalled in terms of raw mohair, mohair yarn and fabric production and export, has lost its reputation as an important producer country today (Table 5 and Figure 7).

Table 5. Wool, hair and mohair production in Kastamonu province by years

Wool, Hair And Mohair Production

Years	Wool (tonnes)	Hair (tonnes)	Mohair (tonnes)
1934/38	110	8	242
1950	167	16	367
1961	221	13	538
1965	230	20	450 (700*)
1970	195	15	265
1991	406.54	7.37	57.57
2000	202.87	9.72	16.16
2005	153.07	4.99	9.75
2010	106.52	5.10	3.08
2017	139.67	13.65	8.06

Source: TUIK, 2018

Change of Wool, Hair and Mohair Production According to Years

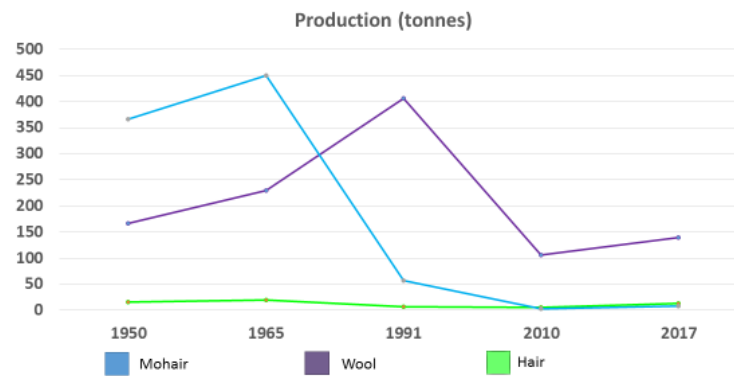


Figure 7. Wool, hair and mohair production in Kastamonu province

With the SWOT analysis method, the strengths, opportunities, weaknesses and threats of Kastamonu's small ruminant potential can be stated as follows:

Structural Properties of Small Ruminant Husbandry

STRENGTHS	WEAKNESSES
-Having a veterinary and animal health database	- Inadequate information on hygiene and sanitation
-The presence of adequate technical staff	- Limited budget opportunity in fight against illness and harm
- Membership in national and international organizations	- Problems occasionally encountered in the movement
- The possibility of using free veterinarians	- Inadequate legislation on welfare practices in farm animals
	- Inadequate management of waste management, control and storage
	- Not enough quarantine centers for smuggled animals

Source: Anonymous, 2008. www.teb.com.tr/docement/kastamonu;

Structural Properties of Small Ruminants Husbandry

OPPORTUNITIES	THREATS
-Developments in good agricultural practices or organic livestock	- Changes in the natural ecosystem
-The start of the expansion of the health insurance	- The level of education of the submitter is low
-The possession of a livestock potential	- Inadequate licensed animal markets
-Adequate number of veterinarians and clinics	- High input costs

Source: Anonymous, 2008. www.teb.com.tr/docement/kastamonu;

2.RESULTS AND DISCUSSION

Kastamonu has historical and natural riches in the Western Black Sea Region and has hosted many civilizations and is considered as one of the important areas of the region when it is considered as tourism industry and agriculture potential. The priorities and outputs of the district analysis studies and institution visits are as follows (İbret, 2004; İbret et al, 2015; Tüfekçi and Ofllaz, 2015)

Population and Migration Effects

The province of Kastamonu is a province with a province that is currently emigrating. However, from the provincial centre, it has been observed that immigration has taken place in recent years and some population has increased. The effects of the university, military and police schools in the city centre cannot be denied. When we look at the age structure of the province centre, it is seen that the ratio of young population is high. In terms of qualified labour force, insufficiencies are noteworthy. In line with the increasing population and profile, there is also an increase in need. The most important of these needs is the increase of social living spaces. Social cultural and sporting activities in these living spaces will enhance the quality of life.

Education

There is no problem in pre-school, first middle and high school level and in the number of teachers in the central district. However, diversification and quality of education services are needed. Especially for working mothers, re-planning of pre-school and primary education institutions according to working hours of their mothers seems important. In addition, the development of the facilities of the schools will increase the quality of education. At the level of university education, studies on development of socialization and social activities should be carried out.

Employment Development

Kastamonu Central District The most developed district in TR82. As it is in the region, migrants in the centre are one of the biggest problems with a resultant work force. The workforce flows into centres where employment opportunities are high. Therefore, precautions should be taken to develop job opportunities in the region. Activities that increase the capacity of people to do business and entrepreneurship will benefit. One of the important employment sources in the region is agriculture. Studies on agriculture should definitely be done. Measures should be taken to ensure the establishment of large agricultural enterprises in the region or to ensure the efficient functioning of agricultural units. It is also important that the agricultural industry is activated in the region.

Transportation Development

One of the key factors in the development of the zone is transportation. The development and diversification of transportation will be a pioneer in the development of the region. Kastamonu Center has Ankara, Sinop, Çankırı, İstanbul and other roads. As Kastamonu's geographical structure is mountainous and rough, there are some difficulties in road transportation. Kastamonu- Çankırı- Ankara road is a double road and the most difficult and problematic slip of the road is Ilgaz Mountain Passage. Due to the single lane of the road, there are some obstacles in transportation especially during winter season. Ilgaz Mountain tunnel studies have been started; It is clear that the transportation will be a great relief by finishing the project. Kastamonu-Çankırı-Ankara road and Kastamonu D-100 highway connection will become more active and functional. Kastamonu does not have any railway. In the following years, Karabük-Araç-Kastamonu railway connection can be realized and positive effect can be obtained in the development of the region.

Tourism

Kastamonu Central has great potential in terms of religious tourism. There are many historical mosques and tombs in the centre. Also Kastamonu Castle, Clock Tower, Cumhuriyet Square and Nasrullah Square are prominent tourist places. Because Kastamonu is one of the forests with high forests, there are many promenades and resting places. Kastamonu is home to centuries-old history and has hosted many civilizations, and thus has an important cultural heritage. Especially, it is very important to get the identity of the historical city with the works to be done in the city centre. Ancient arts tourism, sports tourism, winter tourism in Ilgaz mountains, traditional handicrafts, tourism incentives should be provided in the context of independence road. In addition, to increase the accommodation capacity 3 and the star-studded hotel should be particularly encouraged. Considering the proximity of the provincial center to Ankara and İstanbul, it can be considered a centre of attraction for congresses and meetings to be held in the coming years, considering the historical richness and natural beauties.

Industry

Kastamonu Headquarters is home to many national and internationally known industrial organizations operating in many sectors. There are also many companies that produce in the status of SMEs. Woodworking, furniture, food products, building materials, motor and chain production are produced in various fields. Incentives that increase the competitiveness of existing enterprises need to be provided. In addition, with the opening of the Ilgaz tunnel, there will be incentives for companies to be newly established when it is thought that the increases in industrial investments will come into play.

Agriculture and Animal Husbandry

One of the prominent sectors in the centre is the animal production involved in agricultural production. Studies should be carried out to increase production in the province, which is suitable for cattle and sheep breeding. Animal production should be promoted more professional and co-production. In animal husbandry, poultry production can be considered as an alternative. Especially poultry can be improved. Fruit farming should be promoted. In particular, the fruits suitable for the geographical structure and climate of the province can be detected and encouraged to produce. In the province of Kastamonu, people who are engaged in raising livestock can be encouraged to raise livestock with opportunities such as low average age level and low educational level, low interest loan of young population and free insurance by the state. The Breeding Sheep Goat Breeders Association can provide support for technical support, training seminars and breeder coach / goat breeding related to sheep breeding. In this way small cattle breeding can become made by the younger population. Cultivators should be placed under the consciousness that it is not possible for them to make profit without applying health protection, disinfection and vaccination in their animals. In order for producers to earn more, it is

necessary to work with high-yielding races as well as widespread domestic sheep and goat breeds. Encouraging milk type sheep and goat breeding can increase income levels of breeders. Problems faced by small-scale farmers in the sale of butchers can be solved by establishing meat producers and sellers.

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Recent Developments in Turkish Dairy Goat Farming

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Abstract: There are still 10.63 million goats in Turkey. Hair goats constitute approximately 98% of goat population. Goat farming in Turkey has been performed either within an agricultural facility or in form of village herd or migratory herd. However intensive organizations providing milk for the dairy farms producing cheese have performed their activities for the matter involved also in recent years. In Turkey, 523,395 tons milk produced from 4.96 million goats milked in 2017. Goat milk products produced generally for family consumption in rural area become wanted today upon the concentration of urbanization and developments in tourism. Firms processing the milks collected from goat farms in the integrated plants produce pasteurized milk, cheese, strained yoghurt and butter and put them into market. Furthermore some firms use goat milk in ice-cream production. Main purpose of this study is to analyze recent developments in goat milk production and marketing between 2008 and 2017 in Turkey. Statistical data have been obtained from FAOSTAT and TurkStat. Data obtained have been shown in the tables issued by the use of percentage and index calculations. If problems of farmers are solve by short- and long-term precautions in Turkey, dairy goat farming will make important contributions at regional and national level.

Keywords: dairy goat farming, small ruminant, goat milk, goat milk marketing, goat milk price.

1.INTRODUCTION

There are approximately 1.0 billion goats in the world and 15.3 million tons goat milk was produced in 2016. The share of Turkey in the world's goat population and goat milk production was 1.04% and 2.25%, respectively (FAOSTAT, 2018).

Goat breeding is a traditional animal breeding field performed generally in less developed and developing countries. The number of goats takes a considerable part in animal population in Turkey located at quite suitable conditions in terms of animal breeding considering its climate and field conditions. As a result of the increase in the demand for goat milk and related incentives in recent years the number of goats and production volume of goat milk has increased considerably in Turkey.

The goat milk and products produced mostly for family consumption in the rural areas (cheese, butter, yogurt etc.), have become increasingly important in urban areas thanks to their flavor, aroma and quality and they were begun to be sold in grocery stores with the healthy food choices of the consumers. Also the number of the firms that process the milk collected from the goat farms in the integrated plants increase day by day. The farmers, industrialists and consumers show more interest in the goat milk and products with the economic revaluation of the goat breeding and goat milk in the last era and they take into account the researches in this direction.

In recent years, many studies have been done on economics of goat farming in Turkey (Dellal et al., 2002; Tan and Dellal, 2004; Dellal and Dellal, 2005; Akturk et al., 2005; Dellal et al., 2008; Keskin et al., 2008; Paksoy and Ozcelik, 2008; Demircan et al., 2008; Akturk et al., 2009; Engindeniz and Ucar, 2014a; 2014b; Engindeniz and Ucar, 2016). Though, there is still need for study, especially in national level for determining the problems.

Main purpose of this study is to analyze recent developments in goat milk production and marketing between 2008 and 2017 in Turkey. Statistical data have been obtained from FAOSTAT and TurkStat. Data obtained have been shown in the tables issued by the use of percentage and index calculations.

Goat Population and Milk Production

There are still 10.63 million goats in Turkey (TurkStat, 2018). Hair goats constitute approximately 98% of goat population (Table 1). Other than Hair and Angora goats in Turkey comparatively a little number of Maltase goats and cross breeds and Kilis cross breeds have been produced respectively at Western Anatolia coastline and in Kilis and its vicinity. In the recent years, Saanen cross breeding have been observed to be developed in Aegean and Marmara Regions (Engindeniz and Ucar, 2016). In 2008-2017 period, Hair goats has increased 91.70% and Angora goat has increased 36.71%. Share of goats in the population of small ruminant was 25% in 2017.

Table 1. The numbers of goats in Turkey

Years	Hair goats (1000 heads) (1)	Angora goats (1000 heads) (2)	Total goats (1000 heads) (1+2)	Index (2008=100)	Share of goats in small ruminants (%)
2008	5,435	158	5,593	100.00	18.92
2009	4,981	147	5,128	91.69	19.08
2010	6,141	153	6,294	112.53	21.42
2011	7,127	151	7,278	130.13	22.53
2012	8,199	158	8,357	149.42	23.35
2013	9,059	166	9,225	164.94	23.96
2014	10,167	178	10,345	184.96	24.95
2015	10,210	206	10,416	186.23	24.84
2016	10,137	208	10,345	184.96	25.03
2017	10,419	216	10,635	190.15	24.00

Source: TurkStat (<http://www.tuik.gov.tr>).

In Turkey, 523,395 tons milk produced from 4.96 million goats milked in 2017. 99.39% and 0.61% of total goat milk have been produced from Hair goats and Angora goats, respectively (Table 2). Average milk productivity per milked animal in 2017 was 106.66 kg for Hair goats and 37.18 kg for Angora goats, respectively.

Table 2. Developments in goat milk production of Turkey

Years	Number of animals milked (1000 heads)			Milk production (tons)				Share of goat milk in total milk production
	Hair goats	Angora goats	Total goats	Hair goats	Angora goats	Total goats	Index (2006=100)	
2008	1,937	60	1,997	207,385	2,185	209,570	100.00	1.71
2009	1,778	52	1,830	190,286	1,924	192,210	91.72	1.40
2010	2,516	66	2,582	270,476	2,335	272,811	130.18	2.01
2011	2,968	65	3,033	318,273	2,315	320,588	152.97	2.13
2012	3,440	63	3,503	367,208	2,221	369,429	176.28	2.17
2013	3,878	65	3,943	413,444	2,299	415,743	198.38	2.28
2014	4,322	78	4,400	460,518	2,752	463,270	221.06	2.49
2015	4,484	95	4,579	477,824	3,350	481,174	229.60	2.58
2016	4,466	89	4,555	476,234	3,167	479,401	228.75	2.59
2017	4,877	86	4,963	520,197	3,198	523,395	249.75	2.53

Source: TurkStat (<http://www.tuik.gov.tr>).

There is no any data on web pages of FAOSTAT and TurkStat related to production of other goat milk products (goat butter, goat yoghurt) in Turkey. In 2014, 523,040 tons goat cheese has been produced in the world. Turkey takes 0.01% share in the world with its production of 73 tons. Production of goat cheese in Turkey has increased 40.38% between 2008 and 2014 (FAOSTAT, 2018).

According to results of a study done in provinces of Balıkesir, Çanakkale and İzmir of Turkey, pasture-based feeding is performed in the farms. Additionally, in the farms, averagely 132.37 kg of roughage and 40.03 kg grain feed is given per animal. The feed cost per animal is calculated as €33.14. In the farms, the average unit goat milk cost is determined as 0.30 € kg⁻¹. When the feed support and milk incentive premium are not considered, the unit cost is determined as 0.39 € kg⁻¹ (Engindeniz et al., 2015).

Government Supports for Goat Farming

Turkish Ministry of Food, Agriculture and Livestock (TMFAL) took various precautions for solving the problems and for developing dairy goat farming in recent years. Government supports have been applied in 2017 pursuant to the decree no. 2017/10465 taken by the Council of Ministers. These supports were; 6.08 € per animal for bred goats, 0.12 € per animal for Alum and Brucellosis vaccine, 19.46 € per animal in ovine breeding for protection (Table 3). But, the farmers who farming goats must be a member of the Unions of Goat and Sheep Breeders for receiving these supports.

Table 3. Government supports for goat farming in Turkey (2017)

Supports	Unit Support Amount
Clover (dry farming)	97 €/ha
Forage Clover (irrigated farming), trefoil	146 €/ha
crops Corn silage (dry farming), annual crops	97 €/ha
supports Corn silage (irrigated farming)	219 €/ha
Artificial meadow pasture	146 €/ha
Shepherd support (≥ 250 head)	1,217 €
Animal protection support	20 €/head
Bred goats support	6 €/head
Animal waste support (after vaccine)	30 €/head
Alum vaccine support	0.12 €/head
Brucellosis vaccine support	0.12 €/head
Support of animal improvement by the public	10-17 €/head

Source: Turkish Ministry of Food, Agriculture and Livestock (<http://www.tarim.gov.tr>).

Further, interests are subsidized for the livestock sector in the credits given to Agriculture Sector by the Republic of Turkey, Turkish Agricultural Bank and Agricultural Credit Cooperatives and interest free credit application has started to be implemented (Notification 2017/15). Low interest low for goat farmers are limited with ≥ 25 head.

Goat Milk Marketing

Farmers are dependent on the purchasers fully and unilaterally in the marketing of products. Most important reason of it is the lack of governmental support to this part as well as unorganized state of farmers (Kaymakci and Engindeniz, 2010). A great part of the milk produced from goats is consumed within the body of organization. Remaining part is marketed as raw product in dairy farms or processed in cheese and sold to the purchasers in local markets.

According to the data TurkStat the goat milk price obtained by farmers in Turkey are 0.51 €/kg in 2008, 0.66 €/kg in 2012, 0.68 €/kg in 2016, 0.61 €/kg in 2017, respectively. Changing of milk prices obtained by farmers in Turkey was presented Table 4.

Table 4. Average milk prices received by farmers in Turkey

Years	Goat milk (€/kg)	Sheep milk (€/kg)	Cow milk (€/kg)
2008	0.51	0.49	0.37
2009	0.53	0.55	0.37
2010	0.66	0.63	0.44
2011	0.59	0.57	0.33
2012	0.66	0.63	0.38
2013	0.56	0.58	0.32
2014	0.60	0.64	0.37
2015	0.63	0.67	0.39
2016	0.68	0.67	0.34
2017	0.61	0.59	0.30

Source: TurkStat (<http://www.tuik.gov.tr>).

According to results of a study done in provinces of Balıkesir, Çanakkale and İzmir of Turkey, farmers market 85.38% of goat milk to firms that process goat milk. 10.76% of goat milk is marketed to cooperative and other farmer unions. 3.86% of goat milk is marketed as retail in farm and local markets (Engindeniz et al., 2015).

Total production value of goats (534.9 million €) in Turkey formed 3.14% of total animal production value in 2017. Further, goat milk production value was 56.32% of total production value of goats (Table 5).

Table 5. Obtained production value from Goats in Turkey

Products	2016		2017	
	Production Value (1000 €)	%	Production Value (1000 €)	%
Goat milk	112,471	41.06	301,268	56.32
Goat meat	156,788	57.24	229,096	42.82
Goat hide	2,841	1.04	2,396	0.45
Goat hair and mohair	1,826	0.66	2,201	0.41
Total	273,926	100.00	534,961	100.00

Source: TurkStat (<http://www.tuik.gov.tr>).

Today production of special and quality goat cheese from goat milk is handled seriously by European countries and related production is performed commonly in first France and Spain, Italy, and Greece. Such kind of products may be produced in Turkey with similar conditions and economically considerable earnings may be obtained. Considering the aspects of Turkey regarding agriculture and animal breeding milked goat and production of goat milk are known to have a great potential as in Mediterranean countries. But cheese range manufactured commercially and its quantity are true to be low and insufficient in number and quantity. A great part of traditional cheese specific for locations and regions has continued to be produced and sold therein (Kaymakci and Engindeniz, 2010).

Problems of Goat Farming

There are technical and economic problems of goat farming in Turkey. Technical problems; Information inadequacy of farmers for feeding and preparing feed ratio, Ineffectiveness of farmers for control disease of animals, low output of domestic genotypes, inadequacy of animal breeding and obtain of stud goats projects, decrease and degeneracy of pastures, inadequacy of extension facilities in rural area, difficulties related to obtain of herdsman, problems related to animal welfare, measures for goat-forest relations and inadequacy of animal insurance practices. Economic problems; inadequacy of farmer organizations, difficulties of access to government support, problems related to goat milk marketing, price fluctuations of goat milk, problems related to goat milk production by contract, high feed prices, low demand for goat milk and meat, limited demand of firms that process goat milk, illegal live goat entrance to Turkey (Engindeniz et al., 2015, Engindeniz and Ucar, 2016).

2.CONCLUSION

In Turkey, goat breeding not only constitutes the main means of living for low-income farms situated in forests, forest and mountain villages where climatic and geographical conditions are not favorable, but it is also increasing since, it also ensures better use of production sources in low land villages where per animal production is higher. While, goat breeding in forest and mountain villages are composed of low genotype goats, those breeding in low land villages are composed of high genotype goats and thus, their milk production is high.

If problems of farmers are solve by short- and long-term precautions in Turkey, goat farming will make important contributions at regional and national level. Firstly, goat farming in Turkey should be supported directly and indirectly in accordance with EU standards. Effective training systems should be set up for farmers. Animal registration systems and databases should be enhancement. Input costs in goat farming should be decreased. Further, a cooperative model should be prepared based on horizontal and vertical integration within the period from the production of goat products to consumption by consumers. Cooperatives will be determinative in not only production stage but also in processing and marketing the products.

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An Overview Some Metabolic Diseases and Fertility Disorders in Organic Dairy Herds

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Abstract: The basis of organic dairy production is the maintenance of animal health and welfare because of organic system minimising the use of chemical inputs including veterinary medicines. Therefore, some metabolic diseases and fertility disorders in organic dairy herds were reviewed in this paper. Mastitis, fertility problems and milk production may be the common reasons for culling in organic herds. Mastitis, causing losses in milk production and premature culling of dairy cows, is the one of the diseases occurring after inflammation of the mammary glands and routinely treated with antibiotics because bacterial infections play the role in the etiology of mastitis. Generally, mastitis in dairy herds may not be completely prevented, but its severity and economical losses can be decreased. For this reason, it is advised **do everything possible to prevent mastitis and reduce its incidence**. Fertility disorders in organic dairy herd are also important because an appropriate and effective reproductive program is necessary to the financial input of the dairy farms. Milk yield, breeding season and service can affect on reproductive performance of organic dairy herds. Artificial hormones for breeding or solving reproductive problems can not be used in organic dairy farms. Therefore, the good observation of estrus behaviours and signs, and natural alternative treatments to keep the pregnancy rate high must be applied. Infertility affects on productivity and causes culling of cows in organic dairy herds. However, retention secundinarium, endometritis and abortion can be resulted in fertility disorders. Laminitis is non-infectious inflammation of the foot. Some digestive disorders such as acidosis, changes in the gastrointestinal bacterial flora etc. predisposes cows to laminitis. The effect of a relatively high forage diet may decrease the incidence of hoof problems in organic herds. On the other hand, organic housing and animal welfare such as dry bedding, low stock density, forage-based diet can promote good foot and hoof health. Organic production standards require that the total diets of dairy cows have roughages at least 60%, thus there is a lower risk for laminitis in organic herds. In general, a low milk yields in organic herds compared to conventional herds may not be a risk in early lactation for some metabolic diseases such as milk fever and ketosis because cows may not suffer from energy or nutrient deficiency. It can be stated that a high animal welfare status and organic production standards in organic production make it possible for prevention from some metabolic diseases such as acidosis, laminitis, milk fever, ketosis.

Keywords: Organic dairy production, metabolic diseases, fertility.

1.INTRODUCTION

Metabolism is the sum of all physical, chemical, and metabolic processes occurring in the cells associated with absorbance, breakdown or synthesis of necessary organic molecules in dairy cows. During metabolism, energy is extracted from nutrients and used for maintenance and production. Dysfunction of one or multiple metabolic process is resulted in irregularity of a certain metabolite in the body fluids, and this situation is named as metabolic disease or disorder. Metabolic disorders of dairy cows generally affect them immediately after parturition. Therefore, these disorders may also be called metabolic disease, and are related to the disturbance of one or multiple blood metabolites in sick cows.

Organic milk production is a system which minimises the use of chemical inputs including veterinary medicines. The milk obtained from organic herds grown under a high animal welfare status and the cows are kept into a larger housing area which includes outdoor access and fed organically produced concentrates and roughages, that is, the maintenance of animal health and welfare are the basis of organic production. In this paper, some metabolic diseases and fertility disorders in organic dairy herds were reviewed.

Mastitis

Mastitis is the one of the diseases which occurs after inflammation of the mammary glands. Mastitis routinely treated with antibiotics because bacterial infections play the role in the etiology of mastitis. Mastitis may be an important problem in health management of organic dairy herds. The mastitis infections are **painful for the cows**. Generally, mastitis in dairy herds may not be completely prevented, but its severity and economical losses can be decreased. Mastitis causes **losses in milk production** and premature culling of dairy cows. Furthermore, **mastitis treatment is highly cost** and often **inefficient**. For this reason, it is advised **do everything possible to prevent mastitis and reduce its incidence**.

Somatic cell count is an indirect indicator of udder health and mastitis (Haskell, 2009). Somatic cell count is measured individually or the bulk tank. Some researchers reported that somatic cell count in milk obtained from organic herds were similar (Valle et al., 2007; Haskell, 2009) or higher (Roesch, 2007) than that of conventional dairy herds.

In New Zealand in which organic and non-organic herds were investigated side by side, bulk milk somatic cell count was higher in the organic herd initially however the opposite was found in subsequent seasons (Thatcher et al., 2010), and it was also reported that the importance of the management on organic farms for somatic cell count in milk. However, it can be mentioned that this result is a little bit coincided with the management on dairy farms focusing on maximise milk yield.

Vaarst and Bennedsgaard (2001) also reported that there were no differences in the mastitis incidence or somatic cell count between 27 organic and 57 conventional dairy herds. However, Hardeng and Edge (2001) stated the incidence of mastitis was lower in organic than in conventional herds although there were no differences in the milk somatic cell count. Subclinical mastitis characterized by high milk somatic cell count is more common in organic dairy herds than in conventional herds (Hovi et al., 2003). Mullen et al. (2015) reported that there was no difference in somatic cell count between organic and conventional herds. The number of clinical mastitis case reports in organic dairy herds was often lower (Valle et al., 2007) than that of conventional dairy herds. Silva et al. (2014) stated that the incidence of mastitis in cows was higher in conventional dairy herds than in the organic dairy herds, and a higher milk production in conventional dairy herds caused the greater mastitis incidence. Management such as cow genetics, feeding regimes, herd size, age and milk yield (Fall et al., 2008; Langford et al., 2009) may be the reasons for such differences.

Fertility Disorders

A appropriate and effective reproductive program is necessary to the financial input of the dairy farms. The main goals of dairy farms are that pregnancy should be ensured in appropriate time after calving to remain daily milk production high, and new heifers or calves which are available for replacements or sale. Reproduction may be negatively affected by poor nutrition, mishandling of semen and insemination technique, diseases, and stress. Reproductive performance of organic dairy herds may be different from conventional dairy herds because of milk yield, breeding season and service. Artificial hormones for breeding or solving reproductive problems can not be used in organic dairy farms. Therefore, the good observation of estrus behaviours and signs, and natural alternative treatments to keep the pregnancy rate high must be applied. Infertility affects on productivity and causes culling of cows in both organic and conventional dairy herds (Marley et al., 2010). Some cases such as retentio secundinarium, endometritis and abortion (Weller and Bowling, 2000) can be resulted in fertility problems. Hamilton et al. (2006) and Valle et al. (2007) stated that there was lower retained placenta incidence in organic dairy herds than in conventional dairy herds. Rozzi et al. (2007) stated that fertility, mastitis and milk production were the common reasons for culling in organic herds in Canada. Hamilton et al. (2006) repoted that the culling rate because of mastitis was similar in 26 organic herds and 1,102 non organic. Sundberg et al. (2009) reported that there was a higher somatic cell count in milk obtained from organic herds, while fertility was lower in non organic herds. Mullen et al. (2015) stated that cystic ovaries, laminitis, metritis, retained placenta incidences were low in both organic and non-organic herds and organic herd could be compotitive with a conventional herd for reproduction and cow health within a pasture-based system.

Laminitis

Laminitis is non-infectious inflammation of the foot. The reasons of laminitis are multiple and interrelated. For instance, digestive disorder (acidosis, changes in the gastrointestinal bacterial flora etc) predisposes cows to laminitis. Trace minerals such as copper, zinc and vitamins (particularly A, E, biotin) and beta carotene are necessary for healthy hoof growth. Laminitis is a serious health risk for dairy cows. Laminitis causes limitations to productivity, health, welfare of dairy cows, and economical losses. Hamilton et al. (2002) reported that the incidence of laminitis was not different between organic and non-organic dairy herds. Rutherford et al. (2008) and (2009) stated that laminitis incidence and hock lesions was lower in organic than in non-organic herds. A longer summer grazing period (Rutherford et al., 2009) and the effect of a relatively high forage diet may cause a lower incidence of hoof problems in organic herds compared to conventional herds. On the other hand, organic housing and animal welfare such as dry bedding, low stock density, forage-based diet can promote good foot and hoof health. Organic production standards require that the total diets of dairy cows have roughages at least 60%, thus there is a lower risk for laminitis in organic herds.

Milk Fever

Dairy cows affected subclinical hypocalcemia do not show any clinical symptoms but usually have a low blood calcium concentration within 24 h after parturition. Excitability, nervousness and shuffling of hind feet (the cow is still able to stand) are early clinical symptoms of milk fever. Hamilton et al. (2002) reported that milk fever incidence which was caused by calcium deficiency because of regular milking were similar in both organic and conventional herds in Sweden, although the incidence was lower in organic herds than that of conventional herds in Norway (Hardeng and Edge, 2001; Valle et al., 2007).

Ketosis

Organic production standards require that the diets of dairy cows in organic systems have a relatively greater level of roughage but lower concentrate compared to conventional systems (Marley et al., 2010). There is a lower risk of metabolic diseases such as milk fever, ketosis in organic herds than those in non organic herds because of the differences in diet combinations. However, organic dairy cows generally have lower milk production than the cows in comparable non organic dairy cows. Because of relatively low milk yields, metabolic disorders may not be a risk in early lactation and consequently, dairy cows may not suffer from energy or nutrient deficiency.

Ketosis in dairy cows is appeared by following the accumulation of large quantities of ketone bodies in blood and tissue which cause metabolic acidosis and neurological symptoms. Rutherford et al. (2009) stated that there was a tendency for more cows in organic herds to have subclinical ketosis compared to conventional herds in the United Kingdom. However, Valle et al. (2007) reported that cows in organic herds were treated for ketosis less regularly than those in non-organic herds in Norway. It is a possible explanation for the lower ketosis incidence in organic herds due to relatively lower milk yields.

2.CONCLUSION

In general, a low milk yields in organic herds compared to conventional herds may not be a risk in early lactation for some metabolic diseases such as milk fever and ketosis because cows may not suffer from energy or nutrient deficiency. a high animal welfare status and organic production standards in organic production make it possible for prevention from some metabolic diseases such as acidosis, laminitis, milk fever, ketosis. Therefore, providing adequate nutrients (energy, protein, minerals, vitamins etc) in diets for individual requirement of dairy cows, reducing stress, avoiding sudden changes in feeding, housing, movement, ensuring adequate and appropriate housing or shelter as required, selecting appropriate breeds play key role in prevention from metabolic disorders. It can be stated that

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Additions to the Knowledge of Injurious Mites Living on Garlic in Kastamonu/TURKEY

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Abstract: Garlic is the one of the most important agriculture crops because it is specially tolerant to against climate conditions at production stage, it is suitable for export because it's head parts are big and high quality and it characterize to area as "Taşköprü garlic". Selenium element is a chemical material that is cancer inhibitor and risk dedactive. It exist only in Taşköprü garlic and not the garlics that product at other areas. Taşköprü is the richest cultivar in terms of compound elements, minerals and vitamins. It can be maintained at normal storage condition for 10-11 months without need for cold storage and weight loss of more than 33-37% of dry matter content. Garlic production is one of the very important agricultural products in Kastamonu, Turkey. Taşköprü is the the largest produced area in Kastamonu (85-90%). Pests and diseases are playing an important role in the garlic production, depending on these effects crop losses may up to 50% from 10%. This loss sometimes reach 100% depending on crop plants, species and density of the pest. Mites causes largely the product and yield loss. Detail and comprehensive studies that targeted directly harmful garlic mites in the world and our country are not negligible. Most of the studies is aims to determine the mites of onion and ornamental plants and It is reported to mites cause major problems. In this study, field sampling were conducted for the purpose of identifying most harmful mite species and their distribution and population density in the garlic cultivation areas that are placed in Taşköprü, Hanönü and Merkez Districts in Kastamonu Province in 2014-2015 . When the densities of species that have been identified from samples collected in field surveys were evaluated, identified that *Rhizoglyphus robini* is the most common species with a frequency of 58.82%. *R. robini* was reached the highest density value in Hanönü district. Other than *R. robini*, *Tyrophagus putrescentia* (Schränk) and *Histioglyphus feroniorum* (Kramer) were identified intensely. In this study, 8 species from Acaridae, 2 species from Glycyphagidae, 3 species from Tetranychidae, 2 species from Tarsonemidae and one species from Eriophyidae totally 16 plant parasitic mite were determined. So plant the Turkish fauna of plant parasitic mites on garlic were put forth first time The density of the harmful mite species that were identified were given on family and genus level according to localities.

Keywords: Plant parasitic mites, Garlic, Acari, Taşköprü, Turkey

1.INTRODUCTION

Garlic is the one of the most important agriculture crops because it is specially tolerant to against climate conditions at production stage, it is suitable for export because it's head parts are big and high quality and it characterize to area as "Taşköprü garlic". Selenium element is a chemical material that is cancer inhibitor and risk dedactive. It exist only in Taşköprü garlic and not the garlics that product at other areas. Taşköprü is the richest cultivar in terms of compound elements, minerals and vitamins. It can be maintained at normal storage condition for 10-11 months without need for cold storage and weight loss of more than 33-37% of dry matter content. Garlic production is one of the very important agricultural products in Kastamonu, Turkey. Taşköprü is the the largest produced area in Kastamonu (85-90%) Kılıç *et al.* 2012).

According to United Nations Food and Agricultural Organization, 24.3 million metric tons of garlic were grown worldwide in 2013 (FAO 2015). Nearly 80% of this global production was from China, while India, South Korea, Egypt, and Russia follow China as the top five countries in production of garlic (FAO 2015).

Garlic is an important crop in Turkey, where over 87.000 tons are produced annually; which accounted for 0.36% of the total world production in 2013 (FAO 2015). The greatest production area in Turkey is in Taşköprü Province, especially near the city of Kastamonu (25.2% of total production in Turkey). Taşköprü garlic is recognized as one of the best garlic varieties in Turkey and the rest of the world. In 2012, there were 18.500 ha of Taşköprü garlic with total production of 16.650 tons and yields of 900 kg/ha (Anonymous 2012). In Taşköprü Province, 3.500 families (about 40.000 people) are employed in garlic production. In Kastamonu, mainly Taşköprü garlic is grown, but there are 216 kinds of local garlic cultivars, including some Chinese varieties, that are grown.

Pests and diseases are playing an important role in the garlic production, depending on these effects crop losses may up to 50% from 10%. This loss sometimes reaches 100% depending on crop plants, species and density of the pest. Mites causes largely the product and yield loss. Detail and comprehensive studies that targeted directly harmful garlic mites in the world and our country are not negligible. Most of the studies is aims to determine the mites of onion and ornamental

plants and It is reported to mites cause major problems (Chen and Lo, 1989, Madanlar ve Önder 1996, Diaz *et al.* 2000, Straub 2004, Bayram ve Çobanoğlu 2006, Göven *et al.* 2009, Kılıç 2010, Denizhan 2012, Kılıç *et al.* 2012).

In this study, field sampling were conducted for the purpose of identifying most harmful mite species and their distribution and population density in the garlic cultivation areas that are placed in Taşköprü, Hanönü and Merkez Districts in Kastamonu Province in 2014-2015 .

2.MATERIALS AND METHODS

This study was realized with the weekly sampling were made on garlic cultivation areas in Taşköprü, Hanönü and Central Districts of Kastamonu Province in 2015-2016. Between 2014 and 2016 (April-July) the samples were made weekly. In the samplings of head and green parts was taken with 5 garlic plants together roots from each field. After the samples were brought to the laboratory, garlic samples were cut off with the help of a knife so they were separated from head and leaves each other and put into the Berlese hunters for extraction. The samples of green parts were examined under microscope with the aim of detecting live mites before extraction. After extraction of the samples, their diagnostics were realized. The mite families of phytophagous and its distibution according to disctrics were determined.

3.RESULTS AND DISCUSSION

In the study, 931 samples were taken from 57 points, including 30 villages from Taşköprü, 14 from Hanönü and 13 from the Central District. In 867 of the specimens, mites were determined and the drainer rate of mite was determined as 93,13%. A total of 58 useful and harmful mite species belonging to 25 families and 39 genus were identified from head, green parts, weed and storage samples of garlic. 15 (25.86%) of these species were harmful and 43 (71.14%) of them were useful, saprophagous and neutral (Table 1).

Table 1. Phytophagous mite species that were determined in garlic cultivation areas of Kastamonu

Family	Harmfull Mite Species	Family	Harmfull Mite Species
Acaridae	<i>Tyrophagus putrescentiae</i> (Schränk)	Glycyphagidae	<i>Glycyphagus destructor</i> (Schränk)
	<i>Rhizoglyphus robini</i> (Clarapede)		<i>Glycyphagus domesticus</i> (De Geer)
	<i>Tyrophagus perniciosus</i> (Zakhvatkin)	Tetranychidae	<i>Tetranychus urticae</i> (Koch)
	<i>Acarus immobilis</i> (Griffiths)		<i>Bryobia rubrioculus</i> (Scheuten)
	<i>Tyrophagus neiswanderi</i> (Johnstone & Bruce)		<i>Bryobia kissophila</i> (Eynndh.)
	<i>Tyrophagus similis</i> (Volgin)	Eriophyidae	<i>Aceria tulipae</i> (Keifer)
	<i>Rhizoglyphus callae</i> (Oudemans)	Tarsonemidae	<i>Tarsonemus waitei</i> (Banks)
	<i>Caloglyphus berlesei</i> (Michael)		<i>Tarsonemus</i> sp.

Mites were determined on head samples in the most recentThe most intensive family was Acaridae in surveys (38.95%) (Fig 1).

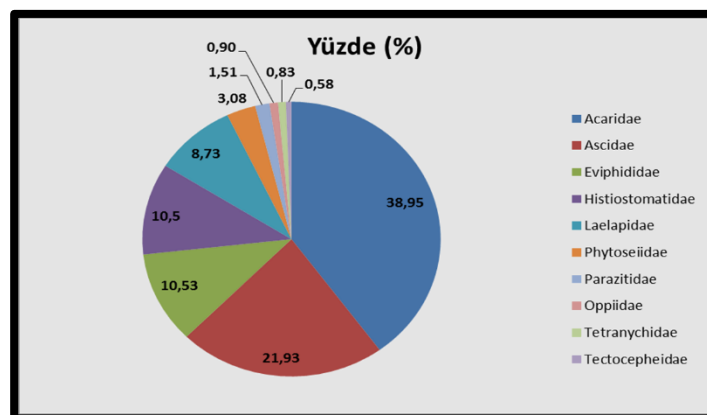


Figure 1. Distribution of mites that were determined in surface surveys in garlic cultivation areas of Kastamonu according to family

Mesostigmata species were found to be the most common in the land surveys. Astigmata with a high ratio of 64.33% in storage surveys and Mesostigmata team members with 77.06% in weed specimens were determined intensively (Fig 2.).

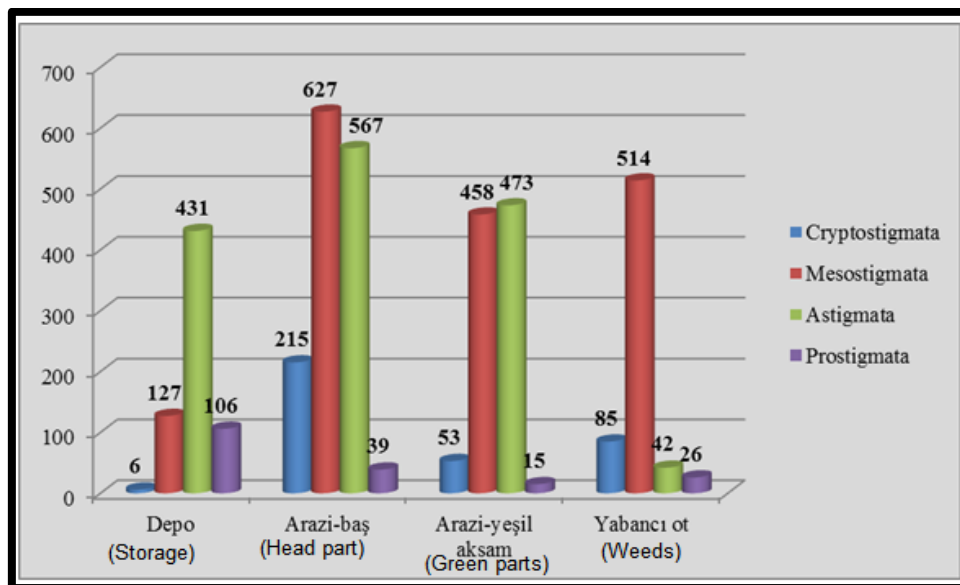


Figure 2. Number of species that were determined in land (head, green parts and weeds) and storage surveys on Kastamonu garlic areas

When the mite densities obtained from land, storage surveys and weed samples are evaluated, a total of 3,784 mites were determined at 2,947 (77.90%) Taşköprü, 680 (17.97%) Hanönü and 157 (4.15%) Merkez districts (Fig 3).

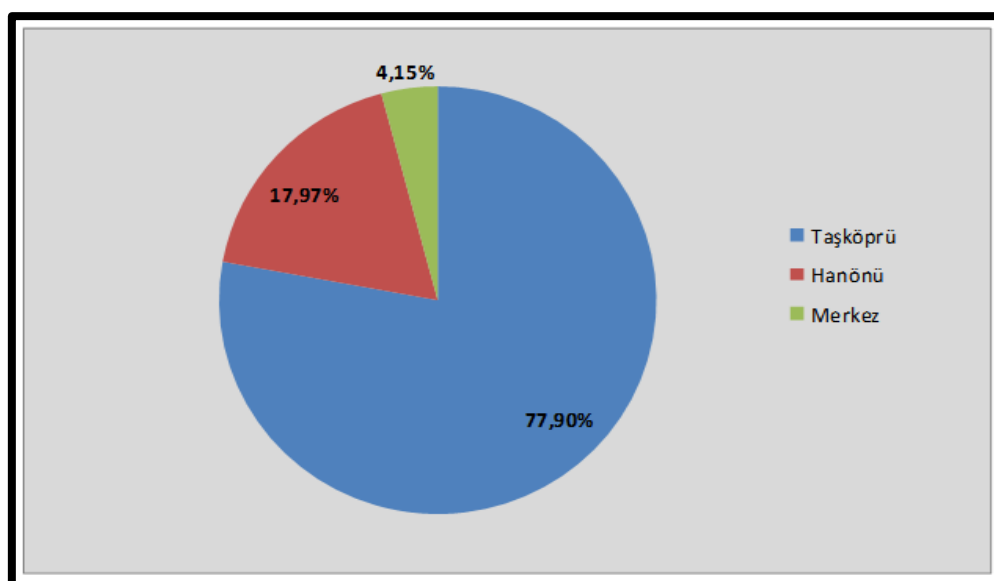


Figure 3. Percentage distribution of mites that determined in surveys on garlic cultivation areas of Kastamonu according to the districts

In our study, the most important harmful genus were determined as *Rhizoglyphus* and *Tyrophagus*. *R. robini* is the most intense harmful mite species (Table 2).

Table 2. Density of mite species that were determined in Kastamonu Garlic areas according to the districts

Species	Density according to the districts (%)		
	Taşköprü	Hanönü	Merkez
Harmfull mite species			
<i>Rhizoglyphus robini</i> (Clarapede)	24.12 (1)	20.63 (1)	25.86 (2)
<i>Histioglyphus feroniarum</i> (Kramer)	9.90 (2)	13.75 (2)	19.31 (1)
<i>Tyrophagus putrescentiae</i> (Schränk)	6.71 (3)	3.35	5.17 (3)
<i>Tyrophagus perniciosus</i> (Zakhvatkin)	3.98	5.20 (3)	-
<i>Acarus immobilis</i> (Griffiths)	2.77	-	-
<i>Tetranychus urticae</i> (Koch)	0.88	0.19	-
<i>Glycyphagus destructor</i> (Schränk)	0.34	-	-
<i>Tyrophagus neiswanderi</i> (Johnstone&Bruce)	0.17	-	-
<i>Bryobia rubrioculus</i> (Scheuten)	0.04	-	-

Within the scope of the study, harmful mite fauna was determined for the first time in garlic in Turkey and biodiversity and distribution of mite were determined. The concentrations of harmful mite populations in garlic have been determined for the first time.

Some mite species harmful to garlic are vectors, especially carrying some virus diseases, the basic data on fighting against virus diseases have been obtained with the identification of mite species that are likely to be vectors in our study.

It is very important to study garlic mite problems especially considering the importance of garlic for health and exporting values. For protecting natural enemies and sustainable growing it is important the training of the farmers for using less chemicals.

The richness of the bio-diversity of the garlic growing areas depends on the Natural enemies or beneficial mite fauna then the phytophagous mite species. The biological diversity is very rich for the predatory mites for the weed plants

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Marketing Structure of Fresh Fruit and Vegetable in Turkey

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Abstract: Turkey has a very high level of fruit and vegetable production potential due to its climate and soil characteristics. Processed agricultural land in the world and in our country is limited and it is caused that adequate and balanced nutrition problems of the rapidly increasing world population. Production and consumption of fruit and vegetables should be extended for the solution the problems of balanced nutrition. When comparing Turkey with many countries of the world, fruit and vegetables are produced almost every seasons and in every region in Turkey. According to Turkey Statistical Institute, total fruit and vegetable productions in Turkey in 2016 were realized as 49.2 million tons, 30.2 million tons from vegetable production and 19 million tons of fruit production were obtained. Turkey also has an important position in the foreign trade as well as its fresh fruit and vegetables production potential. Turkey exported 6.9 million tons of fresh fruit and vegetables in 2016. Provided income from the total fruit and vegetable exports was 1.9 billion dollars.

However there are a number of problems in the fresh fruit and vegetable marketing in Turkey where has high production capacity and many fruits and vegetables. This situation affects the development of the processed fruit and vegetable industry and producer and consumer prices. Due to undeveloped marketing structure and the high number of vehicle, producer income is reduced and the marketing margin is increased. Farmers need to be organized, especially in marketing. In this study, it is aimed to examine fruit and vegetable marketing structure and marketing problems in Turkey.

Keywords: fruit, marketing, marketing margin, vegetable, horticulture.

1. INTRODUCTION

The production of fresh fruit and vegetable is an important sector in Turkish agriculture and the national economy. 25% of total population involves in agriculture sector. Turkish fresh fruit and vegetable sub-sector has an important role because of employment capacity. Approximately 5 million people work in that sector at the various level such as production, processing and marketing area.

On the other hand, fruit and vegetables sector is an important supply sector for processing and export industry, on the other hand, it is an important demand sector for fertilizer, feed, pesticides, fuel and electricity inputs.

The limited field of processed agricultural purposes in the world and Turkey is caused to adequate and balanced nutrition problems. Production and consumption of fruits and vegetables is of great importance for the solution of balanced nutrition problems. Turkey is quite an important country for fresh fruit and vegetable production location in terms of its' geographical location, climate and soil properties. Almost every season and in every region of fruit and vegetable production is concerned in Turkey. However, certain regions are taking more interest in producing these products. For example, the Mediterranean and the Aegean region of Turkey produce 54% of the total fruit production and they produce %49 of the total vegetables production (Akbay et al, 2005).

Fresh fruit and vegetables are important in marketing as production, market structure varies depending on the product and country. Fresh fruits and vegetables can be delivered directly to the consumer. The lack of strong producer organizations increase loyalty to the vehicle and increasing the number of agents increased marketing margin. And also, agricultural production potential in Turkey is not yet being fully used and it contains elements that are slowing the development of the marketing system. It is possible to be given a stronger industry's structure making improvements on stages of production, processing and marketing (Yurdakul et al., 2015).

In this study the structure of fresh fruit and vegetables marketing in Turkey will examine and try to make proposals will reduce the marketing margin.

Supply of Fresh Fruit and Vegetable

The amount of fresh fruit and vegetable production in Turkey was 49.2 million tons in 2016. When examining the total production of fresh fruit and vegetables, it is observed that vegetable production receives the highest share. Total production of these crops generally are more than every individual European country. But in some crops, production is less than that of European countries production, such as olive production in Spain.

In Turkey share of the amount of vegetable production have received in total amount of fresh fruit and vegetable production said to be between 33-35%. Referring to the following table, the share of fruit production is seen to be between 35-39%. The share of fruit and vegetables production have not changed much in the current year (Table 1).

Table 1. Fresh Fruit and Vegetable Production

Years	Vegetables Production (mt)	Vegetables Production (%)	Fruit Production (mt)	Fruit Production (%100)	Total Production (mt)	Total Production (%)
2010	25.997.195	65	13.950.034	35	39.947.229	100
2011	27.547.462	66	14.388.128	34	41.935.590	100
2012	27.820.207	65	14.891.130	35	42.711.337	100
2013	28.448.218	65	15.326.786	35	43.775.004	100
2014	28.569.781	67	14.298.402	33	42.868.183	100

Source: Turkish Statistical Institute, 2015

Foreign Trade of Horticulture Products in Turkey

Turkey fresh fruit and vegetable exports as of 2016 is 1,9 billion \$. This constitutes 76% of the fruit and vegetables 24% (Table 2)

Table 2. Fresh Fruit and Vegetable Exports in Turkey (000 \$)

Item	2014	2016
Fresh Fruit	1.662.658.799	1.481.647,3
Fresh Vegetable	710.183.663	463.348,1
Total	2.393.534.500	1.944.995,4

Source: Turkish Statistical Institute, 2015

When January-June 2015 exports of fresh fruits and vegetables (according to FOB value) is analyzed, it is seen that the rate of decline of -18% and tomato is the first with 281.3 million dollars in export value. Respectively, lemon, orange, cherry, sour cherry and mandarin followed by. Decreases of tomatoes, oranges, cherries cherry and mandarin group have caused to of decline in the rate of -13% in exports in January-June period.

Table 3. Turkey Fresh Fruit and Vegetable Exports

PRODUCT GROUP	01.01-30.06.2014		01.01-30.06.2015		Increase Decrease (%)		2015 (%)
	KG	FOB USD	KG	FOB USD	KG	FOB USD	
TOMATO	469.036.468	344.793.163	384.970.435	281.366.606	-18	-18	28
LEMON	171.607.971	114.159.820	223.892.659	128.656.963	30	13	13
ORANGE	204.169.757	114.173.878	165.359.602	84.622.865	-19	-26	9
CHERRY	30.946.598	99.357.431	34.777.105	69.799.401	12	-30	7
MANDARIN	132.520.721	77.952.268	109.583.299	59.450.237	-17	-24	6
PEPPER	54.281.818	53.112.206	59.654.913	50.652.592	10	-5	5
GRAPEFRUIT	120.412.703	62.415.433	88.191.322	42.712.743	-27	-32	4
APPLE	83.876.273	28.372.924	96.929.145	33.845.049	16	19	3
NAR	46.703.621	31.963.039	53.660.561	31.684.799	15	-1	3
APRICOT	22.169.535	21.958.809	47.026.625	29.163.979	112	33	3

Source: Uludag Exporters Association General Secretariat, 2015

Table 4. Fresh Fruit And Vegetable Export in Some Countries

COUNTRY	01.01-30.06.2014		01.01-30.06.2015		Increase Decrease (%)		2015 (%)
	KG	FOB USD	KG	FOB USD	KG	FOB USD	
RUSSIAN FEDERATION	574.087.225	409.452.507	643.333.794	451.969.203	12	10	45
IRAQ	403.203.630	170.034.052	365.524.564	148.407.658	-9	-13	15
GERMANY	48.042.571	93.812.268	46.458.218	68.313.021	-3	-27	7
ROMANIA	68.972.340	50.186.492	61.557.445	44.552.402	-11	-11	4
UKRAINE	112.744.802	67.486.921	47.617.925	29.104.576	-58	-57	3
BULGARIA	88.527.077	54.480.822	58.932.490	26.145.892	-33	-52	3
SUUDİ ARABİA	39.327.749	24.701.875	44.936.219	23.776.469	14	-4	2
GEORGIA	72.401.082	25.211.646	57.481.949	19.238.654	-21	-24	2
NETHERLANDS	23.213.608	24.649.562	15.694.095	17.468.005	-32	-29	2
SYRIA	20.345.232	6.821.258	40.072.555	12.272.519	97	80	1

Source: Uludag Exporters Association General Secretariat, 2015

During January-June 2015 Russian Federation located first in export with 45% share. In the same period Iraq, Germany, Romania and Ukraine followed.

Marketing Structure

Marketing services of agricultural products are began with harvesting, collecting, and continue storage, processing, transportation and finish to sell the consumer. A minor amount of some products are prepared in the production field for retailing and end user. However, a major part of the production is marketed at different level of marketing channel, which is prepared by the producers. Agricultural products marketing channels vary according to products, organization level, the country's competitiveness and business policies. There are various marketing systems in the fresh fruit and vegetable trade in the world. Products are delivered to the consumer with a variety of marketing channels including brokers or either directly (Albayrak, 2009).

Some producers are delivered to producers through brokers because of shipping costs. Brokers marketed products to marketing channels such as retail and wholesale markets, then they are delivered consumers through market, supermarket, grocery store. In addition, producers can market their products directly to agricultural cooperatives and exporters. The other marketing channel, fruits and vegetables are reached by agricultural cooperatives and then from there to consumers.

The longest of fresh fruit and vegetables marketing channel in Turkey;

"Producer - collector - brokers (production place) - wholesale broker (consumption place) - retailer - consumer"(Akbay et al., 2005)

Markets in a traditional marketing system in Turkey; producers, wholesalers and retailers are divided into three basic groups form. Producer markets are markets where producers sell their products. The wholesale markets where collectors buy the products from producers and sell the processing facilities and large collectors. Retailers markets are sales location in which the product is purchased by end consumers (Akpınar et al., 2009).

Marketing problems of fruit and vegetables in Turkey can be summarized as follows:

- fragmented market structure (in the retail sector)
- lack of producers Corporation
- lack of physical distribution
- lack of government attention to the problem
- lack of scale economy at the farm level, processing industry level, wholesale level and retail level
- lack of consumer voluntary association
- lack of legislation of market organizing and price discovery
- lack of market information at all level in marketing channel and also export marketing channel.

2.CONCLUSION

In sum, Turkey has a big potential and advantages in fruit and vegetables sector although the sector has such problems indicated above in both internal and external market. Fresh fruit and vegetables marketing it is very important in agricultural sector and market structure varies depending on the product and country. The lack of strong producers' organizations in Turkey leads to dependence on broker. This situation causes to increase marketing margin. In the agricultural sector in Turkey when producers buy or sell goods entered the market, are confronted with an organized trade and industry sector. Strategies that will increase the efficiency and quality of production must be determined.

Marketing infrastructure should be improved. Organizations should be encouraged to provide horizontal and vertical integration. Producers should be informed about fruit and vegetable cultivation techniques and result of research should be communicated to the producers. In addition, producers should be encouraged to organize and the establishment of producers' associations must be provided.

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Comparison of the Energy Requirements of Standard Mouldboard Plough, Conventional Reversible Mouldboard Plough and Swing Plough

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Abstract: Mouldboard ploughs are used widely for primary tillage. There are two types of mouldboard ploughs according to turn the furrow slices: one-way version and a two-way version. One-way versions are designed to turn the furrow slices only to the right. Two-way versions or reversible mouldboard ploughs are designed to turn the furrow slices to the right and left. The two sets of bottoms are mounted on a common frame that is rotated 180° about a longitudinal axis to change from one set to the other. The swing plough was developed as an alternative to the conventional reversible mouldboard plough. The energy requirements of mouldboard ploughs are high. Energy requirement of mouldboard ploughs depend on working depth of the plough, working width, number of bottoms, type of mouldboard, soil moisture content, soil bulk density, draft force, soil penetration resistance, forward speed. This study aimed at comparing total energy requirement in relation to the inputs of fuel-oil energy, machine production energy and human labour energy for the standard mouldboard plough, conventional reversible mouldboard plough and swing plough. Mouldboards of standard mouldboard plough and conventional reversible plough used in the study have cylindroid and the bottoms of swing plough have square shaped. The ploughs examined are tractor mounted type and have two bottoms. The total weights of standard mouldboard plough, conventional reversible mouldboard plough and swing ploughs are 205, 402 and 270 daN respectively. During the tests, the ploughs were operated at 25 cm average furrow depth in condition of medium heavy soil. Fuel-oil energy, machine production energy, human labour energy and total energy requirement of ploughs were calculated by using equations. As a result of the study, it was determined that the total energy requirement per unit area (926.00 MJ ha⁻¹) of the swing plough was lower than the standard mouldboard plough (1085.49 MJ ha⁻¹) and conventional reversible plough (1244.25 MJ ha⁻¹). The total energy requirement of the swing plough is 14.69% less than that of the standard mouldboard plough and 25.58% less than that of the conventional reversible plough.

Keywords: Standard mouldboard plough, conventional reversible mouldboard plough, swing plough, ploughing, total energy requirement

1. INTRODUCTION

Soil tillage is the first stage in crop production. Soil tillage may be defined as the obtaining of desired conditions by moving the soil with mechanical manipulation by means of soil tillage tools and machines according to the needs of the plant starting from seedbed preparation (Dursun, 2015). Various tools and machines are used in soil tillage operation. These are consisted of mouldboard ploughs, disc plough, subsoilers, chisels, listers, field cultivators, disc harrows, rollers, scrubbers, etc. Depending on the type of tools and machine used, the soil is inverted, shattered, mixed, aerated or compacted.

Nowadays conservation tillage methods for soil and water conservation have gained importance. No-till is one of the conservation tillage methods. However, mouldboard plough is the most widely used basic tillage tool in our country as in the world. Ploughs are generally divided into two types, mouldboard plough and disc plough. According to the statistics of the year 2017, total number of mouldboard ploughs are 1071553 in Turkey (Anonymous, 2018). The number of mouldboard plough per tractor is 0.82. There are two types of mouldboard ploughs according to turn the furrow slices: one-way version and a two-way version (Gökçebay, 1986). Mostly, one-way versions are used. One-way versions are designed to turn the furrow slices only to the right. Two-way versions or reversible mouldboard ploughs are designed to turn the furrow slices to the right and left. The reversible ploughing method has significant advantages. The method is simple and easy. Dividing of the field as the parcels is not necessary. Ridges and furrows do not form on the soil surface. Other agricultural tools and machines work more easily in the field. Seedbed preparation is more successful in precision sowing. Turning time and fuel consumption are less because of the short turns at the beginning of parcel (Dursun, 2015). However, the reversible ploughs have disadvantages such as being heavy, high draft power requirement and high purchase price.

The energy requirements of mouldboard ploughs which are the basic tillage tool in agricultural production are very high (Boydak and Uygan, 2010). Specific energy requirements of mouldboard ploughs depend on such factors as working depth, working width, number of bottoms, type of mouldboard, soil moisture content, soil bulk density, soil penetrometer resistance and forward speed.

In this study, it was aimed at comparing the total energy requirements of the standard mouldboard plough, conventional reversible mouldboard plough and swing plough.

2.MATERIALS AND METHODS

In this study, 3 ploughs were selected as test material. These are standard mouldboard plough, conventional reversible mouldboard plough and swing plough. The swing plough was developed by Erol et al. (1996) within the scope of TUBITAK project (TOAG-1044) (Figure 1).



Figure 1. Swing plough

The ploughs examined are tractor mounted type and have two bottoms. The total weights of standard mouldboard plough, conventional reversible mouldboard plough and swing plough are 205, 402 and 270 daN, respectively. Mouldboards of standard mouldboard plough and conventional reversible plough have cylindroid and the bottoms of swing plough have square shaped (cylindric). Working width of swing plough can be adjusted to 720 mm, 800 mm and 870 mm. Working widths of standard mouldboard plough and conventional reversible mouldboard plough are 600 mm and 570 mm, respectively (Table 1). Table 2 shows some operating characteristics of these ploughs determined in medium heavy soil condition and at an average working depth of 25 cm. The soil moisture contents for 0-5 cm, 10-15 cm and 20-25 cm soil depths were measured as 15%, 23,9% and 23,2%, respectively. The penetrometer resistances for 10 cm, 15 cm, 20 cm and 25 cm soil depths were determined 0,61 MPa, 1,06 MPa, 1,23 MPa and 1,46 MPa, respectively. Fiat 480 standard tractor was used in the experiments (Erol et al., 1996).

Table 1. Some technical specifications of ploughs examined (Erol et al., 1996)

Technical specifications	Standard mouldboard plough	Conventional reversible plough	Swing plough
Total weight (daN)	205	402	270
Type of bottom/mouldboard	Silindroid	Silindroid	Square shaped (Cylindric)
Number of bottom	2	2	2
Total working width (mm)	600	570	720/800/870
Distance between bodies (mm)	750	605	600/700/800
Under beam clearance (mm)	650	750	700

Table 2. Some operating characteristics of ploughs examined (Erol et al., 1996)

Type of plough	Forward speed (m s ⁻¹)	Effective motor power (kW)	Specific motor power (kW m ⁻¹)	Effective field capacity (ha h ⁻¹)	Fuel consumption (L ha ⁻¹)
Standard mouldboard plough	1.101	13.62	21.28	0.255	22.69
Conventional reversible mouldboard plough	1.100	14.06	23.84	0.234	25.24
Swing plough	1.067	14.02	17.52	0.307	19.20

Fuel-oil energy, machine production energy and human labour energy were calculated in order to compare the total energy requirements of ploughs examined in ploughing. The fuel energy and oil energy inputs were calculated from equations 1 and 2, respectively (Gözübüyük et al., 2012):

$$FE = FC \cdot EVF \quad (1)$$

$$OE = [FC \cdot (0,045)] \cdot EVO \quad (2)$$

In equations;

FE: Fuel energy input (MJ ha⁻¹),

OE: Oil energy input (MJ ha⁻¹),

FC: Fuel consumption (L ha⁻¹),

EVF: Energy value of fuel (MJ L⁻¹),

EVO: Energy value of oil (MJ L⁻¹).

The machine production energy input was calculated from the following equation (Karaağaç et al., 2012):

$$MEI = (E \cdot W) / (EFC \cdot T) \quad (3)$$

In equation;

MEI: Tractor or tool-machine production energy input (MJ ha⁻¹),

W: Weight of tractor or tool-machine (daN),

E: Production energy of unit weight of tractor or tool-machine (MJ daN⁻¹),

T: Economical lifes of tractor or tool-machine (h),

EFC: Effective field capacity başarı (ha h⁻¹).

Human labour energy input was calculated from equation 4 (Gözübüyük et al., 2012):

$$HLE = HLWF \cdot UHLE \quad (4)$$

In equation;

HLE: Human labour energy input (MJ ha⁻¹),

HLWF: Human labour workforce used in unit area (h ha⁻¹),

UHLE: Unit human labour energy equivalent (MJ h⁻¹).

The energy equivalents were taken as 39,60 MJ L⁻¹ (Rathke and Diepenbrock, 2006) and 6,51 MJ L⁻¹, respectively, while the fuel-oil energies were calculated (Ejilah and Asere, 2008). The energy equivalents for producing unit weights of tractor and ploughs were taken as 158,5 MJ h⁻¹ and 121,30 MJ h⁻¹, respectively, while the machine production energies were calculated (Gözübüyük et al., 2012). Unit human labour energy equivalent was assumed as 1,96 MJ h⁻¹ (Davoodi and Houshyar, 2009). In addition, the economical life for tractor was taken as 10000 h and the economical life for ploughs was taken as 2500 h when the energy inputs and tractor or tool-machine (ploughs) were calculated (Evcim, 19901).

3.RESULTS AND DISCUSSION

The energy requirements for ploughing with standard mouldboard plough, conventional reversible mouldboard plough and swing plough were given in Table 3.

Table 3. The energy requirements of standard mouldboard plough, conventional reversible mouldboard plough and swing plough (MJ ha⁻¹)

Type of plough	Fuel-oil energy	Machine production energy *	Human labour energy	Total energy
Standard mouldboard plough	905.17	172.64	7.68	1085.49
Conventional reversible mouldboard plough	1006.89	228.99	8.37	1244.25
Swing plough	765.94	153.67	6.39	926.00

*Plough+tractor

The highest fuel-oil energy (905.17 MJ ha⁻¹) was obtained working with conventional reversible mouldboard plough. The lowest fuel-oil energy (765.94 MJ ha⁻¹) was obtained working with swing plough.

The highest input energy used for machine production in unit area was obtained for conventional reversible mouldboard plough, the lowest value was obtained for swing plough. The energy input for machine production for conventional swing plough is 153.67 MJ ha⁻¹. This value is 172.64 MJ ha⁻¹ for the standard mouldboard plough and 228.99 MJ ha⁻¹ for conventional reversible mouldboard plough.

In terms of human labour energy input required, the lowest value was obtained with swing plough as 6.39 MJ ha⁻¹, while the highest value was obtained with conventional reversible mouldboard plough as 8.37 MJ ha⁻¹.

When the total energy input used was examined, it was seen that the highest value belongs to the conventional reversible mouldboard plough with 1244.25 MJ ha⁻¹ and lowest value belongs to the swing plough with 926.00 MJ ha⁻¹.

4.CONCLUSION

When the results obtained from this study are evaluated in general, it was seen that the total energy requirement per unit area of the swing plough used for soil tillage was lower than that of the standard mouldboard plough and conventional reversible mouldboard plough. The total energy requirement of the swing plough is 14,69% less than that of the standard mouldboard plough and 25,58% less than that of the conventional reversible plough. This difference was due to the fact that the energy used for the production of the used tractor is excluded, especially due to the high level of effective field capacity combined with the energy required for plough production, low fuel consumption and human labour requirements. This case increase the widespread use chance of swing plough which has been developed as an alternative to the conventional reversible plough. The most important disadvantages of the conventional reversible plough are high weight, cost and fuel consumption. However, the swing plough is both more light and has less total energy consumption per unit area.

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Predicting Draft Power and Specific Energy Requirement of Cylindroid Mouldboard Plough

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Abstract: Mouldboard plough is primary tillage implement used in conventional tillage. It is one of the equipment that needs high draft power and specific energy. Predicting the draft power and specific energy requirement of mouldboard ploughs depending on technical properties of the plough, the physico-mechanical properties of the soil and the working conditions before the soil tillage will be useful in terms of energy saving. This study aimed at predicting draft power and specific energy requirement of cylindroid mouldboard ploughs in medium heavy soil conditions. For this purpose prediction equations were developed to calculate draft power and specific energy requirement of mouldboard plough. The prediction equations were developed based on dependent variables such as soil parameters including penetrometer resistance, bulk density and moisture content, working width, working depth, forward speed and field capacity. Equation 1 for predicting the draft power in medium heavy soil conditions and Equation 2 for predicting of the penetrometer resistance of medium heavy soil working with cylindroid mouldboard ploughs were used. The draft power obtained from Equation 3 was rated to the field capacity to predict specific energy requirement of mouldboard plough. As a result, a basic Equation 4 for predicting the specific energy requirement of the mouldboard plough was obtained. To test the reliability of the developed prediction equations, the regression coefficients between the results from prediction equations and some other research results were determined. The study showed that draft power and specific energy requirement could be successfully predicted by the prediction equations with good accuracy when working in medium heavy soil condition with cylindroid mouldboard ploughs. The regression coefficients of relationship between predicted and measured draft power of mouldboard ploughs were varied from 0.948 to 0.996. The regression coefficient of relationship between predicted and measured specific energy requirement of mouldboard ploughs was 0.924.

Keywords: Cylindroid mouldboard plough, soil tillage, draft power, specific energy, prediction equations

1. INTRODUCTION

Soil tillage is one of the most important operations in crop production. The mouldboard ploughs are the most common primary tillage implement in agriculture and widely used for conventional tillage all over the world. They cut off strips of soil called furrow slices, invert and crush them on the active surface consisting of the share and mouldboard in horizontal and vertical planes. As a result of being inverted, furrow slices are displaced and lied against the previous turned furrow slice (Bernacki et al., 1972; Dursun, 2015). There are many different types of mouldboards and the effects to the soil change depending on their types.

Mouldboard ploughs may produce undesirable effects such as increasing soil erosion, loss of soil moisture content, worsening of soil structure due to compaction, and increasing carbon dioxide (CO₂) release into the atmosphere from soil in case of unconscious use. However, despite all these undesirable effects it is recommended that the soil tillage with a mouldboard plough every 4 or 5 years even in no-till method (Dursun, 2015).

Mouldboard ploughs are widely used in conventional tillage in Turkey. According to the statistics of the year 2017, total number of mouldboard ploughs is 1071553 in Turkey (TÜİK, 2018). The number of mouldboard ploughs per tractor is 0.82. However, mouldboard ploughs are one of the highest energy consuming primary tillage implements (Boydaş and Uygan, 2010).

Many studies have been conducted to compare the draft power and energy requirement of different types of mouldboard ploughs as well as the other tillage implements under various conditions. Kheiralla et al. (2003) explained that the specific energy requirements of mouldboard plough, disc plough, rotary tiller and disk harrow were 157.68 MJ ha⁻¹, 151.56 MJ ha⁻¹, and 105.12 MJ ha⁻¹ and 66.60 MJ ha⁻¹, respectively at condition of 10-12 cm working depth in sandy clay loam soil condition. The specific energy of the mouldboard plough and the disc plough were higher than that of the rotary tiller 50 and 44%, respectively (Kheiralla et al., 2003).

Some mathematical models have been developed to predict draft force, draft power and specific energy requirement of mouldboard ploughs. The draft power and specific energy requirement of mouldboard ploughs is affected by many factors, such as working depth, working width, the type and shape of plough body, the sharpness of the share, the overall adjustment of the plough, forward speed, soil type and soil parameters consisted of moisture content, bulk density and penetrometer resistance. Prediction of the draft power and specific energy requirement for mouldboard ploughs could be

useful in terms of proper selection of tractors and ploughs, working at optimum operating conditions and increasing field capacity. Thus, energy inputs and costs for tillage operation could be minimized. This study aimed at predicting draft power and specific energy requirement of cylindroid mouldboard ploughs in medium heavy soil condition.

2. MATERIALS AND METHODS

In this study the prediction equations were developed based on dependent variables such as soil parameters including penetrometer resistance, bulk density and moisture content, working width, working depth, forward speed and field capacity, medium heavy soil conditions. These prediction equations will be used to calculate draft power and specific energy requirement of mouldboard plough.

Equation 1 is used for predicting the draft power of cylindroidal mouldboard (Göknur, 1995) and Equation 2 is used for predicting of the penetrometer resistance in medium heavy soil condition (Göknur Dursun and Dursun, 2000).

$$P = [(71.78) \cdot CI] - (37.20) \cdot a \cdot b \cdot n \cdot v^{1.5} \quad (1)$$

In equation;

P: Draft power (kW),

CI: Soil penetrometer resistance (MPa),

a: Working depth (m),

b: Working width (m),

n: Number of bottoms,

v: Forward speed (m s^{-1}).

$$CI = [a_0 \cdot P_b \cdot [(2.45) - [(0.71) / (a_0^3 \cdot P_b)] - [(0.14) / a_0] + [(6.60) \cdot W_b] + (822.51)] / 10^{+3} \quad (2)$$

Where;

CI: Soil penetrometer resistance (MPa),

a_0 : Measurement depth (m),

P_b : Soil bulk density (daN m^{-3}),

W_b : Soil moisture content (%).

Göknur (1995) determined that regression coefficient of relationship between calculated draft power from Equation 1 and measured draft power was 0.978. Göknur Dursun and Dursun (2000) determined that regression coefficient of relationship between calculated from Equation 2 and measured penetrometer resistance was 0.904.

In order to estimate the draft power, Equation 2 was written instead of penetrometer resistance in Equation 1. Thus, Equation 3 was obtained. This approach will make easier to measure the penetrometer resistance of soil when the penetrometer is not available. In Equation 3, it was assumed that the working depth (a) of the mouldboard plough is equal to the measurement depth (a_0) of the penetrometer.

$$P = [(71.78) \cdot [a \cdot P_b \cdot [(2.45) - [(0.71) / (a^3 \cdot P_b)] - [(0.14) / a] + [(6.60) \cdot W_b] + (822.51)] / 10^{+3}] - (37.20) \cdot a \cdot b \cdot n \cdot v^{1.5} \quad (3)$$

In equation;

P: Draft power (kW),

a: Working depth (m),

b: Working width (m),

n: Number of bottoms,

v: Forward speed (m s^{-1}),

P_b : Soil bulk density (daN m^{-3}),

W_b : Soil moisture content (%).

The draft power predicted from Equation 3 was rated to the field capacity (S) of plough. As a result, Equation 4 was obtained for predicting the specific energy requirement (E_s) of the mouldboard plough.

$$E_s = [(((71.78) \cdot [a \cdot P_b \cdot [(2.45) - [(0.71) / (a^3 \cdot P_b)] - [(0.14) / a] + [(6.60) \cdot W_b] + (822.51)] / 10^3] - (37.20) \cdot a \cdot b \cdot n \cdot v^{1.5}) / [S / (3.60)] \quad (4)$$

In equation;

E_s : Specific energy requirement of mouldboard plough (MJ ha^{-1}),

a: Working depth (m),

P_b : Soil bulk density (daN m^{-3}),
 W_b : Soil moisture content (%),
 b : Working width (m),
 n : Number of bottoms,
 v : Forward speed (m s^{-1}),
 S : Field capacity (ha h^{-1}).

To test the reliability of the developed prediction equations, the regression coefficients of relationships between the results from prediction equations and some results obtained by other researchers.

3.RESULTS AND DISCUSSION

The study showed that draft power and specific energy requirement could be successfully predicted by the prediction equations with good accuracy when working with cylindroid mouldboard ploughs in medium heavy soil condition. The regression coefficients of relationship between measured draft powers and predicted draft powers (Equation 3) of ploughs were varied from 0.948 to 0.996 (Table 1 and Table 2). The regression coefficient of relationship between measured and predicted (Equation 4) specific energy requirement of plough was 0.924 (Table 3).

Table 1. The relationships between the results from prediction Equation 3 and the results from field experiments

Type of plough	Forward speed ¹ (m s^{-1})	Draft power ¹ (kW)	Draft power ² (kW)
Mouldboard plough	1.11	8.17	7.96
	1.67	13.92	14.76
Reversible mouldboard plough	1.10	8.16	7.46
	1.67	15.14	13.92
The regression coefficients (R^2)		0.948	

¹From field experiment (Erol et al., 1996), ²From prediction Equation 3.

Table 2. The relationships between the results from prediction Equation 3 and the results from field experiments

Forward speed (m s^{-1})	Draft power ¹ (kW)	Draft power ² (kW)
0.83	6.50	6.23
1.11	9.80	9.63
1.39	15.30	13.50
1.67	20.70	17.80
The regression coefficient (R^2)		0.996

¹From field experiment (Kheiralla et al., 2003), ²From prediction Equation 3.

Table 3. The results from prediction Equation 4 and field experiments

Type of plough	Forward speed ¹ (m s^{-1})	Field capacity ¹ (ha h^{-1})	Specific energy ¹ (MJ ha^{-1})	Specific energy ³ (MJ ha^{-1})
Mouldboard plough	1.11	0.255	115.34	112.39
	1.67	0.386	129.82	137.63
Reversible mouldboard plough	1.10	0.234	115.27	114.77
	1.67	0.354	141.16	141.55
The regression coefficients (R^2)			0.924	

¹From field experiment (Erol et al., 1996), ²From prediction Equation 3, ³From prediction Equation 4.

It is thought that the specific energy requirement of the mouldboard plough can be predicted with great accuracy as regression coefficient of relationship between the measured and predicted draft power from Equation 3 was quite high.

4.CONCLUSION

As a result of this research, draft power and specific energy requirement cylindroid mouldboard ploughs could be successfully predicted by the prediction equations with good accuracy in medium heavy soil condition. The most important advantage of predicting the draft power and specific energy requirement of mouldboard ploughs depending on technical properties of the plough, the physico-mechanical properties of the soil and the working conditions before the soil tillage will be useful in terms of energy saving.

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Determination of Percent Crop Residue Cover by Drone and Image Processing Method in Wheat Field After Harvesting*

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Abstract: Crop residue management is very important to control soil erosion. Leaving crop residue on the soil surface before and during planting provides very good cover for the soil. Measuring percent crop residue cover is an essential step in improving knowledge about the adoption and impact of conservation tillage. This study aimed at determining the percent crop residue cover using drone and image processing method in wheat field after harvesting. Measurements were performed during in August-October 2017. Line transect method was used as a reference method to control the results obtained from drone and ImageJ image processing method. In order to determine the percent crop residue cover using drone and ImageJ image processing, photographs were taken with a digital camera of the drone from various places of a field (A, B, C parcels) covered with wheat surface residues. The crop residue covers of A, B and C parcels were $\leq 30\%$, 30-60% and $\geq 60\%$, respectively. Wooden frame of size 1x1 m was used to determine sampling areas. During the tests, the flight height of the drone was 1.5 m. The captured digital photos were transferred to the computer and converted to JPEG format. Digital photos were analyzed using the ImageJ image processing software. In the line transect method, the square-shaped areas with a dimension of 10.6 x 10.6 m with a diagonal length of 15 m were marked on field surface. A measuring tape was then laid across the field surface at an angle of 45 degrees along a 15 m long diagonal. Intersecting points with crop surface residues at 30 cm intervals along the single edge of the measuring tape were counted. The percent crop residue cover was calculated by multiplying the number of intersecting points by the total number of slices and multiplying the value by 100. At the end of study, the mean values of percent crop residue cover using drone and image processing software ImageJ (Method 1) and line transect method (Method 2) were determined as 30.33% and 30.00% in A parcel, 64.55% and 57.33% in B parcel, 89.67% and 91.33% in C parcel, respectively. Variance analysis showed that the differences between the results obtained from Method 1 and Method 2 were statistically insignificant ($p>0.05$) in all parcels.

Keywords: Percent crop residue cover, drone, image processing method, ImageJ, line transect method

1. INTRODUCTION

Crop residues consist of vegetatif fragments such as stubble, stem, stalk, straw, glume, corncob, sunflower head, leave, seed pod, capsule, etc. which are remaining on the soil surface after harvesting (Dursun Gökür, 2002). They are also called mulch. There are many benefits such as prevention of erosion and soil moisture loss, increase of soil organic matter content, improvement of soil structure, increase of soil temperature and infiltration, reduction of field traffic, prevention of soil compaction, reduction of fuel consumption and weed control (Dickey et al., 1986; Aase and Tanaka, 1991; Daughtry et al., 1997; Rice, 2002; Bannari et al., 2006; Al-Kaisi and Hanna, 2009; MABC, 2015; Dursun 2015; UNL, 2016; Dursun et al., 2017).

Tillage methods according to the percent crop residue cover remaining on the soil surface after soil cultivation and planting are categorised into three main groups: conventional tillage ($<15\%$), reduced tillage (15-30%) and conservation tillage ($\geq 30\%$) (Dursun, 2015). Crop residue management provides a means for limiting both soil particle detachment and removal from the field. Vegetatif residues protect the soil from impact by dissipating the energy of the raindrops (Al-Kaisi and Hanna 2009). Residue left on the soil surface or crop residue management is the primary erosion control method (Shelton et al., 1995). The first step of crop residue management is to determine the percent crop residue cover (Dursun et al., 2017).

Various estimation and measurement methods are used to determine the percent crop residue cover (Daughtry, 2001; Dursun Gökür, 2002; Daughtry et al., 2006; Dursun et al., 2017). These methods are consisted of interviewee estimation, enumerator estimation visiting the field, interviewee with visual-aid without visiting the field, enumerator with visual-aid visiting the field, the photo comparison method, the calculation method, meter stick method, line transect method, laser scanning measurement method, estimating crop residue cover by blue fluorescence imaging, spectral reflectance measurement method, remote sensing method, field picture collected with a digital camera and analyzed with image processing method, field picture collected with a drone and analyzed with image processing method (Lafren et al., 1981; Dickey and Havlin, 1985; Hickman and Schoenberger, 1989; Corak et al., 1993; McMurtrey et al., 1993; Shelton et al., 1995; Daughtry et al., 1997; Streck et al., 2002; Al-Kaisi and Hanna, 2009; Presley, 2013; Zheng et al., 2014; Kosmowski et al., 2016; Dursun et al., 2017).

Drone is unmanned aircraft or unmanned aerial vehicle that can be remotely controlled. Essentially, drone is flying robot. Drones are used for different purposes such as crop spraying, fertilizing, planting, irrigation, soil and field analysis, health assessment, yield estimation, crop monitoring, weeds detection, monitoring of surface flows, mapping and surveying etc. in agriculture (CEMA, 2016; Kosmowski et al., 2016; McKinnon, 2016). Drones can provide real time imagery and sensor data from fields which cannot be quickly accessed on foot or by vehicle (Malveaux et al., 2014). In this research, it is aimed to determine the percent crop residue cover by using field picture collected with a drone and analyzed with image processing method in the field condition after wheat harvesting.

2. MATERIALS AND METHODS

The research took place in Ankara University Faculty of Agriculture Haymana Research & Experimental Farm in August and October 2017. The field is covered with surface residues of wheat and soil type is clay. The average stubble height is 19 cm.

Measurements were performed at low (A), medium (B) and high (C) percent crop residue cover of parcels. The crop residue covers of A, B and C parcels were $\leq 30\%$, 30-60% and $\geq 90\%$, respectively. Each parcel was divided into 3 sub-parcel.

In drone and image processing method, DJI Phantom 3 Pro drone was used to capture aerial pictures of the surveyed field. Drone has 4 propellers. The maximum flight time is approximate 23 min. The maximum speed is 16 m s^{-1} . The resolution of the drone's camera is 4000x3000 pixels.

ImageJ image analysis program was utilized to evaluate the digital photos. ImageJ supports 8-bit, 16-bit and 32-bit (real) grayscale images and 8-bit and 32-bit color images. It can read many image formats including TIFF, GIF, JPEG, BMP, etc. ImageJ is an open source image processing program. This program was designed for scientific.

In the method drone and ImageJ, the boundaries of the areas to be measured was determined by a wooden frame of 1x1 m square. No measurements were made from areas of flooded lands, drought, soil compaction, insect and weed damage (Eck and Brown, 2004). The digital camera of drone was used to capture aerial pictures of the surveyed fields designated by frame. Field picture was taken by drone at a 1.5 m altitude. The average wind speed was measured as 2 m s^{-1} . Three picture was taken in each sub-parcel. Digital images in JPEG format transferred to the computer have been converted to 8 bit-gray color format in ImageJ. It is then ready to be processed by the Threshold button from the Process menu in the program interface. As a result of this process, soil and crop residues are separated from each other. From the Analyze menu, the List command is given using the Histogram option. Depending on the pixel numbers in the black and white colors, the image of the percent crop residue cover on the screen was obtained as a chart (Dursun et al., 2017).

In the research, the line transect method was used to compare the results which was taken drone image processing method. In the line transect method, squared areas with a size of 10.6 x 10.6 m and a diagonal length of 15 m were marked by the piling of the piles on the corners of each parcel. A strip meter was stretched at diagonally in field surface such as an angle of 45 degrees along the 15 m long diagonal (Dickey et al., 1986; Shelton and Jasa, 2009). It was counted the number of marks that intersect a piece of residue at 30 cm intervals along the single edge of the strip meter. The percent crop residue cover was calculated by dividing the number of intersecting points by the total number of divisions (50 piece) (Laflen et al., 1981; Al-Kaisi and Hanna, 2009; Anonim, 2015; Dursun et al., 2017).

The one-way analysis of variance (ANOVA) were applied to the values obtained from the research. SPSS software package program was used in statistical computations (Lowry, 2018).

3. RESULTS AND DISCUSSION

The averages of percent crop residue cover obtained at the measurements in parcel A ($\leq 30\%$) were given in Table 1. The results of the one-way analysis of variance (ANOVA) were given in Table 2. According to Table 2, it can be say that the difference between the methods was statistically insignificant ($p > 0.05$).

The averages of percent crop residue cover obtained at the measurements made in parcel B (% 30-60) were given in Table 3. The results of the one-way analysis of variance (ANOVA) were given in Table 4. According to Table 4, it can be say that the difference between the methods was statistically insignificant ($p > 0.05$).

Table 1. The averages and standard errors of percent crop residue cover obtained at the measurements in parcel A (%)

Method	Parcel and sub-parcels	$\bar{x} \pm S_{\bar{x}}$
Drone + ImageJ	A1	32.33 \pm 1.76
	A2	32.00 \pm 3.46
	A3	26.67 \pm 1.76
	A parcels	30.33 \pm 1.83
Line transect	A1	32.00
	A2	32.00
	A3	26.00
	A parcels	30.00 \pm 2.00

Table 2. Results of variance analysis of percents crop residue cover found in parcel A

Source of variance	Degrees of freedom	Sums of squares	Mean squares	F	P
Total	11	194.250	-		
Between parcels	2	62.000	-		
Within parcels	9	132.250	-	0.710	0.264
Treatment (Between groups)	3	60.917	20.306		
Error	6	71.333	11.889		

Table 3. The averages and standard errors of percent crop residue cover obtained at the measurements in parcel B (%)

Method	Parcel and sub-parcels	$\bar{x} \pm S_{\bar{x}}$
Drone + ImageJ	B1	63.00 \pm 10.26
	B2	62.33 \pm 2.40
	B3	68.33 \pm 12.25
	B parcels	64.55 \pm 1.90
Line transect	B1	58.00
	B2	58.00
	B3	56.00
	B parcels	57.33 \pm 0.67

Table 4. Results of variance analysis of percents crop residue cover found in parcel B

Source of variance	Degrees of freedom	Sums of squares	Mean squares	F	P
Total	11	1752.250	-		
Between parcels	2	666.500	-		
Within parcels	9	1085.750	-	0.400	0.758
Treatment (Between groups)	3	182.250	60.750		
Error	6	903.500	150.583		

The averages of percent crop residue cover obtained at the measurements made in parcel C (\geq % 90) were given in Table 5. The results of the one-way analysis of variance (ANOVA) were given in Table 6. According to Table 6, it can be say that the difference between the methods was statistically insignificant ($p > 0.05$).

Table 5. The averages and standard errors of percent crop residue cover obtained at the measurements in parcel C (%)

Method	Parcel and sub-parcels	$\bar{x} \pm S_{\bar{x}}$
Drone + ImageJ	C1	91.00 \pm 4.04
	C2	92.33 \pm 0.88
	C3	85.67 \pm 4.98
	C parcels	89.67 \pm 2.03
Line transect	C1	94.00
	C2	92.00
	C3	88.00
	C parcels	91.33 \pm 1.76

Table 6. Results of variance analysis of percents crop residue cover found in parcel C

Source of variance	Degrees of freedom	Sums of squares	Mean squares	F	P
Total	11	350.917	-		
Between parcels	2	60.667	-		
Within parcels	9	290.250	-	0.770	0.551
Treatment (Between groups)	3	80.917	26.972		
Error	6	209.333	34.889		

According to the results obtained from the research, the difference between the percents crop residue cover found in parcels A, B and C is statistically insignificant. This result was confirmed by Karabacak (2007), Kosmowski et al. (2016) and Dursun et al. (2017). Karabacak (2007) found that the correlation coefficient between the values of percent crop residue cover obtained from image analysis and line transect method was 0.91 for wheat. Dursun et al. (2017) determined that the difference between the values of the percent crop residue cover obtained from ImageJ image processing program analyzing photographs which was taken with the digital camera of the smart mobile phone and line transect method is statistically insignificant in the field condition covered with wheat surface residues. Kosmowski et al. (2016) found that the difference between the values of the percent crop residue cover obtained from the image processing method analyzing photographs taken with the camera of the drone and line transect method was statistically insignificant.

4.CONCLUSION

At the end of the research, it was understood that the percent crop residue cover can be successfully determined with drone and ImageJ image processing program.

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Evaluating Afşin-Elbistan Fly Ash as Geopolymer Concrete Raw Material with Blast Furnace Slag Incorporation

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Abstract: Geopolymer concrete is one the most popular green concretes recently. Generally, fly ashes have been preferred as aluminosilicate sources. According to ASTM C 618 fly ashes are divided into two classes as F and C. Afşin-Elbistan thermal power plant fly ash does not correspond to any of these two classes and it is not preferred as concrete admixture. Therefore, this fly ash occurs huge amount of waste material for the region. In this study, in order to evaluate Afşin-Elbistan fly ash, it was used as geopolymer concrete raw material. As the control group, 100% fly ash was used. In order to investigate the availability of the fly ash it is also combined with 25% and 50% of blast furnace slag. As activator, sodium silicate (SS) and sodium hydroxide (SH) solutions were used together. The molarity for SH was 12 and SS/SH ratio was chosen as 1.0 and 1.5. Also, activator/binder ratio (Ac/B) was chosen as 0.45, 0.55 and 0.65. 50x50x50 mm cube samples were produced. All the samples were cured at 85 °C for 24 hours. After heat treatment samples were kept in room temperature for 28 days. Compressive strength, splitting tensile strength, ultrasonic pulse velocity, fresh and hardened unit weight tests were performed. At all sample groups it can be seen that increment in the Ac/B ratio and SS/SH ratio increased the mechanical properties. Besides blast furnace slag usage also increased the mechanical properties. Best results were obtained from the series which incorporates 50% blast furnace slag, 0.65 Ac/B and 1.5 SS/SH. As a result, Afşin-Elbistan fly ash usage by itself was given lower results but it can be utilized by using blast furnace slag together.

Keywords: Geopolymer concrete, Afşin-Elbistan fly ash, Blast furnace slag, Compressive strength, Sodium silicate, Sodium hydroxide

1.INTRODUCTION

Concrete is the most common construction material in the world. It is economic, easy to give shape, durable and the most important one, very strong (Toniolo and Boccaccini, 2017). Cement is one of the main raw materials of concrete with aggregates and water. But the cement production generates serious amount of carbon dioxide (CO₂). In the cement production process, during the calcination of limestone, huge amount of CO₂ being released (Al Bakri et al., 2013). It is known that greenhouse gasses such as methane, nitrous oxide and CO₂ causes global warming. Global warming causes critical environmental problems and these problems directly affects every living creature in the world. It is reported that cement industry has a share on CO₂ emission about 5-7% (Hadi et al., 2017). These numbers should not be underestimated. Therefore, it is known that there is a need for eco-friendly, green construction materials which can reduce the CO₂ emission into atmosphere (Davidovits, 2015).

The structure of geopolymer differs than conventional concrete. There is no need for calcium-silicate-hydrate gels for the strength and the hardened structure. (Okoye et al., 2015). As raw material aluminosilicate sources are being used. Besides, in order to activate these raw materials, an alkaline activator needed to be used such as sodium or potassium hydroxide or water glass (Duxon et al., 2007).

Fly ash is the most common aluminosilicate source for the geopolymer production. It is obtained from the coal burning thermal power plants. Every year approximately 780 million tons of fly ash occurs (Duan et al., 2015). The suitability of fly ash for the geopolymer production arises from the amorphous silica and alumina which constitutes the fly ash (Barough et al., 2010).

Fly ashes have two main classes according to ASTM C618, which are class F and C. These classes were determined according to the SiO₂+Al₂O₃+Fe₂O₃ and CaO content of the fly ash (ASTM C618, 2017). Generally, low calcium fly ashes, which fit to class F, are being preferred for the geopolymer production (Okoye et al., 2017). Afşin-Elbistan thermal power plant (a coal burning thermal power plant in Kahramanmaraş region, Turkey), produces more than 3 million tons of fly ash per year. It is the highest energy and fly ash generating thermal power plant in Turkey. But this fly ash cannot be evaluated as concrete admixture due to high CaO and SO₃ content. Besides SiO₂+Al₂O₃+Fe₂O₃ value is lower than other fly ashes. It is not fitting any of fly ash classes by this chemical composition (Mahyar and Erdoğan, 2015, Şahin et al., 2015).

In this study, evaluation of Afşin-Elbistan fly ash as geopolymer raw material with blast furnace slag incorporation was investigated. A control group produced with 100% fly ash and two other groups produced with 25% and 50% blast furnace slag incorporation. As activator, sodium silicate (SS) and sodium hydroxide (SH) solutions were used together. The molarity for SH was 12 and SS/SH ratio was chosen as 1.0 and 1.5. Also activator/binder ratio (Ac/B) was chosen as 0.45, 0.55 and 0.65. 50x50x50 mm cube samples were produced. As curing process, 24 hours 85 °C heat treatment was chosen. Compressive strength, splitting tensile strength, ultrasonic pulse velocity, fresh and hardened unit weight tests were performed to the geopolymer concretes produced.

2. MATERIALS AND METHODS

Materials

The ground granulated blast furnace slag (GGBFS) used in the study was obtained from Iskenderun Iron and Steel Industry Co. (ISDEMİR) at Iskenderun region. The fly ash (FA) was obtained from Afşin-Elbistan thermal power plant in Kahramanmaraş region. The properties of GGBFS and FA are given in Table 1.

In the study, 0-4 mm crushed sand as fine aggregate and 4-8 mm crushed calcareous rock as coarse aggregate were used. The specific gravities of the aggregates are 2.64 g/cm³ and 2.67 g/cm³, respectively. The grain distribution of the mixture aggregate is illustrated in the Fig. 1.

Table 1. Properties of materials

Component (%)	GGBFS	FA
SiO ₂	43.71	22.73
Al ₂ O ₃	12.56	9.67
Fe ₂ O ₃	1.21	4.63
CaO	32.28	42.94
Specific Gravity (g/cm ³)	2.86	2.42

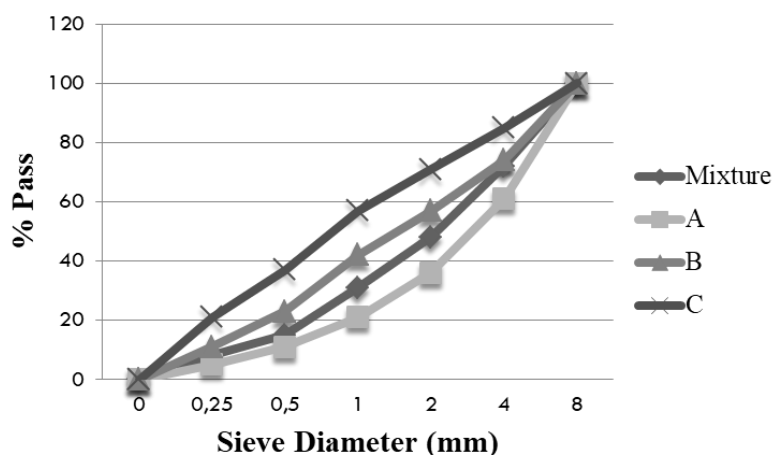


Figure 1. Grain distribution of aggregate

Experimental Study

Mix design of geopolymer concretes are given in Table 2. As a control sample, 100% fly ash geopolymer concrete was produced. Besides 25% and 50% GGBFS was used. As alkaline liquid sodium hydroxide (SH) and sodium silicate (SS) solutions were used together. Two different SS/SH ratio was chosen, which are 1.0 and 1.5. Besides, three different Ac/B ratios were selected. These are 0.45, 0.55 and 0.65.

Table 2. Mixture design of geopolymer concretes

Ac/B	Codes	SS/SH	FA	GGBFS	Fine Agr.	Coarse Agr.	SS	SH
0.45	FA0.45/1	1.0	400	0	1091	727	90	90
	FA0.45/1.5	1.5	400	0	1091	727	108	72
0.55	FA0.55/1	1.0	400	0	1036.8	690	110	110
	FA0.55/1.5	1.5	400	0	1036.8	690	132	88
0.65	FA0.65/1	1.0	400	0	982.6	653	130	130
	FA0.65/1.5	1.5	400	0	982.6	653	156	104
0.45	S25-0.45/1	1.0	300	100	1091	727	90	90
	S25-0.45/1.5	1.5	300	100	1091	727	108	72
0.55	S25-0.55/1	1.0	300	100	1036.8	690	110	110
	S25-0.55/1.5	1.5	300	100	1036.8	690	132	88
0.65	S25-0.65/1	1.0	300	100	982.6	653	130	130
	S25-0.65/1.5	1.5	300	100	982.6	653	156	104
0.45	S50-0.45/1	1.0	200	200	1091	727	90	90
	S50-0.45/1.5	1.5	200	200	1091	727	108	72
0.55	S50-0.55/1	1.0	200	200	1036.8	690	110	110
	S50-0.55/1.5	1.5	200	200	1036.8	690	132	88
0.65	S50-0.65/1	1.0	200	200	982.6	653	130	130
	S50-0.65/1.5	1.5	200	200	982.6	653	156	104

In the study, 50x50x50 mm cube samples were used. The consistencies of the fresh samples were kept constant at 125 mm (see Fig. 2a.). Fresh mixtures were subjected to unit weight test. Molded concretes were cured in the electric oven for 24 hours at 85 °C. After heat-curing, samples were unmolded and were kept in room temperature (20±2 °C) (see Fig. 2b.) and 65% relative humidity for 28 days. After this period, ultrasonic pulse velocity, compressive strength and splitting tensile strength tests were performed on the samples (see Fig. 3.)



Figure 2. (a) Measuring the consistency (b) Geopolymer samples



Figure 3. (a) UPV test (b) Compression test (c) Splitting tensile test samples

3.RESULTS AND DISCUSSION

Unit Weight Results

Fresh and hardened unit weight results are given in Fig. 4.

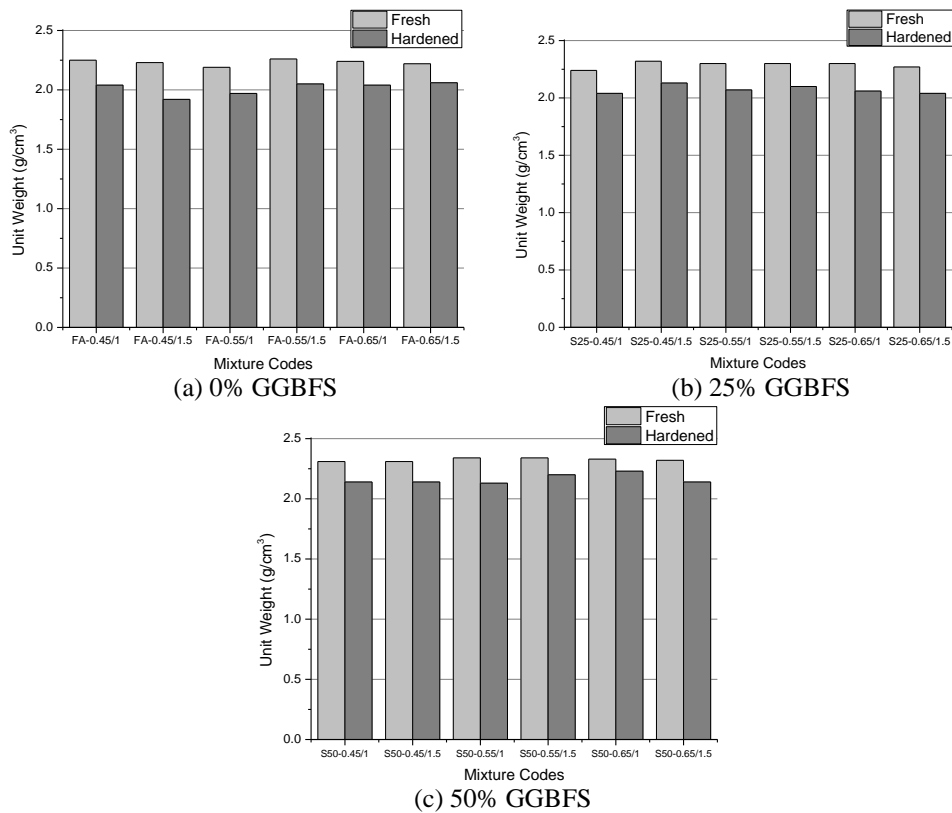


Figure 4. Fresh and hardened unit weights of geopolymers

In general, the average unit weight of a normal concrete is approximately $2300 - 2400 \text{ kg/m}^3$. All the fresh unit weights are between $2190 - 2350 \text{ kg/m}^3$ and the hardened unit weights are between $1920 - 2230 \text{ kg/m}^3$. The lowest fresh unit weight was obtained from 12FA0.55/1.0 sample, by 2190 kg/m^3 and the highest fresh unit weight was obtained from 12S50-0.45/1.5, by 2320 kg/m^3 . The highest hardened unit weight was obtained from 12S50-0.65/1.0, by 2230 kg/m^3 and the lowest hardened unit weight was obtained from 12FA0.45/1.5, by 1920 kg/m^3 . Unit weights are increased with the increase of blast furnace slag amount.

Ultrasonic Pulse Velocity (UPV) Test Results

UPV tests results are given in Fig. 5.

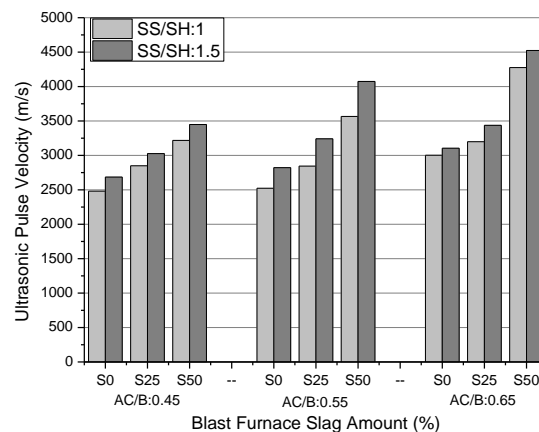


Figure 5. Ultrasonic pulse velocity test results

UPV results of the 100% fly ash containing samples changes between 2481 – 3104 m/s, results of 25% GGBFS+75% FA containing samples changes between 2849 – 3437 m/s. 50% GGBFS+ 50% FA containing samples have results between 3218 – 4524 m/s. Among all the groups, the lowest UPV result was obtained from 12FA0.45/1.0 and the highest UPV result was obtained from S50-0.65/1.5 sample. According to the UPV results, GGBFS containing samples have higher UPV. This means these samples have a denser structure. GGBFS shows filler effect and composes a denser structure. Also activator to binder ratio increased the UPV results. It can be seen that the increase of SS/SH ratio also increased the UPV results.

Compressive Strength Results

Compressive strength results are given in Fig. 6.

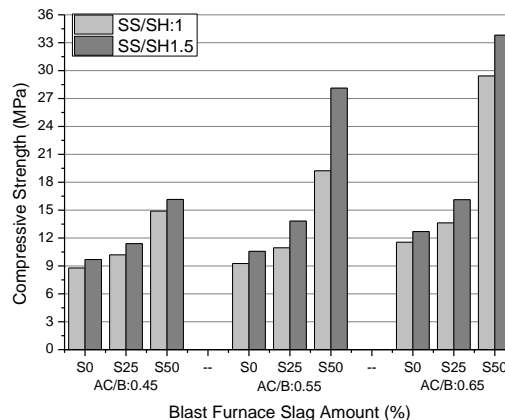


Figure 6. Compressive strength results

100% fly ash containing geopolymers have compressive strength value between 8.8 – 12.7 MPa, 25% GGBFS containing geopolymers change between 10.2 – 16.1 MPa and 50% GGBFS containing series change between 14.9 – 33.8 MPa. The highest compressive strength value of 25% GGBFS containing group is 27% higher and 50% GGBFS containing group is 166% higher compressive strength than the highest compressive strength value among 100% fly ash containing group. The highest value of 50% GGBFS content group is 110% higher than the highest value of 25% GGBFS content group. Compressive strength was increased by the increase of BFS amount at all series. This result can be explained by the high silica and alumina content of the BFS.

Increasing the Ac/B ratio from 0.45 to 0.55 was caused an increment between 5.5% - 74% and increasing to 0.65 was caused an increment between 31% - 109%. Among all series, the increment of SS/SH ratio from 1.0 to 1.5 was caused an increment between 8% - 46%. The highest value obtained from 50% slag, 0.65 activator to binder ratio and 1.5 SS/SH ratio content sample.

Splitting Tensile Strength Results

Splitting tensile strength results are given in Fig. 7.

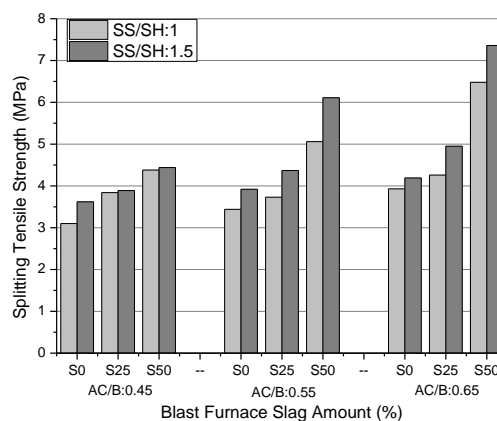


Figure 7. Splitting tensile strength results

According to the splitting tensile strength results, 50% BFS containing samples are the highest ones. The lowest strength value was obtained from 12FA0.45/1.0 sample, which is 3.1 MPa. The highest value was obtained from 12S50-0.65/1.5 sample, which is 7.36 MPa.

The increment trend of the splitting tensile strength by the increment of Ac/B ration and SS/SH ratio is similar to compressive strength and UPV results. Splitting tensile strengths are also increases with the increase of Ac/B and SS/SH ratio.

4.CONCLUSION

According to the results of this experimental study, following conclusions can be drawn;

- Unit weight of geopolymer concrete is generally lower than conventional concrete. 100% and 75% fly ash containing groups have similar unit weight values but 50% of blast furnace slags containing groups have higher values.
- GGBFS usage increased the mechanical properties. Best results were obtained from the series which incorporates 50% GGBFS, 0.65 Ac/B and 1.5 SS/SH.
- Splitting tensile results and ultrasonic pulse velocity test results are similar to compressive strength results.
- At all sample groups, it can be seen that increment in the Ac/B ratio and SS/SH ratio increased the mechanical properties.
- Afşin-Elbistan fly ash usage by itself was given lower results but it can be utilized by using GGBFS together. Also higher SS/SH and Ac/B ratios were given better results for the Afşin-Elbistan fly ash containing geopolymer concretes.

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Investigating the Effectiveness of Some Mineral Materials on Residual Strength of Concretes After Fire: A Taguchi Analyze

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Abstract: In this study, four different mineral materials were used as additives in an effort to improve the fire resistance of concretes. All four mineral materials used at four different levels. Pumice, barite and blast furnace slag used as 0%, 2.5%, 5%, 10% and colemanite used as 0%, 0.25%, 0.5%, 0.75%. In order to evaluate the fire resistances of admixture containing concretes, 100x100x100 mm cube samples were produced. All the samples cured for 28 days in the tap water which is 20±2 °C. After curing period samples subjected to 600 °C and 800 °C for one hour. Two different cooling regimes were conformed which are air and water cooling. Then, compressive strength tests were performed to the samples before and after fire exposure. Ultrasonic pulse velocity tests also performed to the samples before and after fire. In order to determine the effectiveness of each mineral material on the residual compressive strength of the samples after fire exposure, Taguchi analyses were performed. Besides ANOVA was performed by using the signal to noise ratio values obtained from the Taguchi analyze in order to obtain the contribution percentages of the mineral materials on the residual strength. According to the test results at both temperatures, pumice was the most effective parameter on the residual compressive strength. Barite, blast furnace slag and colemanite additives follow pumice respectively. Also it can be concluded that residual strength results of air cooled samples are lower than water cooling, due to much more volumetric degradation.

Keywords: Fire resistance, Taguchi method, Pumice, Barite, Blast furnace slag, Colemanite

1. INTRODUCTION

In general, concrete is a high resistant material against fire, when compared to other construction materials such as timber and steel. It is non-combustible and it has low thermal conduction (Abid et al., 2017). Nevertheless, when a concrete member exposed to high temperatures, there can be significant changes in the physical, mechanical properties and microstructure. These changes are generally can be seen as color change, change in the surface texture and volumetric changes in terms of physical changes. Besides strength properties can be significantly affected by high temperatures, in terms of mechanical properties (Abdul Awal et al., 2015). It is known that, high temperatures also affect the hydration products and this directly affects the microstructure of the concrete. After 100 °C, by the evaporation of the free and the chemically bounded water, water molecule containing hydrates begins to deterioration due to dehydration. Around 450 °C, decomposition of portlandite begins and around 600 °C decarbonation of carbonates begins. Over 800 °C, most of the hydration products become decomposed (Akca and Özyurt, 2018).

Lately, there are many studies in the literature in the field of improving the high temperature resistance of concrete. It is reported by many researchers that using mineral and pozzolanic materials is an effective method to improve the fire resistance of concretes (Morsy et al., 2010). There are studies on using fly ash (Patil and Prakash, 2015), ground granulated blast furnace slag (Siddique and Kaur, 2012, Yüksel et al., 2011), coal bottom ash (Yüksel et al., 2011), palm oil fuel ash (Ismail et al., 2011), vermiculite and silica fume (Koksal et al., 2015).

In an experimental work, determining the effect of the parameters which are affecting the results or a product is very important. For this reason, different designs of experiments methods are being used by the experimental workers. There are two different fundamental techniques in the experimental design, which are full factorial design and the fractional factorial design. These designs are suitable in the designs containing small number of variables and levels. Taguchi developed a new optimization method which can applied more easily (Tan et al., 2005). Taguchi method aims to obtain the optimum conditions by keeping the cost of the experiments in the minimum level.

In this study, four different mineral materials, which are pumice, barite, blast furnace slag and colemanite, were used in the concrete mixtures instead of cement. Taguchi L₁₆ design was used for the design of experiments. According to the L₁₆ table of Taguchi, mixtures were prepared. The samples produced were subjected to 600 °C and 800 °C after 28 days of curing. Two different cooling regimes were used, which are air and water cooling. Residual compressive strengths of the concretes were obtained by using the data before and after high temperature exposure. Besides, ultrasonic pulse velocities of the samples before and after high temperature were determined.

2. MATERIALS AND METHODS

Materials

The ground granulated blast furnace slag (GGBFS) used in the study was obtained from Iskenderun Iron and Steel Industry Co. (ISDEMİR) at Iskenderun region. Colemanite used in the study was obtained from ETI Mine Works in Bigadic region. Pumice and barite was obtained from the reserves close to Osmaniye region. As cement, CEM I 42.5 R type cement was used. The properties of the materials are given in the Table 1.

Two different sizes of aggregates were used in the study. As fine aggregate 0-4 mm crushed sand and as coarse aggregate 4-16 mm crushed rock was used. Sand and coarse aggregate have specific gravities of 2.61 g/cm³ and 2.72 g/cm³, respectively. The grain distribution of the mixture aggregate is shown in the Fig. 1.

Table 1. Properties of materials

Component (%)	Cement	Pumice	Barite	GGBFS	Colemanite
SiO ₂	18.63	40.63	4	43.71	4
Al ₂ O ₃	5.38	15.99	0.84	11.14	0.4
Fe ₂ O ₃	2.80	11.24	0.7	1.21	0.08
CaO	64.39	9.65	1.7	32.28	26
B ₂ O ₃	-	-	-	-	40
BaSO ₄	-	-	89.56	-	-
Specific Gravity (g/cm ³)	3.14	2.91	3.95	2.86	2.47

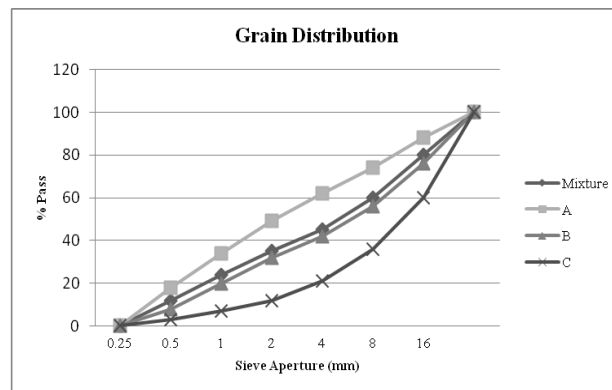


Figure 1. Grain distribution of aggregate

Experimental Design

It is known that, physical and mechanical properties of concrete are being affected by many parameters. These are mainly the parameters in the manufacturing process and the parameters in the mix design. In this study, in order to understand the effects of mineral admixtures used in order to modify the mix design, other parameters were accepted and kept as constant. For time and cost saving, L₁₆ design of Taguchi was chosen. Table 2 shows the factors and the levels selected in the study. Factors are the additives used in the mixture; levels are the proportions of them used in the study. GGBFS, pumice and barite was used 0%, 2.5%, 5% and 10% by weight of cement and fine aggregate, in half. But, colemanite was used 0%, 0.25%, 0.5% and 0.75%. It is reported in the literature that colemanite has retarding effect on the cement hydration in case of using over 1-2% (Pehlivanoglu et al., 2013). Table 3 shows the 16 samples according to the Taguchi design and their mixture proportions. Coarse aggregate and water amount kept constant which are 1151 kg/m³ and 160 kg/m³ respectively.

Table 2. Factors and the levels chosen in the study

Factor	Level 1	Level 2	Level 3	Level 4
(P) Pumice (%)	0	2.5	5	10
(B) Barite (%)	0	2.5	5	10
(S) GGBFS (%)	0	2.5	5	10
(C) Colemanite (%)	0	0.25	0.5	0.75

Method

In the study, all the materials were mixed in a laboratory type pan mixer. 100x100x100 mm cube molds used for the concrete production. Fresh mixtures were cast into molds and wait for 24 hours for setting. After 24 hours, samples were

demolded and kept in lime saturated tap water at 20 ± 2 °C for 28 days. After this curing period, compressive strength tests were performed to one group of samples. Besides, ultrasonic pulse velocities of the samples were measured. After these tests, other groups of samples were subjected to 600 °C and 800 °C in the furnace for one hour, separately. Same tests were subjected to the samples after high temperature exposure and residual parameters were calculated.

Table 3. Mixture proportions

Trial	Code	Pumice (%)	Barite (%)	GGBFS (%)	Colemanite (%)	Cement (kg/m ³)	Sand (kg/m ³)
1	R	0	0	0	0	320	760
2	BSC1	0	2.5	2.5	0.25	303.2	720.1
3	BSC2	0	5	5	0.50	286.4	680.2
4	BSC3	0	10	10	0.75	253.6	602.3
5	PSC1	2.5	0	2.5	0.50	302.4	718.2
6	PBC1	2.5	2.5	0	0.75	301.6	716.3
7	PBS1	2.5	5	10	0	264	627
8	PBSC1	2.5	10	5	0.25	263.2	625.1
9	PSC2	5	0	5	0.75	285.6	678.3
10	PBSC2	5	2.5	10	0.50	262.4	623.2
11	PBC2	5	5	0	0.25	287.2	682.1
12	PBS2	5	10	2.5	0	264	627
13	PSC3	10	0	10	0.25	255.2	606.1
14	PBS3	10	2.5	5	0	264	627
15	PBSC3	10	5	2.5	0.75	261.6	621.3
16	PBC3	10	10	0	0.50	254.4	604.2

3.RESULTS AND DISCUSSION

Residual Compressive Strength

Residual compressive strength results of the concretes are given in Fig. 2.

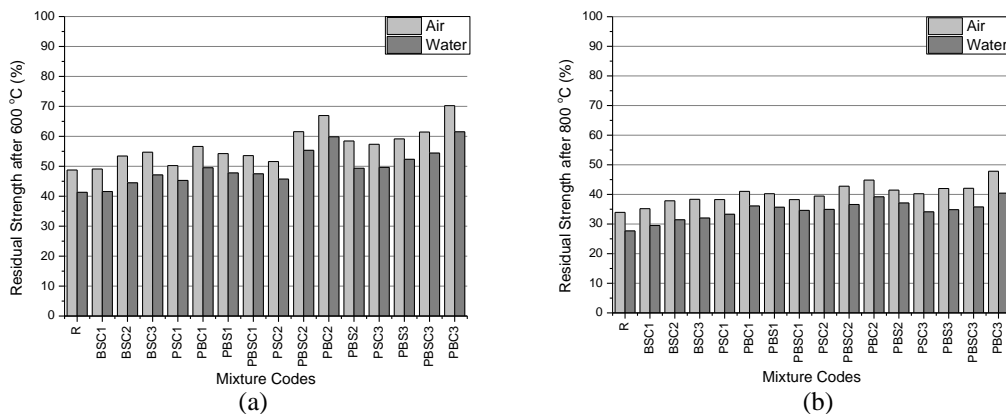


Figure 2. Residual compressive strength results (a) after 600 °C (b) after 800 °C

After 600 °C, both for air and water cooling, the lowest residual strength was obtained from reference sample. The residual strengths are 48.8% and 41.3%, respectively. The highest residual strength was obtained from PBC3 sample. The value is 70.3% for air cooling and 61.5% for water cooling. Similar results were obtained after 800 °C exposure. Reference sample has the lowest residual strengths again and the values are 33.9% and 27.7% for air and water cooling respectively. The highest residual strength obtained sample is PBC3 again. The residual strengths are 47.8% and 40.4% for air and water cooling respectively.

According to the results, all the series, at both temperatures and both cooling regimes, have higher residual strength than reference sample. PBC series which are containing pumice, barite and colemanite have higher results than other series. It can be seen that, with the increase of pumice content, residual strengths were increased. This can be related to the origin of the pumice. Pumice is a volcanic rock and it has high temperature resistance (Türkmen et al., 2017). Besides, pumice is a very porous material. It is known that high strength concretes with low pores experiences more spalling and crackings due to the internal pressure during high temperatures. Pumice, occurs pores inside the structure which reduces this pressure (Abid et al., 2017).

At 600 °C, water cooled samples have lower residual strength than air cooled samples between 12.5% - 15%. This range is 15.5% - 18.6% for 800 °C series. Visuals of concretes after high temperature exposure and cooling are shown in Fig. 3.

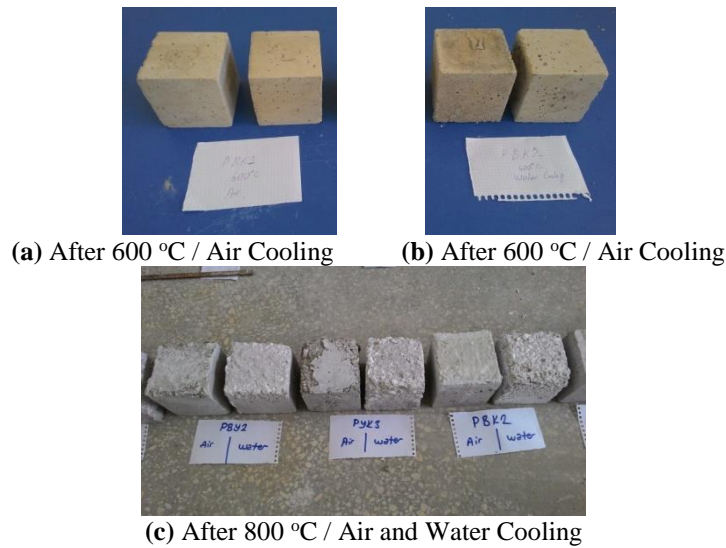


Figure 3. Visuals of some samples after high temperature exposure and cooling

Ultrasonic Pulse Velocity Results

Ultrasonic pulse velocity results are given in Fig. 4 for before and after high temperature exposure.

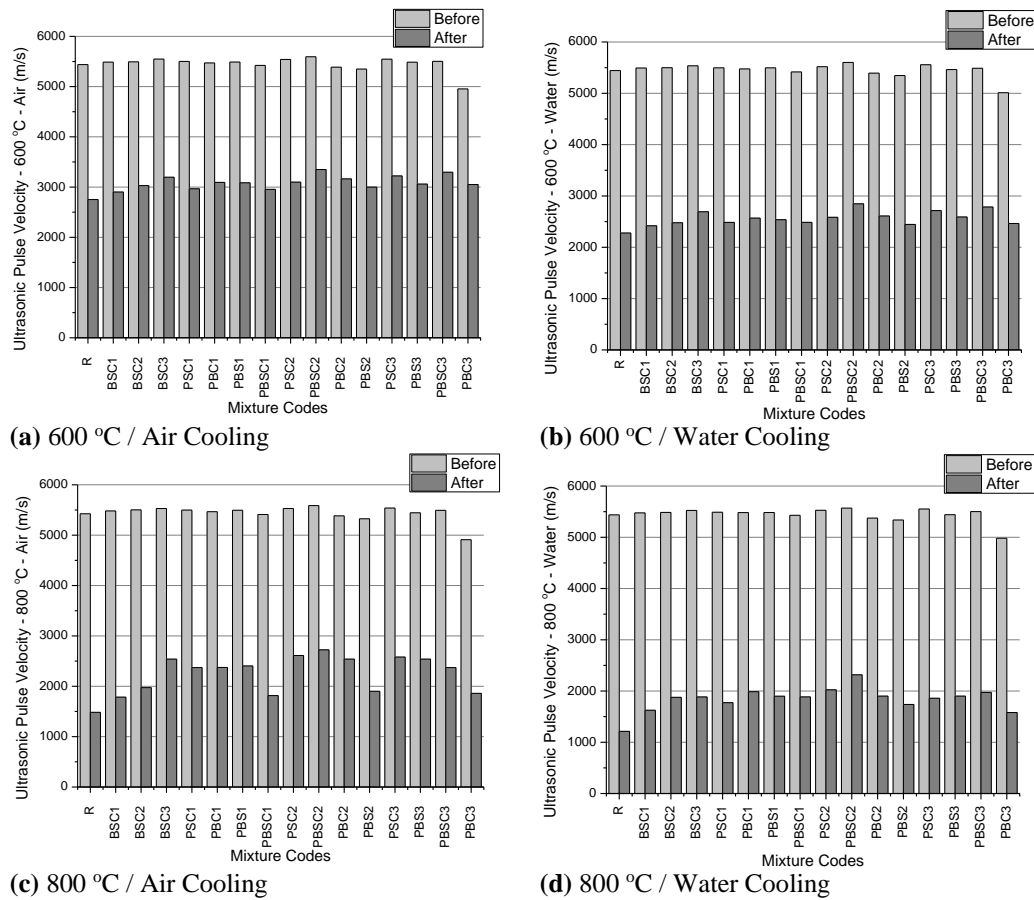


Figure 4. UPV results after high temperature exposure

At 600 °C, for air cooling, UPV results changes between 2752 – 3349 m/s. This range is 2278 – 2847 m/s for water cooling. For 800 °C, air cooling results changes between 1482 – 2639 m/s. This range is 1239 – 2316 m/s for water cooling. These results indicate that, with the increase of temperature, pore amount in the structure increases. Besides, water cooled samples has more porous structure than air cooled ones.

Correlation Between UPV and Residual Strength

It is known that, there is a relation between the pore structure of the concrete and the strength properties. In order to see this relationship for the samples after high temperature, the correlation between UPV results and residual strength are given in Fig.5.

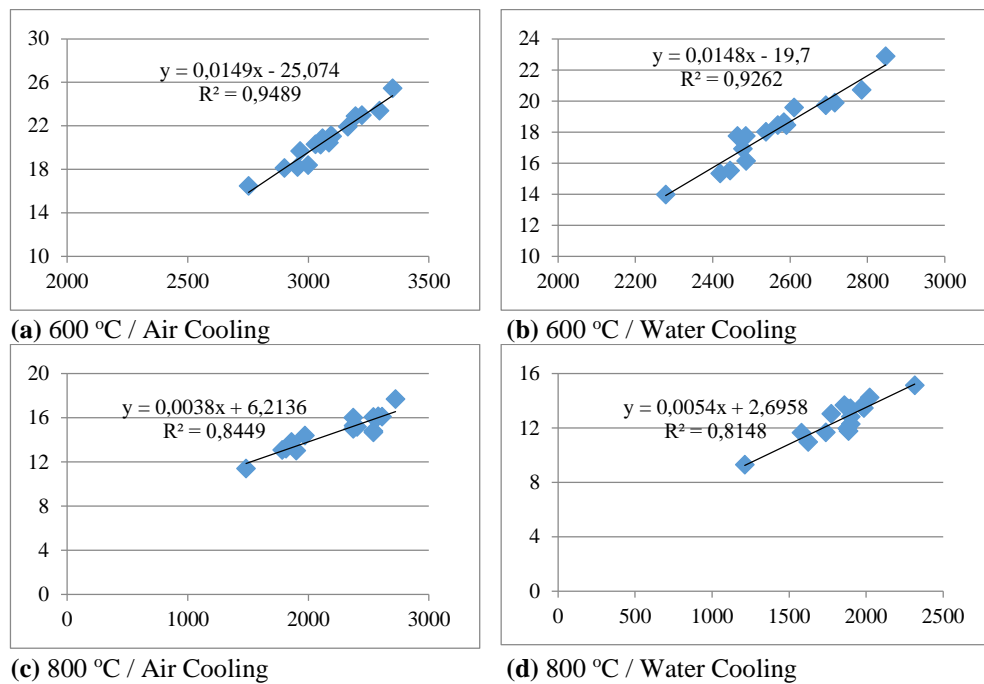


Figure 5. Correlation between the UPV results and the residual strengths

From the Fig. 5, it can be seen that there is a strong relation between UPV results and the residual strengths. R^2 values were obtained by using a linear regression method. R^2 values are 0.95 and 0.93 for air cooled series, 600 °C and 800 °C. For water cooled series, R^2 values are 0.84 and 0.81, respectively.

Taguchi Analysis

The analyzed data by using Taguchi method gives us signal/noise (S/N) ratio as output for every factor and every level of them. This ratio is used to transform the quality characteristics. Table 4 shows the S/N ratios from the analysis.

Table 4. Mean S/N ratios for each level of each factor (dB)

600 °C / Air Cooling					600 °C / Water Cooling				
Level	P	B	S	C	Level	P	B	S	C
1	34.22	34.31	35.58	34.82	1	32.78	33.15	34.40	33.55
2	34.59	35.01	34.72	35.01	2	33.53	33.86	33.50	33.83
3	35.47	35.38	34.70	35.32	3	34.37	34.20	33.52	34.18
4	35.83	35.40	35.10	34.96	4	34.70	34.16	33.96	33.82
Rank	1	2	3	4	Rank	1	2	3	4

800 °C / Air Cooling					800 °C / Water Cooling				
Level	P	B	S	C	Level	P	B	S	C
1	31.19	31.57	32.37	31.88	1	29.57	30.20	31.00	30.53
2	31.95	32.07	31.85	31.96	2	30.86	30.67	30.58	30.68
3	32.48	32.29	31.93	32.36	3	31.35	30.98	30.61	30.95
4	32.66	32.35	32.12	32.08	4	31.18	31.10	30.77	30.80
Rank	1	2	3	4	Rank	1	2	3	4

From the Taguchi analysis, it can be seen from the results, for both temperature and cooling groups, the effectiveness of the admixtures on the residual strengths are same. The most effective parameter on the residual strength is pumice. Barite, GGBFS and colemanite follows pumice, respectively. Taguchi analysis shows the effectiveness level of the admixtures, but in order to obtain the effectiveness value, ANOVA was performed on the S/N values obtained from Taguchi analysis. ANOVA analyses are shown in Table 5.

Table 5. Results of ANOVA for residual compressive strength

600 °C / Air Cooling							600 °C / Water Cooling						
	df	SS	Var	F	Cont	Rank		df	SS	Var	F	Cont	Rank
P	3	6.72	2.24	41.42	53.49	1	P	3	8.90	2.97	17.3	58.56	1
B	3	3.10	1.03	19.11	24.68	2	B	3	2.82	0.94	5.48	18.56	2
S	3	2.03	0.68	12.53	16.18	3	S	3	2.16	0.72	4.2	14.22	3
C	3	0.55	0.18	3.37	4.35	4	C	3	0.80	0.27	1.56	5.28	4
Error	3	0.16	0.05		1.29		Error	3	0.51	0.17		3.38	
Total	15	12.57			100		Total	15	15.21			100	

800 °C / Air Cooling							800 °C / Water Cooling						
	df	SS	Var	F	Cont	Rank		df	SS	Var	F	Cont	Rank
P	3	5.18	1.73	21.41	63.91	1	P	3	7.74	2.58	22.85	71.48	1
B	3	1.51	0.50	6.24	18.64	2	B	3	1.93	0.64	5.69	17.81	2
S	3	0.65	0.22	2.68	7.99	3	S	3	0.44	0.15	1.3	4.06	3
C	3	0.52	0.17	2.17	6.47	4	C	3	0.38	0.13	1.13	3.52	4
Error	3	0.24	0.08		2.99		Error	3	0.34	0.11		3.13	
Total	15	8.10			100		Total	15	10.82			100	

df: degree of freedom SS: sum of squares Var: variance Cont: Contribution

According to the ANOVA analysis, the contribution percentage of the highest contributing admixture, pumice, changes between 53.5% - 71.5%. These results can be attributed to the volcanic origin of the pumice and the porous structure as mentioned in “section 3.1.” The second most effective parameter is barite. The contribution percentage of barite to the residual strength changes between 17.8% - 24.7%. It is reported that barite is a chemically stable material. Its melting point is 1530 °C. Also baritic fines have close thermal expansion value to the hydrated cement mortar (Lo Monte and Gambarova, 2014). The effectiveness of barite can attributed to these properties of the material. Third effective material is GGBFS. The effectiveness percentages are changing between 4.1% - 16.2%. $\text{Ca}(\text{OH})_2$ is one of the main products of the hydration process. By high temperatures it decomposes to CaO and H_2O . This is not a critical reaction for the structure of the concrete. But in the cooling process, CaO may rehydrate by water or moisture. This rehydration creates a serious volumetric expansion (Mendes et al., 2011). GGBFS, consumes the $\text{Ca}(\text{OH})_2$, which is generated by the hydration reaction. This consumption prevents the possible volumetric expansions. This can be named as the main reason for the effectiveness of the GGBFS on the residual strength. The lowest effective parameter is colemanite. The effectiveness percentages are changing between 1.3% - 3.4%. In fact, colemanite is effective on the compressive strength even it is used in very small amounts. But, it looks ineffective due to this low amount.

4.CONCLUSIONS

According to the results of this experimental study, following conclusions can be drawn;

- According to Taguchi analysis, the most effective parameter on residual strength is pumice. This result can be attributed to the volcanic nature and porous structure of the pumice.
- Second effective material is barite. This result can be related to the chemical stability of the barite. Besides barite and hydrated cement mortar have similar thermal expansion coefficients.
- Third effective material is GGBFS. This is related to the pozzolanic nature of the GGBFS. It can consume the $\text{Ca}(\text{OH})_2$ in the hydrated structure of the concrete.
- Residual strengths of air cooled groups are always higher than water cooled groups. This result can be related to the thermal shock effect of water cooling. Water cooling allows more micro crack formation.

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Thermodynamic Analysis of Waste Heat Recovery System in Glass Industry

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Abstract: Glass industry uses the melting furnaces that are fired by the conventional fuels with high temperature. Due to this, high thermal capacity of flue-gases are released into the environment. The systems that gain back the waste heat have become more important in point of energy and environment. Organic Rankine cycle (ORC) is one of the best technological systems with more valuable contributions in heat recovery from industrial processes. In this study, thermodynamic analysis of the power generation system with ORC driven by the waste flue gasses from a glass production facility was performed. The proposed system is composed of three main parts that are the waste heat cycle, ORC, and cooling cycle. In waste heat cycle, the flue gasses and therminol are used as working fluid while Cyclohexane is as working fluid in ORC. On the other hand, the cooling cycle is performed by using water whose the inlet and outlet temperature are respectively 20 °C and 34 °C. While the low pressure ranged between 1,4 bar and 1,8 bar, the high pressure was chosen between 18 bar and 20 bar. The physical properties of the fluids were obtained by using Reference Fluid Thermodynamic and Transport Properties (REFPROP) software program. According to calculations, the ORC was generated the electricity power of 174.10 kWe by using the thermal energy of 950.90 kWt from waste flue gasses. As a result, the proposed system provided generating the useful electricity power by using waste flue gasses in a glass production facility. In this way, the waste flue gases were utilized by ORC and it has provided the positive and valuable contributions to the environment with generating the electricity power.

Keywords: Waste heat recovery, glass industry, ORC, Cyclohexane, thermodynamic analysis.

1.INTRODUCTION

Day by day, global warming and climate change have become as main problem for all countries. The main reason of this situation can be introduced as the greenhouse gases. In Turkey, the portion of the greenhouse gas emissions as CO₂ equivalent are 71.57% in energy, 12.78% in industry, 12.08% in agriculture and 3.55% in waste [1]. CO₂ emissions reveals in glass industry because of the consumption of energy and the usage of raw material [2-3].

The melting furnaces fired by the conventional fuels are used in the glass industry. These furnaces release the high temperature flue gases to the environment. Environment friendly waste heat recovery (WHR) systems have used for gaining waste heat back recently. The usage of the waste heat obtained from the furnace flue gases with high thermal capacity have become more important in point of environment and saving energy [4-10].

Organic Rankine cycle (ORC) is one of the best technological systems with more valuable contributions in heat recovery from industrial processes. In this study, thermodynamic analysis of the power generation system with ORC driven by the waste flue gasses from a glass production facility was performed. For this purpose, current melting furnace in a glass facility was taken into account.

2.MATERIALS AND METHODS

In this study, a glass production facility that use a melting furnace releasing the flue gases temperature of 450°C is taken into account. Thermodynamic properties of cyclohexane are given in Table 1.

Table 1. Thermodynamic properties of cyclohexane.

	Critical Temperature(°C)	Critical Pressure(kPa)	Boiling Point (°C)
Cyclohexane	280.49	4075	80.736

System Description

The proposed system in Fig. 1 is composed of three main parts that are the waste heat cycle, ORC, and cooling cycle. The waste heat is obtained from a furnace flue gases in a glass production facility. In waste heat cycle, the flue gasses and therminol are used as working fluid while Cyclohexane is as working fluid in ORC. The inlet and outlet temperature of the flue gases were accepted as respectively 450°C and 180°C. On the other hand, the cooling cycle is performed by using water whose the inlet and outlet temperature are respectively 20 °C and 34 °C.

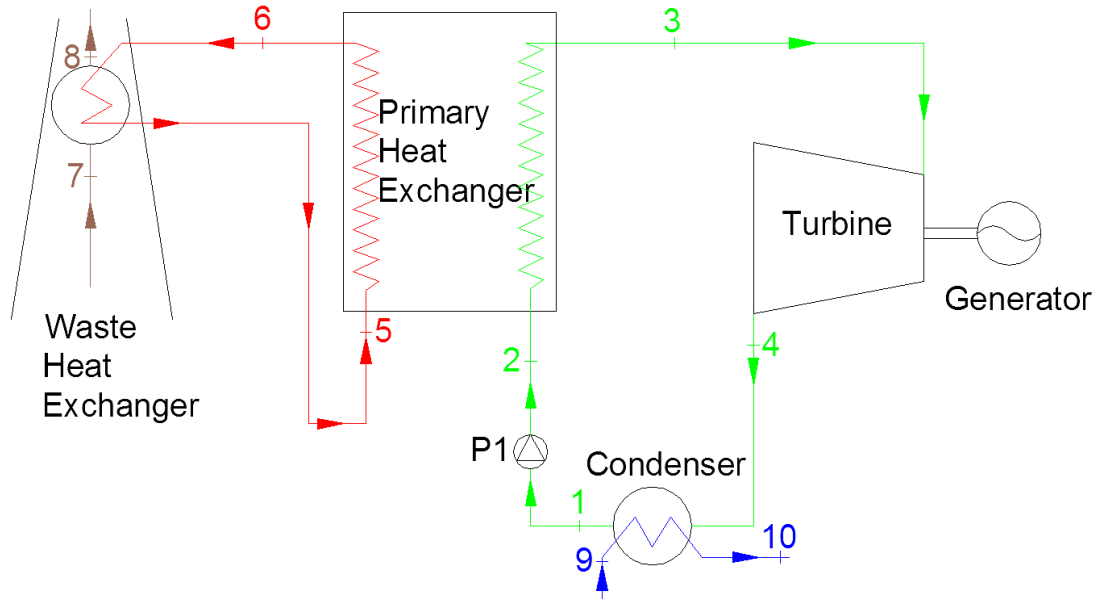


Figure 1. The scheme of the proposed system

According to Fig.1, *ORC* has four equipment that are Primary Heat Exchanger (*PHE*), Turbine, Condenser and Pump. *PHE* provides its heat from thermol and it heats Cyclohexane. The working fluid as superheated steam expands in turbine and generates the electricity power. After turbine, the working fluid becomes liquid phase by giving heat to condenser. After then, the cycle completes with pump.

Energy and Exergy Analysis

There are some assumptions such as kinetic, potential energy effects are negligible, and the reference state is 25°C and 101.325 kPa in the thermodynamic analysis. In addition, the effectiveness of all heat exchangers, the efficiency of turbine and pump are respectively assumed as 97%, 80% and 85%.

The energy transfer from the waste flue gases to waste heat exchanger is given as:

$$\dot{Q}_{WHE} = \dot{m}_{flue} \times (h_7 - h_8) \quad (1)$$

where \dot{m}_{flue} is the mass flow rate of the waste flue gases. So, the mass rate of thermol, \dot{m}_{ther} , is calculated by the following equation:

$$\dot{Q}_{PHE} = \dot{Q}_{WHE} \times 0.97 = \dot{m}_{ther} \times (h_5 - h_6) \quad (2)$$

The mass rate of Cyclohexane, \dot{m}_{cyclo} , is calculated by the following equation:

$$\dot{Q}_{PHE} \times 0.97 = \dot{m}_{cyclo} \times (h_3 - h_2) \quad (3)$$

The generated power in turbine is given as:

$$\dot{W}_{turb} = \dot{m}_{cyclo} \times (h_3 - h_4) \times \eta_{turb} \quad (4)$$

The power consumption in pump is calculated by the following equation:

$$\dot{W}_{P1} = \frac{\dot{m}_{cyclo} \times (h_2 - h_1)}{\eta_{P1}} \quad (5)$$

The thermal energy transfer from the Cyclohexane to condenser is given as:

$$\dot{Q}_{con} = \dot{m}_{cyclo} \times (h_4 - h_1) \quad (6)$$

The mass rate of the cooling water, \dot{m}_{CW} , is calculated by the following equation:

$$\dot{Q}_{con} \times 0.97 = \dot{m}_{CW} \times (h_9 - h_{10}) \quad (7)$$

The net power generation of *ORC* is given as:

$$\dot{W}_{net} = \dot{W}_{turb} - \dot{W}_{P1} \quad (8)$$

The efficiency of *ORC* is calculated by the following equation [11]:

$$\eta_{ORC} = \frac{\dot{E}_{out}}{\dot{E}_{in}} = \frac{\dot{W}_{net}}{\dot{Q}_{PHE}} \quad (9)$$

The exergy balance equation for steady systems is given by the following equation:

$$\dot{E}_{X_{heat}} - \dot{E}_{X_{work}} + \dot{E}_{X_{m,i}} - \dot{E}_{X_{m,o}} = \dot{E}_{X_{dest}} \quad (10)$$

Here the exergy terms occurred by heat, work and mass flow are given as following:

$$\dot{E}_{x_{heat}} = \sum \left(1 - \frac{T_0}{T_k}\right) \dot{Q}_k \quad (11)$$

$$\dot{E}_{x_{deworkst}} = \dot{W} \quad (12)$$

$$\dot{E}_{x_{m,i}} = \sum \dot{m}_i \psi_i \quad (13)$$

$$\dot{E}_{x_{m,o}} = \sum \dot{m}_o \psi_o$$

where ψ indicates the physical exergy term and given as:

$$\psi = (h - h_0) - T_0(s - s_0) \quad (14)$$

where h is enthalpy, s is entropy, and the subscript zero indicates properties of fluids at the dead state. The exergetic efficiency of ORC is then calculated by the following equation[11-12]:

$$\varepsilon_{ORC} = \frac{\dot{E}_{x_{out}}}{\dot{E}_{x_{in}}} = \frac{\dot{W}_{net}}{m(\psi_i - \psi_o)} \quad (15)$$

The all designs were performed by changing the low pressure between 1.4-1.8 bar and the high pressure between 18-20 bar. The physical properties of the fluids were obtained by using Reference Fluid Thermodynamic and Transport Properties (*REFPROP*) software program [13].

3.RESULTS AND DISCUSSION

Thermodynamic analysis of the proposed system was performed by changing the low pressure between 1.4-1.8 bar and the high pressure between 18-20 bar. The variation of \dot{W}_{net} , η_{ORC} , and ε_{ORC} versus P_2 as $P_1=1.8$ bar is given in Fig.2.

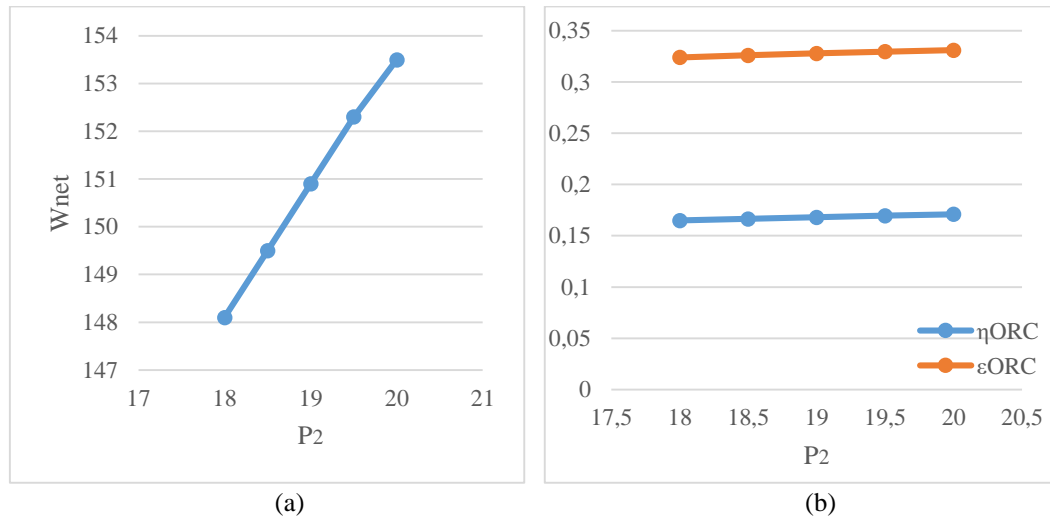


Figure 2. The variation of \dot{W}_{net} , η_{ORC} , and ε_{ORC} versus P_2 as $P_1=1.8$ bar.

According to Fig.2, \dot{W}_{net} increases with raising P_2 (Fig.2a) and η_{ORC} differs from 16.49% to 17.10% while ε_{ORC} changes between 32.41% and 33.10% (Fig.2b). The variation of \dot{W}_{net} , η_{ORC} , and ε_{ORC} versus P_1 as $P_2=20$ bar is given in Fig.3.

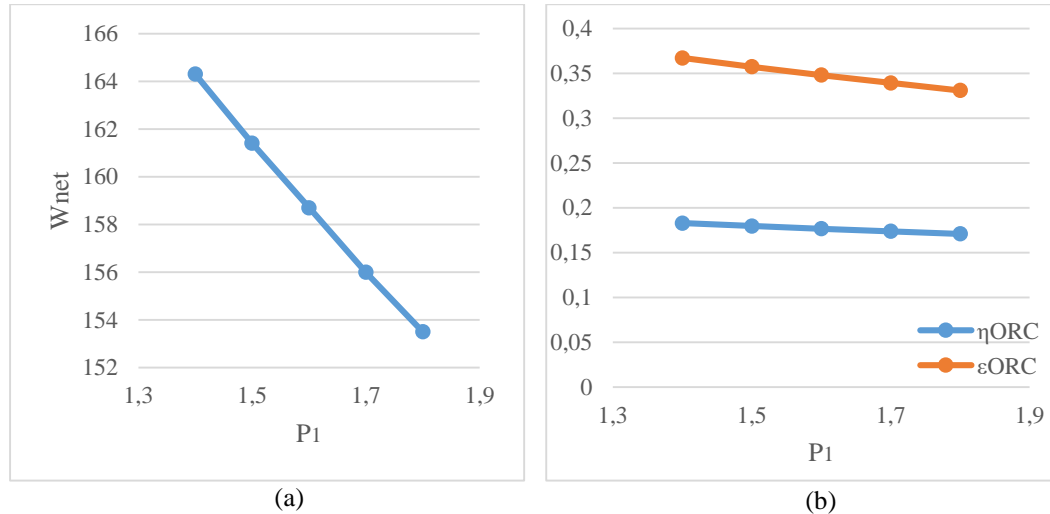


Figure 3. The variation of \dot{W}_{net} , η_{ORC} , and ϵ_{ORC} versus P_1 as $P_2=20$ bar.

According to Fig.3, η_{ORC} and ϵ_{ORC} decreases with increasing P_1 (Fig.3a). Also, \dot{W}_{net} differs from 164.30 kW to 153.50 kW (Fig.3b). The variation of \dot{W}_{net} , η_{ORC} , and ϵ_{ORC} versus P_2 as $P_1=1.4$ bar is given in Fig.4.

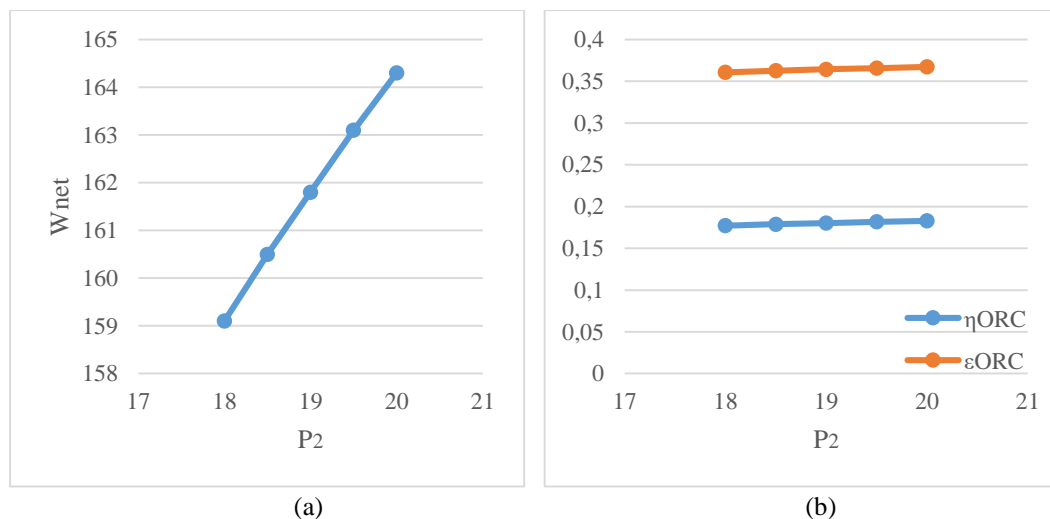


Figure 4. The variation of \dot{W}_{net} , η_{ORC} , and ϵ_{ORC} versus P_2 as $P_1=1.4$ bar.

According to Fig.4, \dot{W}_{net} increases with raising P_2 and the maximum value of that is 164.30 kW (Fig.4a). η_{ORC} differs from 17.72% to 18.30% while ϵ_{ORC} changes between 36.07% and 36.72% (Fig.4b).

4.CONCLUSION

Organic Rankine cycle (ORC) is one of the best technological systems with more valuable contributions in heat recovery from industrial processes. In this study, thermodynamic analysis of the power generation system with ORC driven by the waste flue gasses from a glass production facility was performed. For this purpose, current melting furnace in a glass facility was taken into account.

The highest value of \dot{W}_{net} is calculated as 164.30 kW when P_1 and P_2 are respectively 1.4 bar and 20 bar. In addition, the maximum values of η_{ORC} and ϵ_{ORC} are respectively calculated as 18.30% and 36.72% at this point. This proposed system generates 164.30 kW by using a glass production facility that use a melting furnace releasing the flue gases temperature of 450°C to the environment. By this way, the waste thermal energy in the flue gases can be converted into the useful electricity power.

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Performance Analysis of Isopentane, R123, and R141b for Organic Rankine Cycle Used in Waste Heat Recovery System

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Abstract: In this study, the performance of different organic fluids used in organic Rankine cycle (ORC) was thermodynamically investigated for waste heat recovery system. For this purpose, isopentane, R123, and R141b were selected as the working fluid because of similar physical properties and common usage in the literature. ORC mainly composed of three components that are the primary heat exchanger (PHE), turbine, condenser and pump. The thermal energy obtained from the waste flue gasses was transferred to the PHE by therminol. The working fluid in ORC was evaporated by the thermal energy from PHE and it expanded in the turbine generating the electricity power. After turbine, the working fluid was condensed in the condenser that was cooled from the cooling tower. The working fluid went back to PHE by pump. Different turbine inlet and outlet pressures of the working fluid were utilized to get the maximum power generation. The thermal energy recovered the waste flue gasses was 980.30 kWt as the constant value for three ORCs. The physical properties of the fluids were obtained by using Reference Fluid Thermodynamic and Transport Properties (REFPROP) software program. According to calculations, the efficiencies of ORC for isopentane, R123, and R141b were calculated respectively the range of 0.1487-0.2005, 0.1643-0.2199, and 0.1737-0.2300. The maximum electricity power of 218.70 kWe was obtained from R141b while the minimum electricity power was 141.4 kWe for isopentane. R141b have showed the best performance among the selected organic working fluids. As a result, the analyzed ORCs make the positive and valuable contributions to the environment despite they generate the different power outputs.

Keywords: Waste heat recovery, performance analysis ORC, isopentane, R123, R141b.

1. INTRODUCTION

With the increase of population and development of technology the usage of energy is raising rapidly. Waste heat generally generated industrial processes causes serious environmental problems, global warming, and climate change [1-3]. For these reasons, environment friendly waste heat recovery (WHR) systems have used for gaining waste heat back recently. Organic Rankine cycle (ORC) is one of the best technological systems with more valuable contributions in heat recovery from industrial processes [4-7].

The different working fluids for ORC have been used in more studies in the literature recently. The authors selects different working fluids in order to define the optimum ORC system. This choice of working fluid is more important because thermo-physical properties of that have major impacts on the system efficiency [8-11].

In this study, the performance of different organic fluids used in organic Rankine cycle (ORC) was thermodynamically investigated for waste heat recovery system. For this purpose, isopentane, R123, and R141b were selected as the working fluid because of similar physical properties and common usage in the literature. Also, a current melting furnace in a glass facility was taken into account.

2. MATERIALS AND METHODS

In this study, a glass production facility that use a melting furnace releasing the flue gases temperature of 450°C is taken into account. Thermodynamic properties of isopentane, R123, and R141b are given in Table 1.

Table 1. Thermodynamic properties of isopentane, R123, and R141b.

Refrigerants	Critical Temperature (°C)	Critical Pressure (kPa)	Boiling Point (°C)
Isopentane	187.20	3378.00	27.83
R123	183.68	3661.80	27.82
R141b	204.35	4212.00	32.05

System Description

The proposed system in Fig. 1 is composed of three main parts that are the waste heat cycle, *ORC*, and cooling cycle. The waste heat is obtained from a furnace flue gases in a glass production facility. In waste heat cycle, the flue gasses and therminol are used as working fluid while isopentane, R123, and R141b are as working fluid in *ORC*. The inlet and outlet temperature of the flue gases were accepted as respectively 450°C and 180°C. The thermal energy recovered the waste flue gasses was 980.30 kWt as the constant value for three *ORCs*. On the other hand, the cooling cycle is performed by using water whose the inlet and outlet temperature are respectively 20 °C and 34 °C.

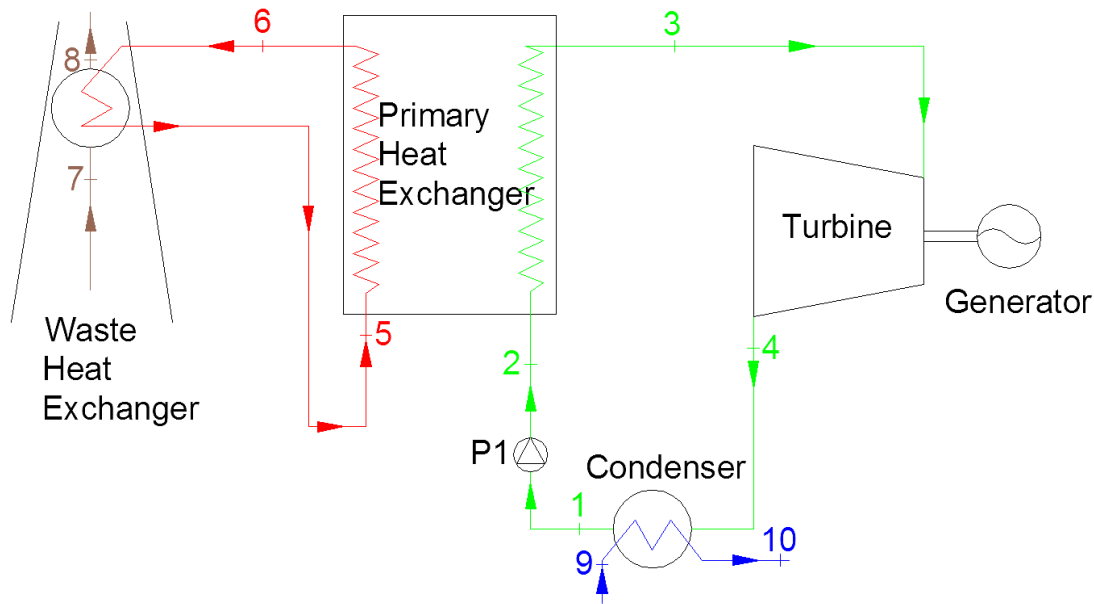


Figure 1. The scheme of the proposed system

According to Fig.1, *ORC* has four equipment that are Primary Heat Exchanger (*PHE*), Turbine, Condenser and Pump. *PHE* provides its heat from therminol and it heats refrigerants. The refrigerants as superheated steam expands in turbine and generate the electricity power. After turbine, the refrigerants become liquid phase by giving heat to condenser. After then, the cycle completes with pump.

Energy and Exergy Analysis

There are some assumptions such as kinetic and potential energy effects are negligible and the reference state is 25°C and 101.325 kPa in the thermodynamic analysis. Also, the effectiveness of all heat exchangers, the efficiency of turbine and pump are respectively assumed as 97%, 80% and 85%.

The energy transfer from the waste flue gases to waste heat exchanger is given as:

$$\dot{Q}_{WHE} = \dot{m}_{flue} \times (h_7 - h_8) \quad (1)$$

where \dot{m}_{flue} is the mass flow rate of the waste flue gases. So, the mass rate of therminol, \dot{m}_{ther} , is calculated by the following equation:

$$\dot{Q}_{PHE} = \dot{Q}_{WHE} \times 0.97 = \dot{m}_{ther} \times (h_5 - h_6) \quad (2)$$

The mass rate of refrigerants, \dot{m}_{ref} , is calculated by the following equation:

$$\dot{Q}_{PHE} \times 0.97 = \dot{m}_{ref} \times (h_3 - h_2) \quad (3)$$

The generated power in turbine is given as:

$$\dot{W}_{turb} = \dot{m}_{ref} \times (h_3 - h_4) \times \eta_{turb} \quad (4)$$

The power consumption in pump is calculated by the following equation:

$$\dot{W}_{P1} = \frac{\dot{m}_{ref} \times (h_2 - h_1)}{\eta_{P1}} \quad (5)$$

The thermal energy transfer from the refrigerants to condenser is given as:

$$\dot{Q}_{con} = \dot{m}_{ref} \times (h_4 - h_1) \quad (6)$$

The mass rate of the cooling water, \dot{m}_{CW} , is calculated by the following equation:

$$\dot{Q}_{con} \times 0.97 = \dot{m}_{CW} \times (h_9 - h_{10}) \quad (7)$$

The net power generation of ORC is given as:

$$\dot{W}_{net} = \dot{W}_{turb} - \dot{W}_{P1} \quad (8)$$

The efficiency of ORC is calculated by the following equation [12]:

$$\eta_{ORC} = \frac{\dot{E}_{out}}{\dot{E}_{in}} = \frac{\dot{W}_{net}}{\dot{Q}_{PHE}} \quad (9)$$

The exergy balance equation for steady systems is given by the following equation:

$$\dot{E}_{X_{heat}} - \dot{E}_{X_{work}} + \dot{E}_{X_{m,i}} - \dot{E}_{X_{m,o}} = \dot{E}_{X_{dest}} \quad (10)$$

Here the exergy terms occurred by heat, work and mass flow are given as following:

$$\dot{E}_{X_{heat}} = \sum \left(1 - \frac{T_0}{T_k}\right) \dot{Q}_k \quad (11)$$

$$\dot{E}_{X_{deworkst}} = \dot{W} \quad (12)$$

$$\dot{E}_{X_{m,i}} = \sum \dot{m}_i \psi_i \quad (13)$$

$$\dot{E}_{X_{m,o}} = \sum \dot{m}_o \psi_o$$

where ψ indicates the physical exergy term and given as:

$$\psi = (h - h_0) - T_0(s - s_0) \quad (14)$$

where h is enthalpy, s is entropy, and the subscript zero indicates properties of fluids at the dead state. The exergetic efficiency of ORC is then calculated by the following equation[12-13]:

$$\varepsilon_{ORC} = \frac{\dot{E}_{X_{out}}}{\dot{E}_{X_{in}}} = \frac{\dot{W}_{net}}{\dot{m}(\psi_i - \psi_o)} \quad (15)$$

The all designs were performed by changing the low pressure between 1.50-2.50 bar and the high pressure between 15-30 bar. The physical properties of the fluids were obtained by using Reference Fluid Thermodynamic and Transport Properties (*REFPROP*) software program [14].

3.RESULTS AND DISCUSSION

Thermodynamic analysis of the proposed system was performed by changing the low pressure between 1.50-2.50 bar and the high pressure between 15-30 bar. The variation of \dot{W}_{net} versus P_2 as $P_1=2.5$ bar is given in Fig.2.

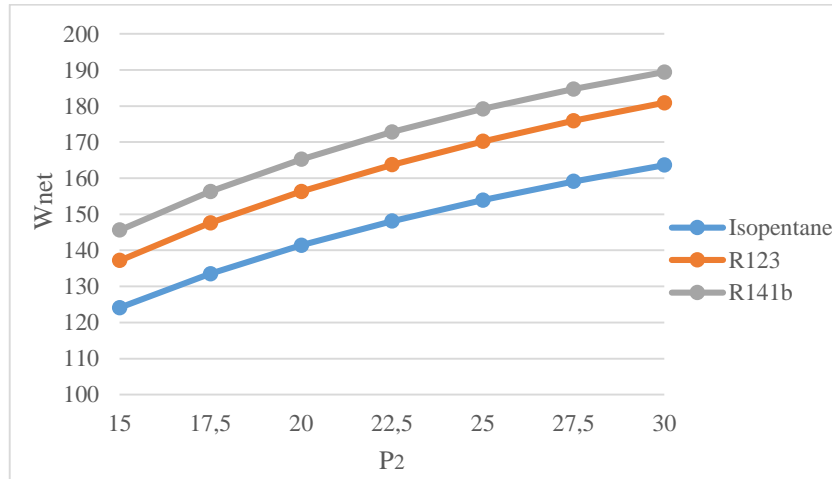


Figure 2. The variation of \dot{W}_{net} versus P_2 as $P_1=2.5$ bar.

According to Fig.2, \dot{W}_{net} increases with raising P_2 and it differs from 124.10 kW to 163.60 kW for isopentane, 137.20 kW to 180.90 kW for R123, and 145.60 kW to 189.40 kW for R141b. The variation of η_{ORC} and ε_{ORC} versus P_2 as $P_1=2.5$ bar is given in Fig.3.

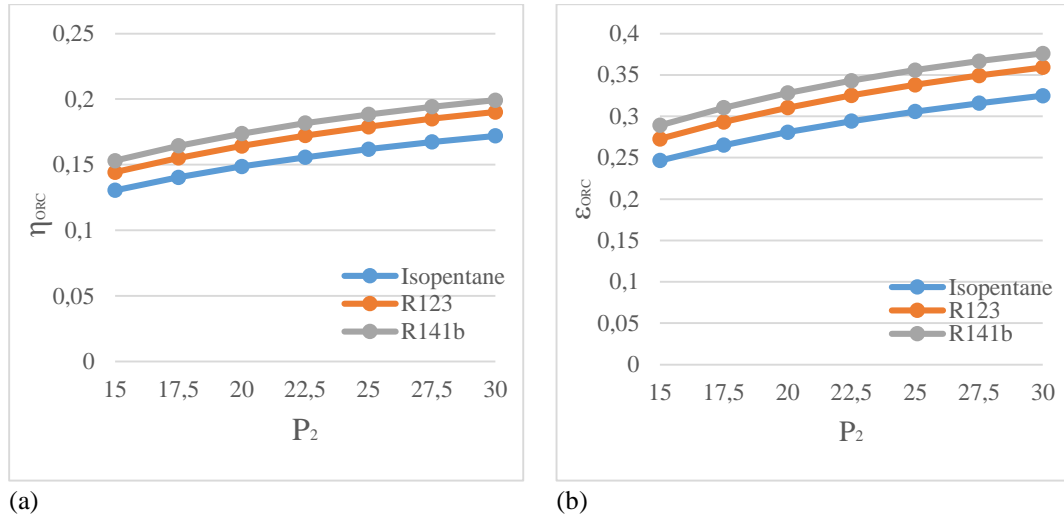


Figure 3. The variation of η_{ORC} and ϵ_{ORC} versus P_2 as $P_1=2.5$ bar.

According to Fig.3, η_{ORC} and ϵ_{ORC} increase with raising P_2 . For three working fluids, η_{ORC} and ϵ_{ORC} change respectively 13.05%-19.92% and 24.66%-37.60% and these values of R141b are higher than isopentane and R123. The variation of \dot{W}_{net} versus P_1 as $P_2=30$ bar is given in Fig.4.

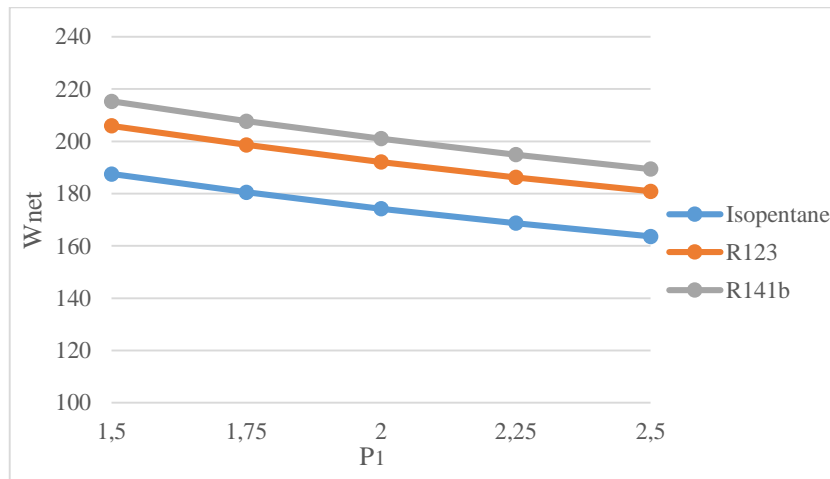


Figure 4. The variation of \dot{W}_{net} versus P_1 as $P_2=30$ bar.

According to Fig.4, \dot{W}_{net} decrease with raising P_1 and it differs from 187.50 kWe to 163.60 kWe for isopentane, 205.90 kWe to 180.90 kWe for R123, and 215.30 kWe to 189.40 kWe for R141b. The variation of η_{ORC} and ϵ_{ORC} versus P_1 as $P_2=30$ bar is given in Fig.5.

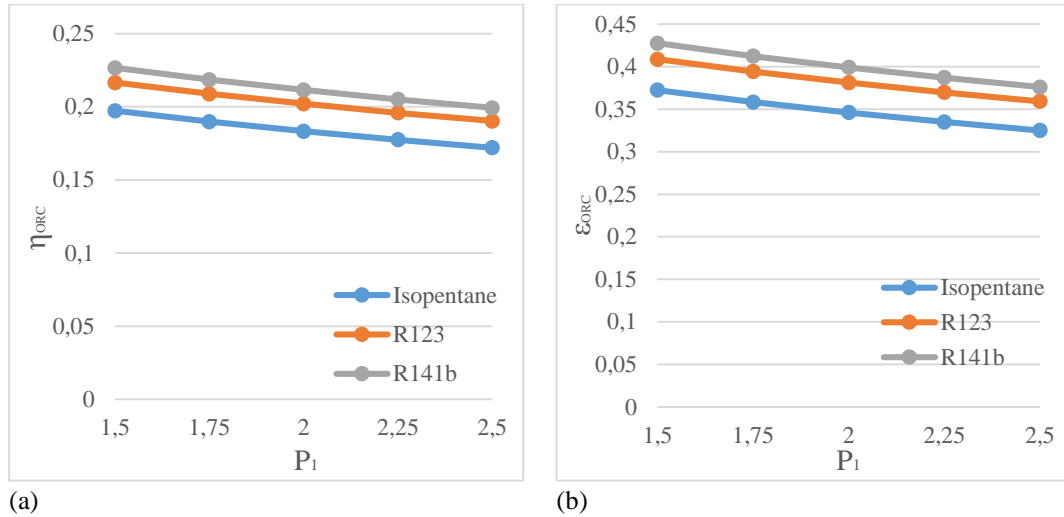


Figure 5. The variation of η_{ORC} and ϵ_{ORC} versus P_1 as $P_2=30$ bar.

According to Fig.5, η_{ORC} and ϵ_{ORC} decrease with raising P_1 . For three working fluids, η_{ORC} and ϵ_{ORC} change respectively 22.65%-17.20% and 42.74%-32.49% and these values of isopentane are smaller than R123 and R141b. The variation of \dot{W}_{net} versus P_2 as $P_1=1.5$ bar is given in Fig.6.

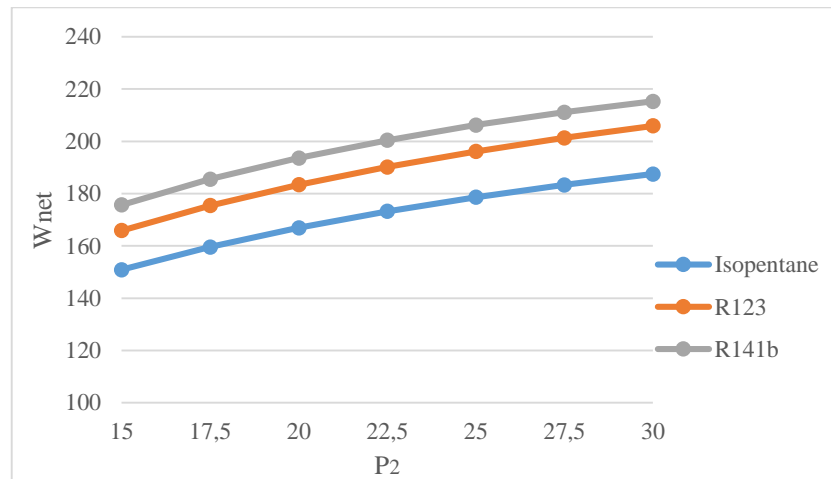


Figure 6. The variation of \dot{W}_{net} versus P_2 as $P_1=1.5$ bar.

According to Fig.6, \dot{W}_{net} increases with raising P_2 and it differs from 150.90 kWe to 187.50 kWe for isopentane, 165.90 kWe to 205.90 kWe for R123, and 175.70 kWe to 215.30 kWe for R141b. The variation of η_{ORC} and ϵ_{ORC} versus P_2 as $P_1=1.5$ bar is given in Fig.7.

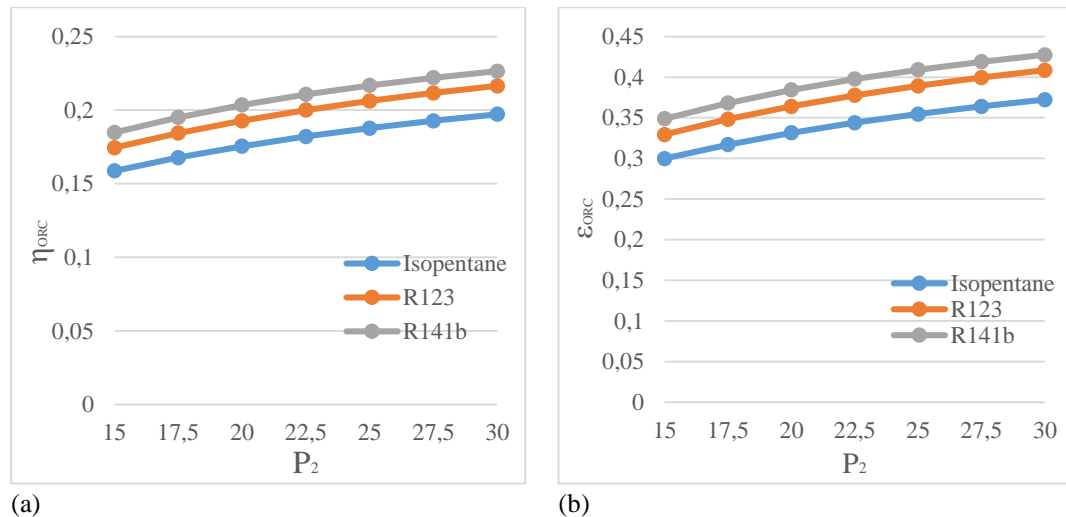


Figure 7. The variation of η_{ORC} and ϵ_{ORC} versus P_2 as $P_1=1.5$ bar.

According to Fig.7, η_{ORC} and ϵ_{ORC} increase with raising P_2 and they reach the maximum values. For three working fluids, η_{ORC} and ϵ_{ORC} change respectively 15.87%-22.65% and 29.98%-42.74% and these values of R141b are higher than isopentane and R123.

4.CONCLUSION

Organic Rankine cycle (ORC) is one of the best technological systems with more valuable contributions in heat recovery from industrial processes. In this study, the performance of different organic fluids used in organic Rankine cycle (ORC) was thermodynamically investigated for waste heat recovery system. For this purpose, isopentane, R123, and R141b were selected as the working fluid because of similar physical properties and common usage in the literature. In addition, a current melting furnace in a glass facility was taken into account.

As the results obtained for the three fluids are compared, the highest value of \dot{W}_{net} is calculated as 215.30 kWe when P_1 and P_2 are respectively 1.5 bar and 30 bar for using R141b as working fluid in ORC. In addition, the maximum values of η_{ORC} and ϵ_{ORC} are respectively calculated as 22.65% and 42.74% at this point for same working fluid R141b. This system that use R141b as the working fluid in ORC generates 215.30 kWe by recovering the waste thermal energy of 980.30 kWt from a glass production facility. By this way, the waste thermal energy in the flue gases can be converted into the useful electricity power.

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Effects of Convective Hot Air Drying on Drying Characteristics, Colour, Total Phenolic Content and Antioxidant Capacity of Carrot Slices

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Abstract: In this study, the effects of different temperatures applied by convective hot air drying on drying characteristics, colour, total phenolic content and antioxidant capacity of carrot slices were examined. Carrot (*Daucus carota* L.) slices with the moisture content of 5.18 kg water/kg dry base were dried by convective hot air drying at 60, 70 and 80°C until the moisture content fell down to 0.05 kg water/kg dry base. Drying experiments were completed between 240 and 395 min depending on temperatures. For the selection of the most suitable thin layer drying model, seven mathematical models (Page, Modified Page, Logarithmic, Lewis, Henderson and Pabis, Two Term Exponential, and Wang and Singh) were applied to the drying treatments. According the results obtained, Page and Modified Page were considered to be the best models with the highest value of correlation coefficient (R^2) and the lowest value of root mean square error (RMSE) and chi squared (χ^2) compared to the other models. It is shown that different temperatures caused statistically significant changes on some colour parameters. Compared to the fresh samples, dried carrots resulted with 61.27-50.21 % and 83.59-83.12 % decrease in total phenolic content and antioxidant capacity, respectively. The effective moisture diffusivity (D_{eff}) values of dried carrot slices increased with the rise of drying temperatures and ranged between 2.33×10^{-9} to 4.02×10^{-9} m²/s.

Keywords: Carrot, drying, modelling, colour, phenolic content, antioxidant capacity, D_{eff}

1. INTRODUCTION

Carrot (*Daucus carota* L.) is a cone-shaped vegetable from the family of parsley gills (*Apiaceae*), a two-year herbaceous cultivated plant. It is one of the most important sources of provitamin A (Oszmianski and Górka 2002; Koca 2006). Carrot carotenoids are composed of 60-80% β -carotene, 10-40% α -carotene and 1-5% lutein. Besides carotenoids, it includes other antioxidant compounds such as phenolics (Zhang and Hamauzu 2004b) and vitamin C (Alasalvar et al. 2005). Fresh carrots contain 3.48 mg of α -carotene, 8.29 mg of β -carotene, 0.26 mg of lutein, 0.66 mg of α -tocopherol and 5.9 mg of vitamin C in 100 grams (USDA, 2002). Furthermore, carrots are also rich in vitamins B₁, B₂, B₆, B₁₂ and various minerals (Singh and Gupta, 2007). Researchers report that carotenoids found in carrots have a protective effect on many diseases such as cancer and cardiovascular diseases (Riboli et al., 1996; Santos et al., 1996; Nicolle et al., 2004).

Carrots, which are suitable for growing every season of the year in our country's climate and soil conditions, are among the most commonly consumed vegetables. Fresh carrots are suitable to microbiological deterioration, as are other fruits and vegetables. For this reason, drying, which is one of the main preservation methods of fruits and vegetables, can also be applied for the preservation of the carrot. Together with being a preservation method, drying has advantages like facilitating storage and transportation conditions of foods as well as allowing them for consumption in every season. Furthermore, foods become more resistant to microbiological, enzymatic and chemical degradations with drying (Singh and Heldman, 2015; Kutlu et al., 2015).

In this field, mathematical models are used for the development of the drying systems performance, the preservation of the nutritional quality of foods and the decision of the most suitable food-specific technique (Sharma et al., 2011). There are many mathematical models for the drying process and the most commonly used model is called the Thin-Layer drying model (Doymaz, 2012).

The purpose of this study is to compare the total phenolic content, antioxidant capacity and colour parameters of fresh and dried carrot samples with the selection of the most appropriate mathematical model by determining drying kinetics of the carrot slices dried in the hot air dryer.

2. MATERIALS AND METHODS

Materials

The carrots supplied from a local market in Bursa were kept in the refrigerator at a temperature of 4 ± 0.5 °C until the drying process. After the carrot samples were washed and water was removed, they were sliced using a slicer (Nicer Dicer, Zhe Jiang, China) with a diameter of 2.84 cm and a thickness of 0.61 cm. Moisture of the samples were analysed with moisture analyser (Sartorius MA150, Germany) and the primary moisture of carrot slices was 5.18 kg water/kg dry base.

Drying Procedure

A hot air convective dryer was used for drying experiments which was produced by Yucebas Machine Analytical Equipment Industry (Y35, Izmir, Turkey) with the technical features of 220 V, 50-60 Hz, 200 W. 50 g carrot slices were placed uniformly on a greaseproof paper. Drying treatments were carried out at 60, 70 and 80°C temperatures and a constant 10% relative humidity. Samples were weighed at a constant intervals during drying. The loss of moisture was determined by measuring samples using a digital balance (Mettler Toledo, MS3002S, Greifensee, Switzerland) with the accuracy of 0.01 g.

Mathematical Modelling of Drying Curve

Seven different thin-layer drying models were used to select the best model for explaining the drying curve of carrot slices in Table 1. By employing the following equations, moisture ratio (*MR*) and drying rate were determined in celery slices during drying:

$$MR = \frac{M - M_e}{M_i - M_e} \quad (1)$$

where, *MR* is moisture ratio, *M* is the moisture content at a certain time (g water/g dry base), *M_i* is the primary moisture content (g water/g dry base), *M_e* is the equilibrium moisture content (g water/g dry base) (Arslan and Ozcan, 2010).

$$Drying\ rate = \frac{M_{t+dt} - M_t}{dt} \quad (2)$$

where, *M_i* and *M_{t+dt}* are the moisture content at *t* and *t+dt* (g water/g dry base) respectively, and *t* is drying time (min) (Dadali et al., 2007b).

Root mean square error (*RMSE*) gives deviation between the estimated and experimental values for the models. The higher correlation coefficient (*R*²), and reduced *RMSE*, Chi square (*χ*²), were used to identify the excellence of fit model in the hot air drying curves of carrot slices. These parameters could be calculated using the sequent equations:

$$RMSE = \left[\frac{1}{N} \sum_{i=1}^N (MR_{exp,i} - MR_{pre,i})^2 \right]^{1/2} \quad (3)$$

$$\chi^2 = \frac{\sum_{i=1}^N (MR_{exp,i} - MR_{pre,i})^2}{N - n} \quad (4)$$

where, *MR_{exp,i}* is the empirically dimensionless moisture ratio for test *i*, *MR_{est,i}* is the estimated dimensionless moisture ratio for test *i*, *N* is the count of observation and *n* is the count of constants in the model (Avhad and Marchetti, 2016).

Table 1. Mathematical Models Used in Drying of Carrot Slices

Model no	Model name	Model	References
1	Page	$MR = \exp(-kt^n)$	Liu et al. (2009)
2	Modified Page	$MR = \exp [(-kt)^n]$	Toğrul (2006)
3	Logarithmic	$MR = a \exp(-kt) + c$	Bhattacharya et al. (2015)
4	Lewis	$MR = \exp(-kt)$	Doymaz (2006)
5	Henderson and Pabis	$MR = a \exp(-kt)$	Evin (2011)
6	Two Term Exponential	$MR = a \exp(-kt) + (1-a) \exp(-kat)$	Ertekin and Yaldız (2014)
7	Wang and Singh	$MR = 1 + at + bt^2$	Wang and Singh (1978)

Calculation of Effective Moisture Diffusivity

Fick's diffusion equation has been widely used to describe the drying process of biological products during the falling rate period (Dadali et al., 2007a). The solution of Fick's second law in slab geometry is given by Crank (1975) as shown in equation (5), assuming moisture change being only by diffusion, constant temperature and effective moisture diffusivity, and negligible shrinkage (Demiray et al., 2014).

$$MR = \frac{8}{\pi^2} \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2} \exp \left(- \frac{(2n-1)^2 \pi^2 D_{eff} t}{4L^2} \right) \quad (5)$$

where, *D_{eff}* is effective moisture diffusivity (m²/s), *L* is the half thickness of the slab in samples (m), and *n* is a positive integer. In practice, only the first term equation (5) is written in a logarithmic form as follows:

$$MR = \frac{8}{\pi^2} \exp \left(- \frac{\pi^2 D_{eff} t}{4L^2} \right) \quad (6)$$

The effective moisture diffusivity of the samples can be calculated by plotting experimental drying data in terms of $\ln MR$ versus drying time, using the following equation:

$$D_{eff} = -\frac{slope 4L^2}{\pi^2} \quad (7)$$

Colour Analyses

The colour parameters of fresh and dried carrots were measured with CR-5 Konika Minolta (Osaka, Japan) colorimeter. The device was calibrated with a standard black and white ceramic plate before the experiments. The L^* , a^* , b^* values were displayed in lightness, redness and yellowness, respectively. In order to describe colour changes during drying, Chroma (C^*_{ab}), Hue angle (h°) and total colour difference (ΔE^*_{ab}) were obtained from L^* , a^* , b^* values and shown in equations of 8, 9 and 10 (Karaaslan and Tuncer, 2008).

$$Chroma (C^*) = \sqrt{(a^*)^2 + (b^*)^2} \quad (7)$$

$$h^\circ = \arctan \left(\frac{b^*}{a^*} \right) \quad (8)$$

$$\Delta E^* = \sqrt{(L^* - L_0^*)^2 + (a^* - a_0^*)^2 + (b^* - b_0^*)^2} \quad (9)$$

Extraction Method of the Samples

The extracts of fresh and dried carrots were prepared according to Vitali et al. (2009) with slight modifications.

Determination of Total Phenolic Content and Antioxidant Capacity

Folin-Ciocalteu spectrophotometric method was used for the determination of total phenolics as described by Spanos and Wrolstad (1990). Total phenolic content was described as mg gallic acid equivalents (GAE) per 100 g dry weight (mg GAE/100g dw).

Antioxidant capacity of the fresh and dried carrot slices were measured according to DPPH (Katalinic et al. 2006) method and the results were given as $\mu\text{mol Trolox equivalent (TE)}$ per g dry weight ($\mu\text{mol TE/g dw}$).

Statistical Analysis

JMP software version 6.0 (SAS Institute Inc. NC, 27513) was utilized to perform statistical analyses. Least Significant Difference (LSD) test was used if the significant differences ($p < 0.05$) were found between means.

3.RESULTS AND DISCUSSION

Drying Characteristics of Carrot Slices

The carrot slices dried in the hot air dryer using different temperatures (60, 70, 80 °C) until the final moisture content reached 0.05 (kg water kg km⁻¹). The change in moisture content depending on the time during drying were shown in Figure 1. Drying time reduced with the rise of drying temperature. The drying process was completed at the longest (395 min) 60°C temperature, while 80°C resulted with the fastest drying time (240 min). Similar results were reported in previous studies of red pepper (Doymaz and Pala, 2002), mushroom (Giri and Prasad, 2007), kiwifruit (Orikasa et al., 2008), apple pomace (Wang et al., 2007) and mint leaf (Therdthai and Zhou, 2009) drying with hot air at different temperatures.

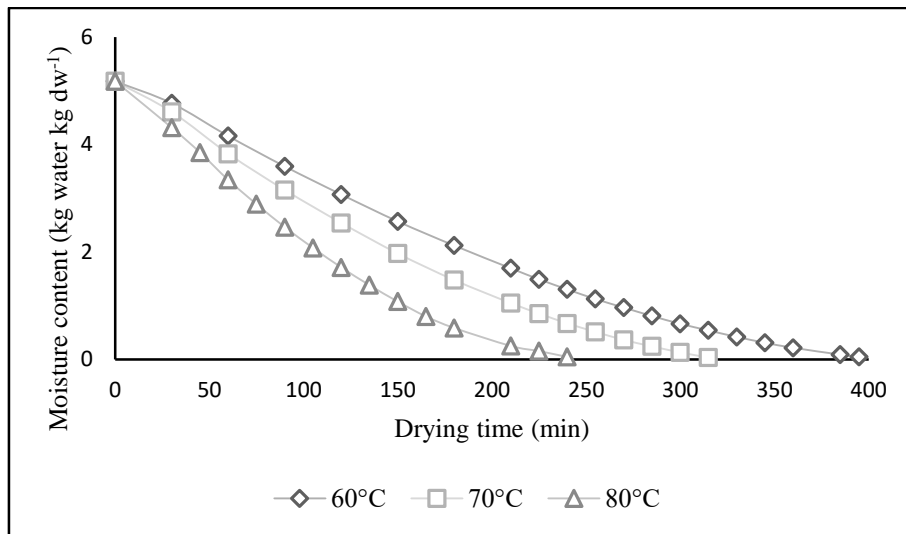


Figure 1. Drying Curves of Carrot Slices at Different Drying Temperatures

Furthermore, calculated drying rate of carrot slices was presented in Figure 2. As can be seen from this figure, drying rates decreased with the reduction of drying temperature and ranged from 0.020 to 0.034 kg water kg dw⁻¹ (min) for 60 and 80°C temperatures respectively. This is explained by the increase in the heat transfer coefficient, which affects the heat and mass transfer ratio of the high temperature difference between ambient air and carrot slices (Demiray and Tülek, 2014). It was seen that the drying occurred at a falling rate period after a brief increase period at the beginning. A constant rate drying period was not observed when the carrot slices were dried with hot air drying. When the previous studies were examined, Demiray and Tülek (2014) and Wang et al. (2007) did not observed a constant rate period during drying of onion slices and apple pomace with hot air dryer.

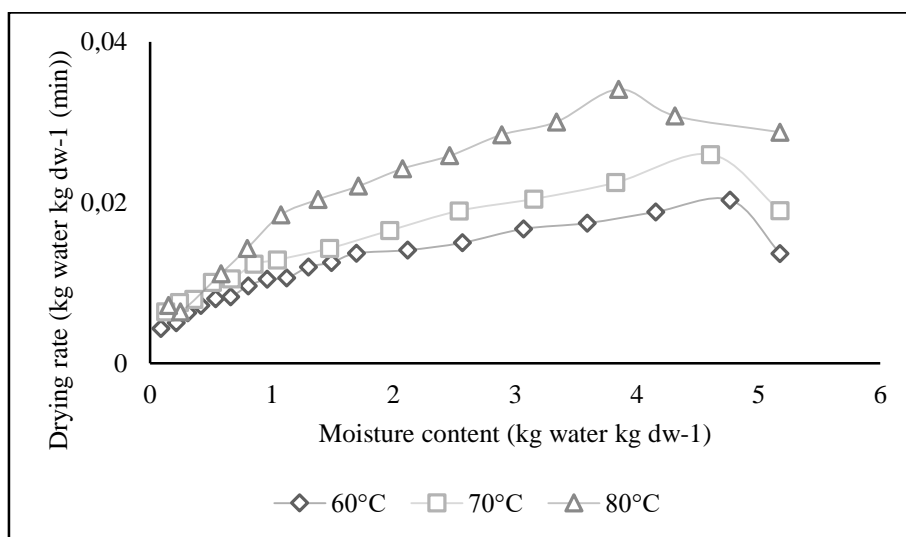


Figure 2. Drying Rate Curves for Carrot Slices versus Moisture Content at Different Drying Temperatures

Mathematical Modelling of Drying Curves

Drying model coefficients and the comparison criteria used to evaluate the quality of the model fit (R^2 , RMSE and χ^2) can be seen in the Table 2. The suitable drying methods with the highest value of R^2 (0.9912) and the lowest value of RMSE (0.004961) and χ^2 (0.000426) were obtained from Page and Modified Page models.

Table 2. Statistical Results Obtained from the Modelling of Dried Carrot Slices

Model no	Temperature(°C)	Model coefficient			RMSE	χ^2	R ²
1	60	n=1.4561	k=0.0050		0.005431	0.000655	0.9877
	70	n=1.4452	k=0.0008		0.006188	0.000663	0.9890
	80	n=1.4508	k=0.0012		0.004961	0.000426	0.9912
2	60	n=1.4561	k=0.0056		0.005431	0.000655	0.9877
	70	n=1.4452	k=0.0070		0.006188	0.000663	0.9890
	80	n=1.4508	k=0.0095		0.004961	0.000426	0.9912
3	60	k=0.0100	a=1.8025	c=0.0086	0.07947	0.148600	0.8526
	70	k=0.0117	a=1.5927	c=0.0061	0.059944	0.067374	0.9023
	80	k=0.0162	a=1.6651	c=0.0087	0.077162	0.111638	0.9159
4	60	k=0.0085			0.029148	0.017886	0.8223
	70	k=0.0114			0.036363	0.021251	0.8233
	80	k=0.0153			0.040878	0.026856	0.8501
5	60	k=0.0102	a=1.9159		0.054785	0.066699	0.8595
	70	k=0.0130	a=1.8740		0.065675	0.074651	0.8409
	80	k=0.0176	a=1.9123		0.066004	0.075401	0.8921
6	60	k=0.0062	a=0.6571		0.01648	0.006035	0.8595
	70	k=0.0079	a=0.6521		0.019127	0.006332	0.8409
	80	k=0.0106	a=0.6566		0.017688	0.005415	0.8921
7	60	b=0.0003	a=-0.0037		0.005437	0.006629	0.9065
	70	b=0.0005	a=-0.0048		0.031904	0.001762	0.9754
	80	b=0.0009	a=-0.0065		0.005516	0.005265	0.9186

Moisture ratios obtained from dried carrot slices at different temperatures were illustrated in Figure 3. Furthermore Figure 4 indicated the comparison of the predicted and experimental moisture ratio values for dried carrot slices. As seen in Figure 3, the established model gave a good agreement between the predicted and the experimental moisture ratio values, which was banding around at 45° straight line. This indicated that the Page model was a suitable model for determining the drying behaviour of carrot slices. Yoğurtçu (2014) applied three different models to determine drying characteristics of lemons in different microwave powers (90, 180, 360, 600 W) and indicated that the Page model is the best model to represent lemon drying behaviour. These results also agree with the reports by Dadali et al. (2007b), Çakmak et al. (2016) and Arslan and Ozcan (2010) for drying of okra, wild strawberry and onion.

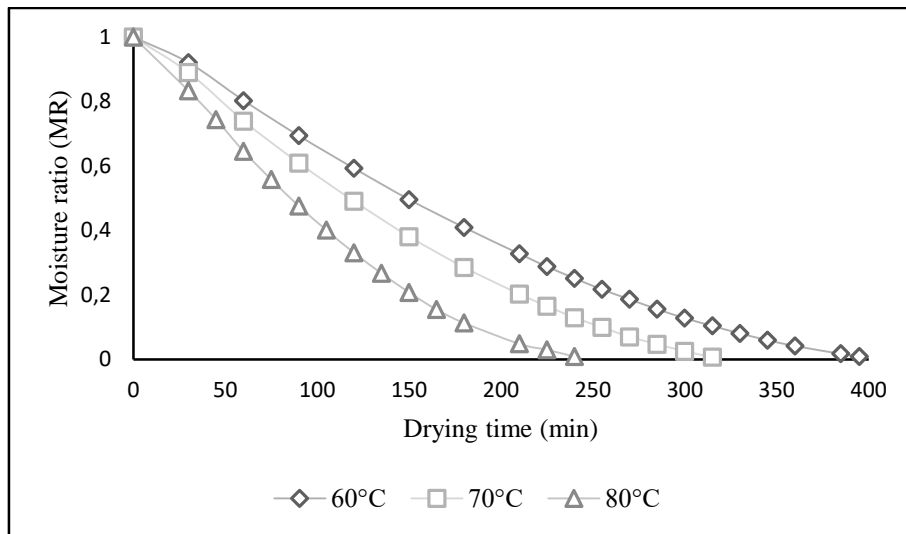


Figure 3. Moisture Ratios of Carrot Slices Versus Drying Time at Different Drying Temperatures

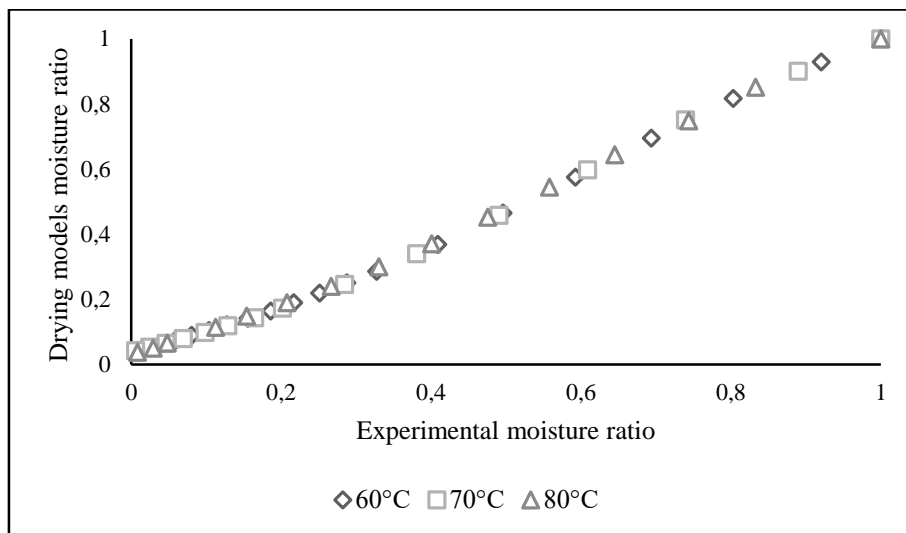


Figure 4. Comparison of Experimental and Drying Models Moisture Ratio for the Page Model

Effective Moisture Diffusivity (D_{eff})

The effective moisture diffusivity (D_{eff}) values for different drying temperatures, calculated from equation (6), ranged from 2.33×10^{-9} to $4.02 \times 10^{-9} \text{ m}^2 \text{ s}^{-1}$ (Table 3). It was observed that D_{eff} values increased with the rise in drying temperature. This result can be explained by the easier evaporation of the product in high temperature and the increase in drying rate (Mengeş and Ertekin, 2006). The values of D_{eff} in our study were within the general range 10^{-12} - 10^{-8} for drying of food materials (Demiray and Tulek, 2017). Our findings are in line with the results informed by Demiray and Tulek (2012) who also acquired an increase in D_{eff} with the rise in drying temperature from $1.015 \times 10^{-9} \text{ m}^2 \text{ s}^{-1}$ to $2.650 \times 10^{-9} \text{ m}^2 \text{ s}^{-1}$.

Table 3. Effective Moisture Diffusivity of Dried Carrot Slices at Different Temperatures

Temperature (°C)	$D_{eff} (\text{m}^2 \text{ s}^{-1})$
60	2.33×10^{-9}
70	2.97×10^{-9}
80	4.02×10^{-9}

Colour Analyses

Colour is a crucial quality factor for the acceptance of food products because consumers look colour of foods before taste them. The colour parameters of fresh and dried carrot slices were given in Table 4. It was determined that the L^* values of the samples ranged from 43.09 to 49.11 and the darkest colour was observed from the samples dried at 80°C. The

reason of discolouration in carrot slices could be due to non-enzymatic Maillard browning or decomposition of pigments. Similarly, in the literature, it was reported that the L^* value was decreased due to the increase in temperature when the persimmons were dried with hot air (Tülek and Demiray, 2014). The redness (a^*) value was found the highest at 60°C drying temperature, while the lowest a^* value was obtained from the temperatures of 70 and 80°C. When carrot slices dried at different temperatures, b^* (yellowness) and C^*_{ab} (colour intensity) values were decreased when compared with fresh sample but the changes in drying temperatures did not cause an important effect on these values. Moreover, h° (hue angle) values were decreased in dried carrots compared to fresh sample. Hawlader et al. (2006) reported that the decrease in h° value was a result of darker colours. In this case, the lowest h° value in the samples dried at 60°C indicated that a darker product was obtained. This result could be explained by a longer drying time at lower temperatures. The highest colour change (ΔE^*_{ab}) values were obtained from the samples dried at 60 and 80°C temperatures, while the samples dried at 70°C showed the lowest ΔE^*_{ab} value.

Table 4. Comparison of Colour Parameters in Fresh and Dried Carrot Slices at Different Temperatures *

Drying temperature (°C)	L^*	a^*	b^*	C^*	h°	ΔE^*_{ab}
Fresh	49.11±0.63 a	22.05±0.63 c	27.60±1.19 b	35.32±1.29 b	51.37±0.58 a	-
60	45.96±0.56 b	31.47±0.88 a	30.42±1.46 a	43.95±1.59 a	44.02±0.62 c	10.43±0.55 a
70	44.85±0.37 b	30.08±0.58 b	30.08±0.67 a	42.55±0.88 a	45.00±0.15 b	9.45±0.19 b
80	43.09±0.85 c	29.69±0.37 b	30.31±0.71 a	42.44±0.76 a	45.59±0.37 b	10.13±0.17 a

* Different letters in the same column display that significant difference ($p < 0.05$)

Total Phenolic Content and Antioxidant Capacity

The total phenolic contents of fresh and dried carrot slices were displayed in Table 5. Total phenolic content of fresh carrots were obtained as 79.35±8.35 mg GAE 100g dw⁻¹. Our result was found higher than data obtained by Kour and Kapoor (2002) and Kahkonen ve ark. (1999) as 55.00±0.90 mg 100g⁻¹ and 60.00±0.00 mg GAE 100g⁻¹, respectively. Additionally, Zhang and Hamazu (2004) researched total phenolic content in different carrot tissues and observed that peel tissue provide 54.1% of the amount of total phenolics in 100 g fresh weight of carrots, while the phloem tissue provides 39.5% and the xylem tissue provides only 6.4%. These differences in the literature were thought to be from the raw material variety, the solvent type used in the extraction method and given the results as dry or wet basis. After drying total phenolic contents of carrots were observed a reduction that was the highest 61.27 % at 70°C drying temperature. The heat induced losses in total phenolic content were similarly reported in previous studies (Vega Galvez et al., 2009; Miranda et al., 2010). Reduction in the total phenolic content during drying process may be explained as binding of polyphenols to proteins, changes in chemical structures and low extraction efficiencies. In addition activation of oxidative enzymes such as polyphenoloxidase and peroxidase is the other important factor related to the loss in total phenolic content (Martin-Cabrejas et al., 2009; Miranda et al., 2010).

The antioxidant capacity values of fresh and dried carrot slices were shown in Table 5. After drying, there was a significant reduction in antioxidant capacity compared to fresh carrot for all drying temperatures ($p < 0.05$) but drying temperatures showed no significant effect on antioxidant capacity of samples ($p > 0.05$). There was no result for antioxidant capacity of dried carrots as trolox equivalent in the literature. Although, antioxidant capacity of fresh carrots were found by Kaur and Kapoor (2002) as 37.50 and 67.00 % in aqueous and ethanol extract, respectively.

Table 5. Total Phenolic Content and Antioxidant Capacity of Fresh and Dried Carrot Slices at Different Temperatures

	Total phenolic content (mg GAE 100 g dw ⁻¹)	Antioxidant capacity (μ mol TE g dw ⁻¹)
Fresh	79.35±8.35 a	33.35±0.22 a
60	39.51±1.11 b	5.61±0.06 b
70	30.73±2.37 c	5.47±0.05 b
80	30.87±2.94 bc	5.63±0.03 b

4.CONCLUSION

In this study, the effect of hot air drying temperatures on drying characteristics, colour, total phenolic content and antioxidant capacity of carrot slices were investigated. Our results showed that, the fastest and shortest drying time were obtained from 80 and 60°C temperatures, respectively. Among the mathematical models evaluated, the Page and Modified Page models were considered to be the best models to describe the drying characteristics of carrot slices. While L^* , h° were decreased, a^* , b^* , C^*_{ab} values increased after drying. Both of total phenolic content and antioxidant capacity of dried samples were decreased after drying as 61.27 % and 83.59 %, respectively. Fick's model of moisture diffusion fitted all experimental data with acceptable correlation coefficients.

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POSTER PRESENTATIONS

Multiband Microstrip Patch Antenna for Automobile Radars

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Abstract: In this paper, two different configurations of low priced microstrip patch antenna which is used in radar-based systems such as blind spot detection in automobiles, detection before the crash and of emergency braking are presented. Nowadays, 24 GHz and 79 GHz are the most frequently used frequencies in automobile radar systems. The proposed antennas are designed on FR-4 substrate with dielectric constant of 4.3 and thickness of 1.6 mm. Size of the antenna is 25 x 20 mm. Antennas presented in this study are working at 10-11 GHz, 22-26 GHz and 75-81 GHz frequency bands. According of the results of this study, second designed antenna is more reliable than first for automobile radars.

1. INTRODUCTION

Nowadays, with the "Advanced Driver Assistance System (ADAS)" feature that does not move only with the commands of the user, work continues to produce intelligent automobiles that help drivers when necessary. Autonomous automobiles that are currently being developed work directly using these systems (Guizzo, 2011). In these systems various technologies are being used. Lidar, ultrasonic sensor, proximity sensor, accelerometers and image processing with cameras are examples of them (Guizzo, 2011) (WAX, 2008).

Adaptive cruise control, blind-spot detection, pre-crash detection, emergency braking systems are radar based (Wenger, 2005). In basic parking assistance systems ultrasound technology is used however radar systems are used for blind detection systems and emergency breaking systems because of safety-critical requirements. Since radars operate with radio frequency, they give more detailed results in distance detection (DG CONNECT, 2017).

The radar used in automobiles is called "Short Range Radar (SRR)" and "Long Range Radar (LRR)". The idea of using radar in automobiles was introduced in the early 1970s (Meindel, 2014). Since that time, 10 GHz, 16 GHz, 24 GHz, 35 GHz, 60 GHz, 79 GHz and 94 GHz frequencies were tested on automobiles (Meindel, 2014). However, the most commonly used car radar frequencies today are 24 GHz (22 - 26 GHz) and 79 GHz (77 - 81 GHz) (Karthik Ramasubramanian, 2017). In addition, these frequencies were officially allocated by the European Commission for automobile radars (DG CONNECT, 2017). The use of 24 GHz within these two frequencies is being gradually reduced (FEDERAL COMMUNICATIONS COMMISSION, 2017). It was planned to switch from 24 GHz to 79 GHz on automobile radars as from 2013, but the transition was delayed to 2018 because 79 GHz technology is not yet fully matured (H.-L. Bloecher, 2009). Nevertheless, the transition is expected to be completed fully in 2022 (DG CONNECT, 2017).

For this reason, it is considered that antennas can be operated in frequency bands of 10 - 11 GHz, 22 - 26 GHz and 75 - 81 GHz in this study. Microstrip antenna is chosen for its low cost, easy production and low weight. Currently, 24 GHz is more common than 79 GHz. However, when 79 GHz radar studies access sufficient maturity, systems will use that frequently.

Microstrip Patch Antennas

Microstrip antennas were very popular in space applications in the 1970s. Today they are used in military and civilian applications. The metal patch on the antenna can be in different configurations, such as rectangular or circular. Rectangular microstrip patch antennas; is the most widely used type due to its easy design, easy production, propagation characteristics and especially low cross-polarization propagation characteristics. Microstrip antennas are compatible with low-profile, cheap and easy production with modern printed circuit technology, planar and non-planar surfaces and are durable in rigid surface mounting and Monolithic Microwave Integrated Circuit (MMIC) design. In addition, resonance frequency, polarization, radiation pattern and impedance are versatile. Microstrip antennas can easily be mounted on the surfaces of high-performance aircraft, spacecraft, satellites, missiles, cars and mobile devices (Balanis, 2005).

In this study, two different designed and produced antennas shown in Figure 1 and Figure 2. After selecting the frequency band, FR-4 material was selected as PCB material. The dielectric constant of the FR-4 material used is 4.3. Subsequently, the dimensions of the antenna with 50 Ω input impedance and operating at 10 GHz center frequency were theoretically calculated (Balanis, 2005). The result of optimization, proposed antenna's dimensions obtained. Dimensions of designed antennas are 25 x 20 mm² and height is 1.6 mm (Figure 1 and Figure 2).

The intended frequencies of use of the antenna are 24 GHz and 77 GHz. For the purpose of improving the antenna parameters in these frequency values, a smaller patch antenna was placed in the first designed patch antenna as shown in Figure 2. Both designed antennas were produced.

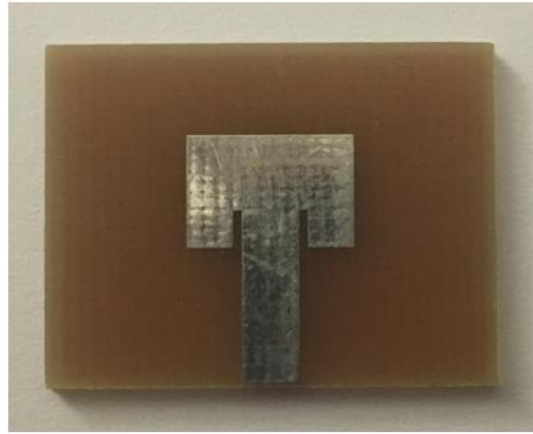


Figure 1. First Antenna



Figure 2. Second Antenna

Performance of Antennas

Antenna parameters such as return loss, Voltage Standing Wave Ratio (VSWR), bandwidth, gain and direction are important for analyzing the performance of antennas.

The VSWR value can be calculated from the return loss value S₁₁. Return loss is a parameter which shows matching of reflection coefficient line impedance and antenna impedance, and can be calculated by this equation:

$$VSWR = \frac{1+|S_{11}|}{1-|S_{11}|} \quad (1)$$

The VSWR value increases with the increase in the impedance mismatch of the transmission line and the antenna. In this case, it is preferable that the VSWR value is low. The operating frequency band of an antenna can be determined from the graph of the VSWR value or from the graph of the S₁₁ parameter, as in this study. The operating frequencies of the antenna are values where S₁₁ is less than -10 dB or VSWR is less than 2:1. In addition, the Band Width (BW) of the antenna can be obtained from the S₁₁ or VSWR graphs.

In this part of the paper, return loss, gain, direction and bandwidth parameters of both antennas are examined in 9 - 12 GHz, 22 - 26 GHz and 75 - 81 GHz frequency bands.

S11 parameters of both antennas were measured (MEAS) and compared with the simulations (SIM) in the 9 - 12 GHz and 22 - 26 GHz frequency bands (Figure 3 – Figure 8). Only simulation results share in the 75 - 81 GHz band because of these parameters can't be measured (Figure 5, Figure 8).

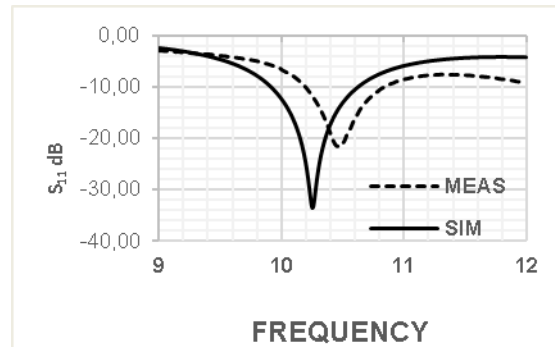


Figure 3. S₁₁ parameter of first antenna at 9–12 GHz

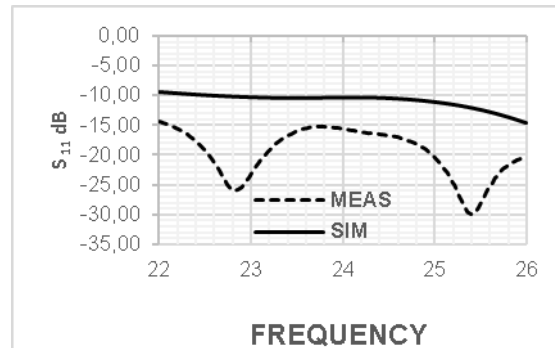


Figure 4. S₁₁ parameter of first antenna at 22-26 GHz

S11 parameter and bandwidth values of first antenna (Figure 1) for three frequency bands are shown in Table 1. This antenna has S11 value of -16.50 dB and bandwidth of 6000 MHz at 79 GHz. However any measurement could not be done for this frequency band.

Table 1. Parameters of first antenna (*could not measure)

Simulation Frequency Band	S ₁₁	BW (MHz)	Measured Frequency Band	S ₁₁	BW (MHz)
10.2 GHz	-33.58	700	10.5 GHz	-21.6	630
24 GHz	-10.42	4000	24 GHz	-15.66	4000
79 GHz	-16.50	6000	79 GHz	*	*

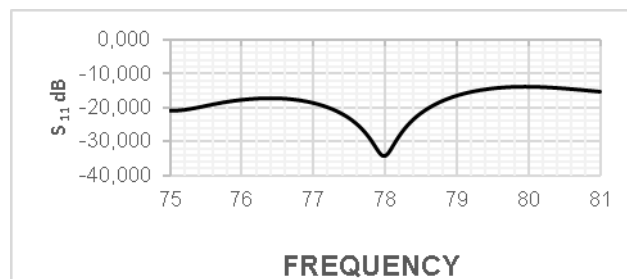


Figure 5. S₁₁ parameter of first antenna at 75-81 GHz

S11 parameter and bandwidth values of second antenna (Figure 2) for three frequency bands are shown in Table 2. This antenna has S11 value of -17.90 dB and bandwidth of 6000 MHz at 79 GHz. However any measurement could not be done for this frequency band like the first antenna.

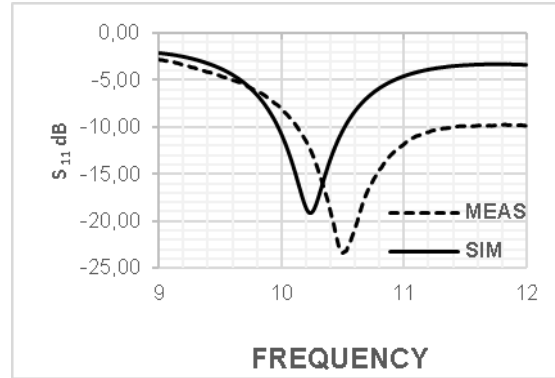


Figure 6. S_{11} parameter of second antenna at 9-12 GHz

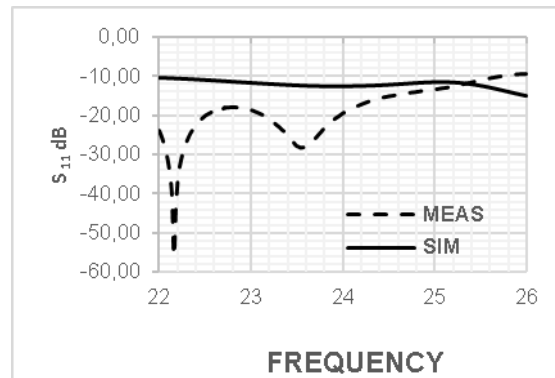


Figure 7. S_{11} parameter of second antenna at 22-26 GHz

Table 2: Parameters of second antenna (* could not measure)

Simulation			Measured		
Frequency Band	S_{11}	BW (MHz)	Frequency Band	S_{11}	BW (MHz)
10.2 GHz	-19.10	545	10.5 GHz	-23.34	1245
24 GHz	-12.60	4000	24 GHz	-19.46	3720
79 GHz	-19.10	6000	79 GHz	*	*

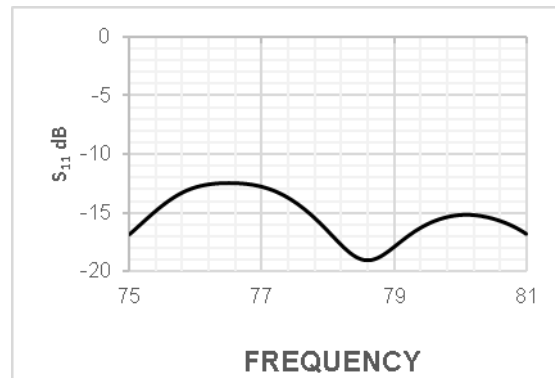


Figure 8. S_{11} parameter of second antenna at 75-81 GHz

2.CONCLUSION

At present, the most widely used frequency in automobile radar is 24 GHz. However, when the work of 79 GHz reaches sufficient level, the systems will start to use this frequency. At this point two different antenna designs are proposed for use in automobile radars. The two designed antennas were produced and measured.

By the results of the simulation of first antenna; for 24 GHz return loss value is -10.42 dB, bandwidth is 3532 MHz, for 79 GHz return loss value is -16.50 dB, bandwidth is 6000 MHz and for 10.20 GHz return loss value is -33.58, and bandwidth is 700 MHz. In order to enhance the performance, second antenna is designed by changing the first antenna. The results of the simulation of second antenna; for 24 GHz return loss value is -12.60 dB, bandwidth is 4000 MHz, for 79 GHz return loss value is -18.00 dB, bandwidth is 6000 MHz and for 10.20 GHz return loss value is -19.10, bandwidth is 535 MHz. Designed antennas were produced and its seen that simulation results of return loss were coherent with measurements at 10-11 GHz and 22-26 GHz bands. Measurement results of first antenna; for 10.5 GHz return loss is -21.60 dB, bandwidth is 630 MHz and for 24 GHz return loss is -15.66 dB, bandwidth is 4000 MHz. Measurement results of second antenna; for 10.5 GHz return loss is -23.34 dB, bandwidth is 1245 MHz and for 24 GHz return loss is -19.46 dB, bandwidth is 4000 MHz.

It is seen that the measurements made are consistent with the simulation results. According to the measured results, the second antenna performance is better than the first antenna in all frequency bands. In the third frequency band, 75 - 81 GHz, the simulation result of second antenna is better than the first antenna. According to these results, the second antenna is suitable for use on 22 - 26 GHz and 75 - 81 GHz car radars.

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Anthropogenic Biomes (Anthromes) of Turkey

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Abstract: Today's landscape has transformed into a complex system due to the interaction of natural processes and human activities. This transformation stemming from anthropogenic pressures of human and human activities in the last century has put pressure on terrestrial ecosystems and given rise to the emergence of the notion of anthromes defined as anthropogenic biomes or human biomes. This notion put forward by Anthromes Working Group has been invented to understand the ecological patterns and interactions of biomes in terrestrial ecosystems. Thus, anthromes provide information about the change of classical biomes through human influence, shed light on the intensity of man-made changes and help to model and evaluate global biotic or ecological footprints from the past to the future. The purpose of this study is to detect and map current anthromes in Turkey. To this end, the study used the anthromes classification system developed by Anthromes Working Group and cartographic methods based on Geographic Information System (GIS) techniques. Turkey's anthropogenic biomes map was created through the comparative analysis of previous research data and the current satellite imagery in the dataset obtained from the Copernicus land monitoring service. The study sought to answer the research questions about the detection and spatial distribution of anthromes classes, thereby significantly and directly contributing to the understanding of Turkey's anthropogenic geography. The study results demonstrated that used anthromes constitute a larger part in the anthromes classification of Turkey compared to the smaller rate of wild anthromes, while seminatural anthromes spread on Turkey's land at a ¼ rate. Thus, the results indicate a day-by-day decline in natural areas due to the current anthropogenic activities in Turkey compared to the increase in artificial areas. Unless wild anthromes are prevented from disappearing, it may soon lead to serious problems including biomedical crises or intensified degradation of natural ecosystems. In order to avoid such problems, careful planning should be done to protect natural areas and work should be carried out to regularly monitor anthromes.

Keywords: Anthropogenic Biomes, Used anthromes, Anthromes anthromes, Wild anthromes, Turkey.

1.INTRODUCTION

Today's landscape has transformed into a complex system due to the interaction of natural processes and human activities. This transformation stemming from anthropogenic pressures of human and human activities in the last century has put pressure on terrestrial ecosystems and given rise to the emergence of the notion of anthromes defined as anthropogenic biomes or human biomes. This notion put forward by Anthromes Working Group has been invented to understand the ecological patterns and interactions of biomes in terrestrial ecosystems (Ellis et al., 2010; Ellis, 2013; 2014; 2015). Thus, anthromes provide information about the change of classical biomes through human influence, shed light on the intensity of man-made changes and help to model and evaluate global biotic or ecological footprints from the past to the future (Özşahin and Eroğlu, 2017).

This study aimed to detect and map current anthromes in Turkey and sought answers to the research questions on the identification and geographical distribution of anthromes. Thus, this study is of importance in contributing to understanding the anthropogenic geography of Turkey.

2.MATERIALS AND METHODS

The study used the new anthromes classification system developed by Anthromes Working Group and cartographic methods based on geographic information system (GIS) techniques. The map of Turkey's Anthropogenic Biomes of 500 x 500 m resolution was created in line with the anthromes classification system through the comparative analysis of current research data and the dataset drawn from the National Land Cover Classification and Tracking System (UASİS in its Turkish acronym). The accuracy of the map data was verified using the LANDSAT and RASAT satellite images available for free on the Internet.

Table 1. The Description of the New Anthromes Classification

Level	Class	Description
USED ANTHROMES		
Dense settlements		Urban and other dense settlements
11	Urban	Dense built environments with very high populations
12	Mixed settlements	Suburbs, towns and rural settlements with high but fragmented populations
Villages		Dense agricultural settlements
21	Rice villages	Villages dominated by paddy rice
22	Irrigated villages	Villages dominated by irrigated crops
23	Rainfed villages	Villages dominated by rainfed agriculture
24	Pastoral villages	Villages dominated by rangeland
Croplands		Lands used mainly for annual crops
31	Residential irrigated croplands	Irrigated cropland with substantial human populations
32	Residential rainfed croplands	Rainfed croplands with substantial human populations
33	Populated rainfed cropland	Croplands with significant human populations, a mix of irrigated and rainfed crops
35	Remote croplands	Croplands without significant populations
Rangeland		Lands used mainly for livestock grazing and pasture
41	Residential rangelands	Rangelands with substantial human populations
42	Populated rangelands	Rangelands with significant human populations
43	Remote rangelands	Rangelands without significant human populations
SEMINATURAL ANTHROMES		Inhabited lands with minor use for permanent agriculture and settlements
51	Residential woodlands	Forest regions with minor land use and substantial populations
52	Populated woodlands	Forest regions with minor land use and significant populations
53	Remote woodlands	Forest regions with minor land use without significant populations
54	Inhabited treeless and barren lands	Regions without natural tree cover having only minor land use and a range of populations
WILD ANTHROMES		Lands without human populations or substantial land use
61	Wild woodlands	Forests and savanna
62	Wild treeless and barren lands	Regions without natural tree cover (grasslands, shrublands, tundra, desert and barren lands)

3.RESULTS AND DISCUSSION

According to the new anthromes classification, the volume and geographical distribution of anthromes in Turkey are relatively little different compared to the rest of the world. Although the percentage of used anthromes is greater both in Turkey and in the world compared to the other anthrome classes, this is not true for seminatural and wild anthromes. Accordingly, the percentage of seminatural anthromes is 19.2% and that of wild anthromes is 25.3% in the world, while they are 24.9% and 5.1%, respectively, in Turkey (Figure 1; Table 2). Thus, it seems that the anthropogenic change and transformation in Turkey occurred faster and more intensely compared to the world.

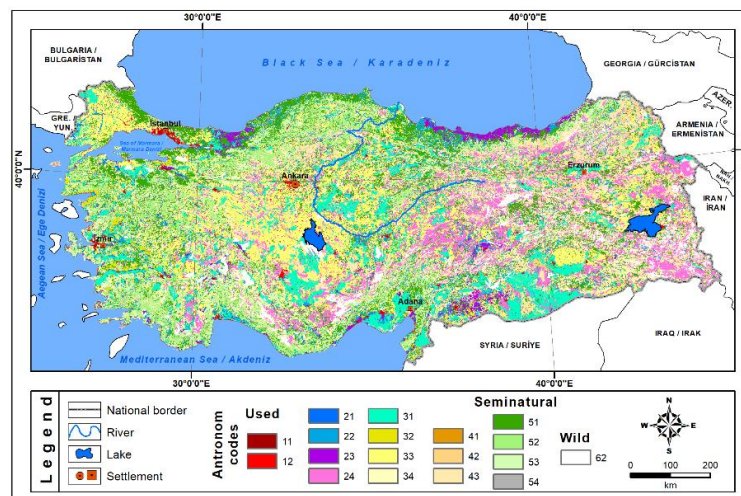


Figure 1. Anthropogenic Biomes in Turkey according to the New Anthromes Classification

Table 2. A Comparison of the Proportional Distribution of the New Anthromes Classes

Level	Class	World	Turkey		
USED ANTHROMES					
Dense settlements		Area (ha)	%	Area (ha)	%
11	Urban	684.360	0.5	129.100	0.2
12	Mixed settlements	915.144	0.7	19.569.275	24.9
Villages					
21	Rice villages	2.195.127	1.7	4.309.725	5.5
22	Irrigated villages	1.733.295	1.4	8.926.750	11.4
23	Rainfed villages	3.576.908	2.8	7.866.875	10.0
24	Pastoral villages	819.547	0.6	500	0.001
Croplands					
31	Residential irrigated croplands	1.090.155	0.9	474.000	0.6
32	Residential rainfed croplands	10.307.863	8.0	10.543.150	13.4
33	Populated rainfed cropland	6.037.937	4.7	214.975	0.3
34	Remote croplands	2.514.529	2.0	91.700	0.1
Rangeland					
41	Residential rangelands	7.908.903	6.2	1.938.150	2.5
42	Populated rangelands	13.753.742	10.7	150	0.0002
43	Remote rangelands	19.595.557	15.3	875.750	1.1
SEMINATURAL ANTHROMES					
51	Residential woodlands	4.896.997	3.8	3.876.375	4.9
52	Populated woodlands	9.305.111	7.3	12.830.200	16.3
53	Remote woodlands	5.008.400	3.9	2.563.225	3.3
54	Inhabited treeless and barren lands	5.463.074	4.3	302.500	0.4
WILD ANTHROMES					
61	Wild woodlands	17.749.664	13.8	0	0
62	Wild treeless and barren lands	14.629.299	11.4	3.977.300	5.1
TOTAL		128.185.612	100	78.489.700	100

The results of the study showed that according to the new anthromes classification of Turkey, the percentage of used anthromes is larger than wild anthromes and seminatural anthromes spread on the land of Turkey at a ¼ rate. Thus, the results indicate a day-by-day decline in natural areas due to the current anthropogenic activities in Turkey compared to the increase in artificial areas. Unless wild anthromes are prevented from disappearing, it may soon lead to serious problems including biomedical crises or intensified degradation of natural ecosystems. In order to avoid such problems, careful planning should be done to protect natural areas and work should be carried out to regularly monitor anthromes.

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Methanation of Carbondioxide over the Nay-Zeolite and Molecular Sieve Supported Nio Composed Catalysts

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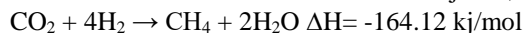
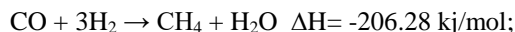
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Abstract: In this study, methanation of carbondioxide was studied over the molecular sieve and NaY-zeolite supported NiO catalysts. Catalysts were prepared by using two different impregnation method. The first one is traditional impregnation method and second one is surfactant assisted impregnation method. Surfactant used in order to improve the average pore size, pore volume and distribution of active component in the porous structures of the support. All catalysts characterized by using different characterization techniques. X-Ray diffraction analysis used to find the crystal phases present in the catalysts and to calculate the average crystal sizes. The N₂ physisorption analysis used to observe the surface area, pore volume and average pore diameter present in the catalysts. CO₂ methanation were done between the 300°C and 600°C temperatures by using 25% CO₂, 50% H₂ and remain He feed condition. CO₂ methanation activity studies showed that molecular sieve supported NiO catalysts are most active catalysts in comparison with the NaY-Zeolite supported catalysts. NiO/MS-S catalyst prepared by the surfactant assisted impregnation method gave 50% CO₂ conversion to methane above the 500°C and NiO/MS catalyst prepared by the traditional impregnation method gave maximum 23% CO₂ conversion to methane at 600°C temperature. Activity results showed that preparation of catalysts by using surfactant lead to increase in the activities of the catalysts for the CO₂ methanation reaction.

1.INTRODUCTION

Methane is an energy carrier of significant importance to the industry, energy, and transportation sectors worldwide. Its existing distribution infrastructure in many countries makes it a constitutive element of modern economies. The major share of industrially used methane comes from fossil natural gas resources. However, the debate of the finiteness of fossil resources and climate change caused the research expenditures relating to catalytic and biological methane production from carbon oxide-rich gases (methanation) to increase over the last years. Research into catalytic methanation processes focuses on two options, CO methanation and CO₂ methanation. Methanation processes aim to produce methane from hydrogen and carbon oxides. The conversion of carbon monoxide is referred to as CO methanation, the conversion of carbon dioxide as CO₂ methanation, respectively. (HABAZAKI 1998; DU 2007; YACCATO 2005; TAKENAKA 2004; CHOUDHURY 2006)



2.MATERIALS AND METHODS

Catalysts Preparation

In this study, NiO/NaY-Zeolite and NiO/Molecular Sieve catalysts were prepared 5/95 weight ratio. Catalysts were prepared by using two different impregnation method. The first one is traditional impregnation method and second one is surfactant assisted impregnation method. The detailed description of the methods are given below.

Impregnation Method: The Ni(NO₃)₂·6H₂O, NaY-Zeolite and Molecular Sieve were used to prepare NiO/NaY-Zeolite and NiO/Molecular Sieve catalysts. . After weighting the precursor salts the solvent (water) added and then mixture was mixed at room temperature for 3 hour. After mixing step, the solution was dried in furnace for a day at 40 °C and then dried at 110°C overnight. Two-step drying was used the remove solvent from the solute in controlling way. Then catalyst was calcined at 500°C for 3 hour in order to obtain the desired crystal structure.

Surfactant Assisted Impregnation Method: This preparation method is in the same way with the impregnation method. The difference here is the addition of surfactant CTAB (Cetyltrimethylammonium bromide). The amount of the CTAB that was used in the preparation was determined from the metal ratio present in the catalyst to CTAB.

Catalysts Characterization

The BET multipoint surface areas of the catalysts were evaluated by using a Quantochrome Autosorp 1C/MS device. Before the analysis, the samples were outgassed at 300 °C for 1 h. X-ray diffraction patterns were obtained using a PHILIPS PW 1840 diffractometer. A Rigaku rotating anode X-ray diffractometer system generating CuK α radiation was used to obtain XRD patterns.

CO₂ Methanation Catalytic Activity Studies

The catalytic activity tests of the catalysts were carried out at atmospheric pressure and in the temperature of 300°C – 600°C in a fixed bed quartz reactor having an internal diameter of 5mm. The gas mixture 25 vol.% CO, 50 vol.% H₂ and remain He was fed to the reactor with a total flow rate of 25 ml min⁻¹. The space velocity was 45,000 h⁻¹. The reactant and product gas composition was analyzed by a gas chromatograph (CLARUS 500, PerkinElmer) equipped with thermal conductivity detector (TCD) filling of column is carbosphere.

3.RESULTS AND DISCUSSION

Table 1 shows the multipoint BET surface areas and average pore diameter results of the catalysts obtained from the N₂ physisorption analysis. Results show that using surfactant at the preparation lead to increase in the surface areas of the catalysts. On the other hand, NaY-zeolite supported catalysts gave highest surface area results. All catalysts have average pore diameter in the mesopore diameter scale. Table 2 shows the meso+micro pore volume and total pore volume of the catalysts. Molecular sieve supported NiO catalysts prepared by the impregnation method has highest total pore volume value and this catalysts also has highest macro pore volume value.

Table 1. Physical properties of the catalysts obtained from the N₂ physisorption analysis.

Catalysts	Multipoint BET Surface Area m ² /g		Average Pore Diameter, Å	
	Impregnation	Surfactant Assisted Impregnation	Impregnation	Surfactant Assisted Impregnation
Ni/NaY-Zeolite	546	683	26, 37, 63, 116	21, 38, 63, 91
Ni/Molecular Sieve	29.3	33	42, 77	24, 38, 94, 171

Table 2. Pore volume results of the catalysts obtained from the N₂ physisorption analysis.

Catalysts	Total Pore Volume, cm ³ /g STP (gas volume)		Meso+Micro Pore Volume, cm ³ /g STP (gas volume)	
	Impregnation	Surfactant Assisted Impregnation	Impregnation	Surfactant Assisted Impregnation
Ni/NaY-Zeolite	184	228	176	219
Ni/Molecular Sieve	1015	102	383	75

Figure 1 and Figure 2 shows the CO₂ methanation activity results of the catalysts. All catalysts gave high activity at high temperatures. CO₂ methanation activity studies showed that molecular sieve supported NiO catalysts are most active catalysts in comparison with the NaY-Zeolite supported catalysts. NiO/MS-S catalyst prepared by the surfactant assisted impregnation method gave 50% CO₂ conversion to methane above the 500°C and NiO/MS catalyst prepared by the traditional impregnation method gave maximum 23% CO₂ conversion to methane at 600°C temperature. Activity results showed that preparation of catalysts by using surfactant lead to increase the activities of the catalysts for the CO₂ methanation reaction.

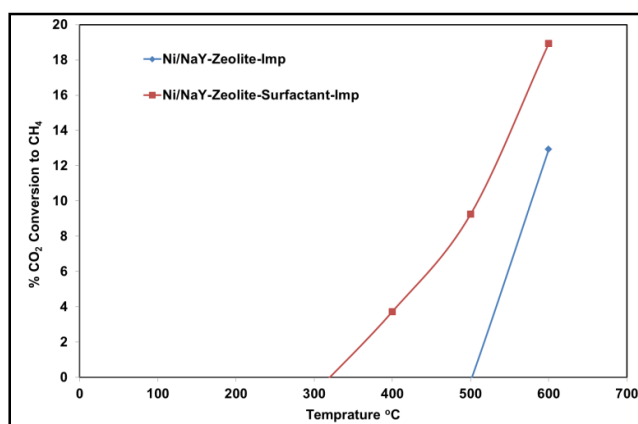


Figure 1. CO₂ methanation activities as a function of temperature of the NaY-Zeolite supported NiO composed catalysts.

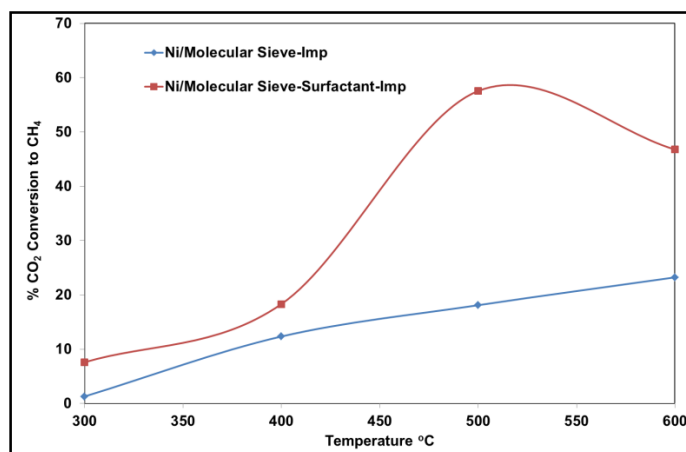


Figure 2. CO₂ methanation activities as a function of temperature of the Molecular Sieve supported NiO composed catalysts.

In this study, effect of the surfactant that used in the catalysts preparation on the CO₂ methanation activities of the NaY-zeolite and Molecular Sieve supported NiO catalysts were investigated. Multipoint BET surface area results showed that using surfactant lead to increase in surface area values by improving the porosity of the catalysts. However, highest surface area values were obtained over the NaY-Zeolite supported catalysts. Average pore diameter and pore volume results showed that all catalysts showed meso pore structure. But according the pore volume results, the macropore ratio in the molecular sieve supported NiO catalysts prepared by the impregnation method was high which was obtained by comparison the total pore volume value with meso+micro pore volume values. The value of the macro pores for other catalysts were low in compare with the meso+micro pores. According to the X-Ray diffraction results, NiO crystal phase was obtained from all catalysts which was the desired metaloxide crystal phase in catalysts structures. CO₂ methanation activity studies showed that molecular sieve supported NiO catalysts are most active catalysts in comparison with the NaY-Zeolite supported catalysts. Although surface areas of the NaY-zeolite supported catalyst \approx 20 times greater than the molecular sieve catalyst, molecular sieve supported NiO catalysts are most active catalysts. This result indicate that high surface area has no effect on the CO₂ methanation activity in this study. NiO/MS-S catalyst prepared by the surfactant assisted impregnation method gave 50% CO₂ conversion to methane above the 500°C and NiO/MS catalyst prepared by the traditional impregnation method gave maximum 23% CO₂ conversion to methane at 600°C temperature. Activity results showed that preparation of catalysts by using surfactant lead to increase the activities of the catalysts for the CO₂ methanation reaction.

N₂ physisorption analysis results showed that surfactant significantly affects the surface area values. Although NiO/Molecular Sieve catalyst prepared by using the surfactant has low surface area value, it shows highest CO₂ methanation activity. In general, all catalysts gave CO₂ conversion at higher temperatures.

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Accurate Modeling for Photovoltaic Modules

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Abstract: This paper presents a method to determine series and shunt resistances of the photovoltaic (PV) module. The method used only the data commonly provided by the PV module manufacturer. The model of three different type of PV technology are developed and simulated in Matlab/Simulink environment. The results showed the importance of considering the effect of intrinsic resistances for accurate PV module modeling.

Keywords: Photovoltaic module, Series resistance, Shunt resistance, Matlab.

1. INTRODUCTION

Generating environmentally safe energy is one the most important challenges facing the world. The energy through the photovoltaic system is clean and sustainable because of the abundance and ubiquity of the solar energy. Solar photovoltaic industry production rose more modestly than in previous years, increasing by about 20% and reaching a worldwide production volume of about 60 GW of PV modules in 2016. The compound annual growth rate (CAGR) over the last 15 years was above 40% which makes PV one of the fastest growing industries at present [1].

The PV module manufacturer provides a datasheet of the module's performance. This performance is evaluated under standard test conditions (STC), where the solar irradiance of 1000 W/m² is used, the cell's temperature is considered as 25°C and the average of solar spectrum at air mass (AM) is equal to 1.5. Some parameters such as the series and shunt resistances are unfound in the datasheet commonly provided by the manufacturer. Using PV models without defining these resistances result in modeling inaccuracy because the behavior of PV module is strongly influenced by these resistances.

The aim of this paper is to define the equations describing the PV module and then presents a method to determine the series and shunt resistances using only the datasheet. The series resistance is a lumped parameter value which represents a variety of internal resistances such as resistance introduced in cell solder bonds, emitter and base regions, cell metallization and cell-interconnected busbars [2]. The shunt resistance value represents any parallel high conductivity paths across the PV cell.

Different methods to estimate the parameters necessary to model a PV module are found in the literature [3-10]. Three different type of PV technology are modeled and evaluated under Matlab/Simulink platform. The simulation results demonstrated clearly the effect of resistances on the output power of the different PV modules.

Modelling of The PV Module

A common one-diode equivalent circuit for PV cell found in the literature is shown in Figure 1. PV module is a group of PV cells connected in series or parallel. The analysis of the circuit results to the mathematical expression of the output current of the PV module, as described in equation (1).

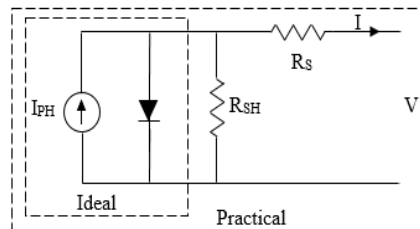


Figure 1. Equivalent circuit of PV cell

$$I = I_{PH} - I_S \left[e^{\frac{q(V+R_S I)}{N_S n k T}} - 1 \right] - \frac{V+R_S I}{R_{SH}} \quad (1)$$

I and V are the output current and voltage of PV module. I_{PH} is the photo-generated current. I_S is the cell's saturation current. T is the temperature of the cell. N_S , k , q and n represent the number of cells connected series in the PV module,

the Boltzmann constant (1.38064×10^{-23}), the electron charge (1.60217×10^{-19}), and the quality factor of the used material, respectively. R_S and R_{SH} are the intrinsic equivalent series and shunt resistances.

The cell's saturation current depends on the cell temperature as described in equation (2). The photo-generated current varies with cell's working temperature and the solar insolation. Its relationship with these two factors is given in equation (3) [11-12].

$$I_S = \frac{I_{SC,STC} + K_I \Delta T}{\frac{q(V_{OC,STC} + K_V \Delta T)}{N_s n k T} - 1} \quad (2)$$

$$I_{PH} = [I_{PH,STC} + K_I \Delta T] \left[\frac{G}{G_{STC}} \right] \quad (3)$$

$I_{SC,STC}$ and $V_{OC,STC}$ are the short-circuit current and open-circuit voltage at STC. $I_{PH,STC}$ is the photo-generated current at STC. K_I and K_V are the temperature coefficients of short-circuit current and open-circuit voltage. ΔT ($\Delta T = T - T_{STC}$) is the difference of temperature between cell's working temperature and cell's temperature at STC. G and G_{STC} are the actual irradiation and irradiation at STC.

Equation (3) shows that when the cell works at STC ($T = T_{STC}$ and $G = G_{STC}$), the photocurrent becomes equal to the short circuit current ($I_{PH,STC} = I_{SC,STC}$).

The ideal PV module model does not take into account the resistances effect on the output power. Therefore it can be modeled by taking series resistance with a minimum value (0Ω) and shunt resistance with a maximum value (10000Ω).

To be able to model a practical PV module, it is necessary to determine the different parameters that describe the equations (1), (2) and (3). Most of these parameters ($I_{SC,STC}$, $V_{OC,STC}$, K_I , K_V , N_s , n , T_{STC} , G_{STC}) are given by the datasheet of the PV module. However the series and shunt resistances values that influence the output power of the PV module remain unknown. Determining them make the proposed model the most representative of the chosen PV module.

2. MATERIALS AND METHODS

The determination of these resistances is either mathematically done or by relying on experimental data [3-10]. The method used in this work is based on the fact that the maximum power obtained by adjusting R_S and R_{SH} , is equal to the maximum power given by the datasheet. This may be a solution for finding the values of the resistances [12].

According to [12] and [13], the initial value of series resistance may be 0, its maximum value ($R_{S,max}$) can be expressed as in (4) and the minimum value of shunt resistance ($R_{SH,min}$) may be given by equation (5).

$$R_{S,max} = \frac{V_{OC,STC} - V_{MP,STC}}{I_{MP,STC}} \quad (4)$$

$$R_{SH,min} = \frac{V_{MP,STC}}{I_{SC,STC} - I_{MP,STC}} - \frac{V_{OC,STC} - V_{MP,STC}}{I_{MP,STC}} \quad (5)$$

$I_{MP,STC}$ and $V_{MP,STC}$ are the maximum current and voltage at maximum power of PV module under STC. Their values are found in the datasheet. In this work, the determination of R_S and R_{SH} is done by adjusting their values until the output power of the PV module matches with the maximum power ($P_{MP,STC}$) under STC which is described in equation (6).

$$P_{MP,STC} = V_{MP,STC} I_{MP,STC} \quad (6)$$

3.RESULTS AND DISCUSSION

The PV module is built in Simulink/Matlab environment, as shown in Fig.2. A ramp block that generates a signal that starts at a specific time and value, is used for modeling the voltage. the outputs are scoped with the voltage in order to get the current-voltage (I-V) and power-voltage (P-V) characteristics.

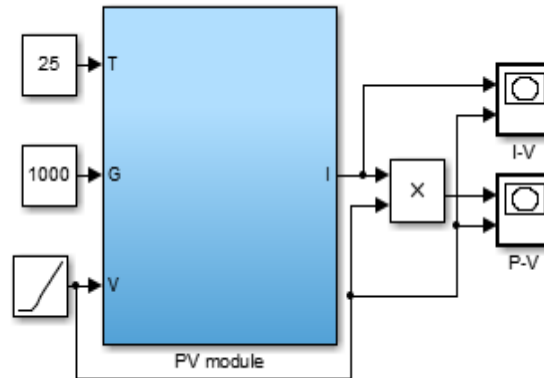


Figure 2. PV module built in Matlab

The subsystem implementing the PV module shown in Fig. 2 is depicted in Fig. 3. The modeling is based on the inputs values (Fig. 3 (a)), which are the temperature and the solar irradiance, the parameters values (Fig. 3 (b)) taken from the datasheet and the calculated resistances values (Fig. 3 (c)). In addition to that math blocks of Simulink/Matlab program are used to calculate equations (1), (2) and (3) that describe the PV module's working principle.

The method used in this paper is to compute R_S and R_{SH} until their values math with the maximum power given by the datasheet. The simulation started from R_S equal to 0Ω and R_{SH} equal to 10000Ω . This represents an ideal model of PV module, which does not take into account the losses resulting from the presence of the resistances.

The simulation continued with the minimum values of R_S and R_{SH} (85.62Ω calculated from equation (5)) and by adjusting only R_S until its maximum value (equation (4)) is reached. R_S is expected between $R_{S,min}$ (0Ω) and $R_{S,max}$ (1.38Ω). Table I shows the different simulations (1 to 7) with different values of R_S . The used PV module is KYOCERA KC50T.

Table I. Simulation results with different of R_S

$R_S (\Omega)$	0	0	0.276	0.552	0.828	1.104	1.38
$R_{SH} (\Omega)$	10000	85.62	85.62	85.62	85.62	85.62	85.62
$P_{MP,STC} (W)$	58.46	54.41	52.05	49.59	47.35	45.01	42.75

It is pointed out from Table I, that the corresponding values of R_S and R_{SH} , that can match with the maximum power may respectively be around 0.1Ω and 100Ω . Therefore the simulation continued with these values as initial values, as shown in Table II.

This iterative method to compute R_S and R_{SH} gave approximatively R_S equal to 0.1Ω and R_{SH} equal to 96Ω which match with $53.999 W$, which is approximatively equal to the maximum power ($54 W$) of the chosen PV module at STC. These resistances values make the proposed model the most representative of the chosen PV module.

The same iterative method has been evaluated with three different PV module technology. The type of these PV modules are monocrystalline silicon (SINEFO SFM050), polycrystalline silicon (KYOCERA KC50T) and thin-film technology, which is copper indium diselenide (SHELL ST40) based solar cells. Table III summarizes the different parameters with resistances series and shunt calculated of the different PV modules and their I-V and P-V characteristics under STC are shown in Fig. 4, Fig. 5 and Fig. 6.

The effect of resistances on the output power of the PV module is clearly demonstrated and neglecting these resistances leads to inaccurate results when modeling PV module.

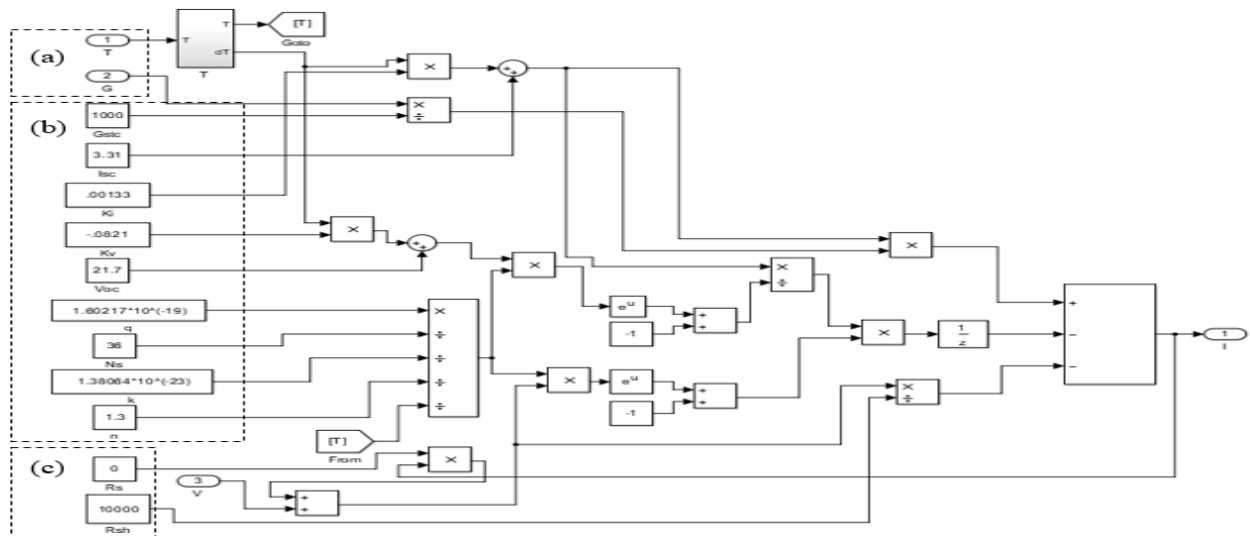


Figure 3. Simulink model of the PV module

Table 2. Simulation results with different of R_s and R_{sh}

R_s (Ω)	0.1	0.1	0.15	0.15	0.15	0.125	0.1	0.1	0.1	0.1	0.11	0.1	0.1
R_{sh} (Ω)	100	95	95	100	97.5	97.5	97.5	98	97.25	97	97	96.75	96
P_{MP} (W)	54.14	53.96	53.46	53.64	53.55	53.81	54.05	54.07	54.04	54.03	53.94	54.02	53.999

Table 3. PV modules parameters

PV modules	$P_{MP,STC}$ (W)	$V_{MP,STC}$ (V)	$I_{MP,STC}$ (A)	$V_{OC,STC}$ (V)	$I_{SC,STC}$ (A)	K_v ($V/^{\circ}C$)	K_i ($A/^{\circ}C$)	N_s	n	P_{MP} (simulation)	R_s (Ω)	R_{sh} (Ω)
KYCERA KC50T	54	17.4	3.11	21.7	3.31	-	0.00133	36	1.3	53.999	0.1	96
SINEFO SFM050	50	17.3	2.90	21.6	3.18	-	0.00159	36	1.3	49.993	0.09	66.5
SHELL ST40	40	16.6	2.41	23.3	2.68	-0.1	0.00035	42	1.5	40.002	0.45	59

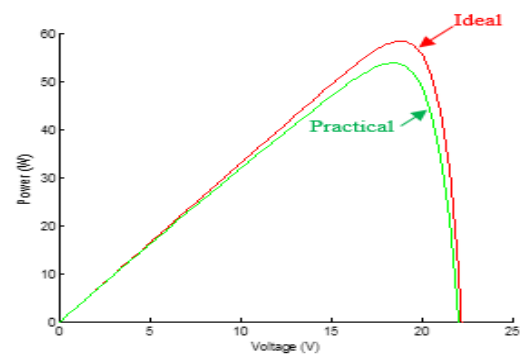
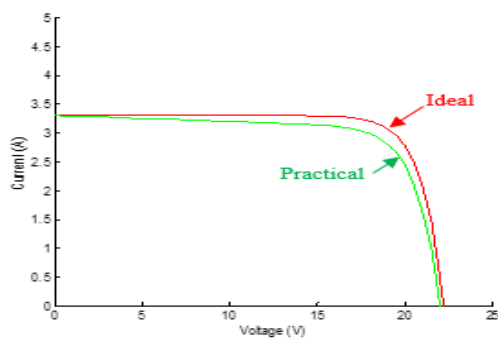


Figure 4. I-V and P-V characteristics of KYOCERA KC50T

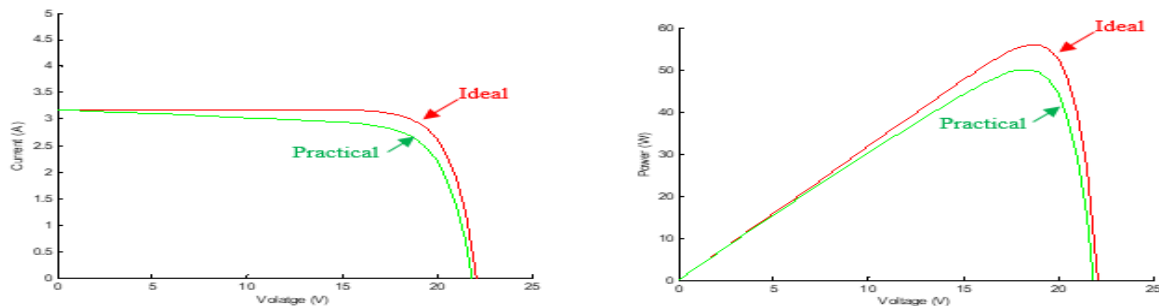


Figure 5. I-V and P-V characteristics of SINEFO SFM050

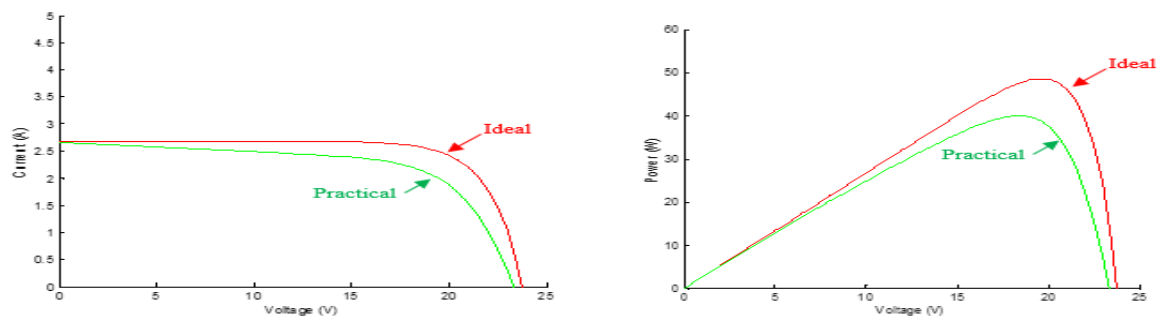


Figure 6. I-V and P-V characteristics of SHELL ST40

This paper proposed a method of series and shunt resistances determination. The proposed method is simple and used only the datasheet of the module. Matlab/Simulink program was used to model and simulate the different type of PV modules, which are monocrystalline silicon, polycrystalline silicon and thin-film technology. It is observed that the values of series and shunt resistances play an important role in the modeling of PV module.

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Effect of Nitrate and/or Nitrite on Free Amino Acid Composition of Pastırma

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Abstract: The aim of the research was to determine the effect of nitrate and / or nitrite on the free amino acid composition of pastırma, a traditional Turkish meat product. For this purpose, four different curing mixtures (I. 150 mg/kg KNO₃, II. 300 mg/kg KNO₃, III. 150 mg/kg NaNO₂ and IV. 150 mg/kg KNO₃ + 150 mg/kg NaNO₂) were used and pastırma production was carried out under traditional conditions. *M. longissimus thoracis et lumborum* was used as raw material in production and production was repeated twice. After production, pastırma samples from each group were examined for free amino acid composition. The free amino acid composition of the samples was determined by HPLC using a fluorescence detector and the results were expressed as mg / 100g dry matter. The usage of different curing mix had a significant effect (P<0.05) on aspartic acid, histidine, arginine, tyrosine, phenylalanine and proline, while it had a very significant effect (P<0.01) on serine, glycine, cystine and valine. On the other hand, the usage of different curing mix had not a significant effect (P>0.05) on glutamic acid, threonine, alanine, methionine, isoleucine, leucine and lysine amino acids. Alanine, glutamic acid, arginine, leucine and lysine were predominant amino acids in pastırma samples. In addition, the highest total amino acid amount was determined in the pastırma group produced using 150 ppm KNO₃ while it lowest in the pastırma group produced using 150 ppm KNO₃ + 150 ppm NaNO₂ combination.

Keywords: Pastırma, free amino acid, curing, nitrate, nitrite

1.INTRODUCTION

Pastırma, categorized in intermediate moisture foods, is a traditional Turkish meat product processed in pieces (Gökalp *et al.* 1999). Pastırma is accepted as a safe meat product due to low water activity (Öztürk 2015) and curing applied in the production process (Kaban 2013). Nitrite and/or nitrate in curing process are used as curing agent in the product processing (Gökalp vd 1999; Aksu ve Kaya 2002; Uğuz *et al.* 2011).

Amounts of peptides with low molecular weight and free amino acid increase during production process of dry-cured meat product like pastırma due to proteolysis reaction (Toldra 2006).

The aim of the present study was to determine the effect of different curing mix (I. 150 mg/kg KNO₃, II. 300 mg/kg KNO₃, III. 150 mg/kg NaNO₂ and IV. 150 mg/kg KNO₃ + 150 mg/kg NaNO₂) on the free amino acid composition of pastırma.

2.MATERIALS AND METHODS

Production of Pastırma

M. Longissimus thoracis et lumborum muscles obtained from two different beef carcasses were used as raw material in production. Pastırma was manufactured in local factory according to method reported by Gökalp vd (1999) and Tekinşen and Doğruer (2000), and production was repeated twice.

Determination of Free Amino Acid Composition

Free amino acid extraction of the samples was performed according to Aristoy and Toldra (1991) and Antoine *et al.* (1999), with slight modifications. The free amino acid composition of the samples was determined by HPLC (Thermo scientific) with fluorescence detector and Zorbax Eclipse-AAA 4.6 x 150mm, 3,5 µm column. Amino acid mix solution (Sigma-Aldrich, 79248) was used as amino acid standard. OPA (ortho-phthalaldehyde) and FMOC (9-fluorenylmethyl chloroformate) as derivatization reagent for amino acids, 0.4 N Borate (Agilent PN 5061-3339; pH 10.2) as the buffer solution were used. Mobile phase A: 40 mM NaH₂P0₄ (pH 7.8) and mobile phase B: Acetonitrile: Methanol: Water/ 45: 45: 10, v/v/v solution as the mobile phase was conducted in chromatography system. Flow rate of mobile phase conducted in the system was 2 mL/min and column temperature was 40°C. The free amino acid contents of the samples were given as mg / 100 g dry matter.

3.RESULTS AND DISCUSSION

Duncan multivariate test results regarding to the averages of free amino acid of pastırma produced with different curing mix were given in Table 1.

Table 1. Duncan multivariate test results regarding to the averages of free amino acid of pastırma produced with different curing mix (Average \pm SD)

Amino acid (mg/100 g dry matter)	150 ppm KNO ₃	300 ppm KNO ₃	150 ppm NaNO ₂	150 ppm KNO ₃ + 150 ppm NaNO ₂
Aspartic acid	11,35 \pm 3,25a	8,51 \pm 4,14ab	8,16 \pm 0,91ab	4,62 \pm 2,16b
Glutamic acid	141,73 \pm 10,88a	111,51 \pm 33,38a	138,25 \pm 12,41a	119,62 \pm 50,19a
Serine	145,34 \pm 32,12a	46,28 \pm 29,81b	72,89 \pm 13,18b	73,09 \pm 41,90b
Histidine	22,87 \pm 9,63a	6,97 \pm 2,57b	17,86 \pm 14,54ab	6,92 \pm 3,10b
Glycine	65,41 \pm 12,42a	64,98 \pm 9,75a	42,33 \pm 14,35b	28,92 \pm 13,21b
Threonine	27,85 \pm 6,02a	15,17 \pm 3,69a	16,52 \pm 6,47a	19,61 \pm 12,30a
Arginine	185,58 \pm 25,22a	88,78 \pm 22,31b	139,37 \pm 33,53ab	119,69 \pm 57,43b
Alanine	1615,31 \pm 98,45a	1363,25 \pm 414,69a	1253,04 \pm 430,12a	1052,01 \pm 82,39a
Tyrosine	41,34 \pm 25,95a	22,11 \pm 5,75ab	22,39 \pm 11,63ab	5,72 \pm 2,51b
Cystine	12,46 \pm 3,81a	4,76 \pm 1,73b	5,87 \pm 1,22b	6,10 \pm 3,72b
Valine	73,66 \pm 8,11a	41,27 \pm 18,28b	36,14 \pm 8,54b	38,18 \pm 14,29b
Methionine	19,11 \pm 9,66a	9,43 \pm 3,52a	21,46 \pm 11,53a	13,30 \pm 3,39a
Phenylalanine	37,21 \pm 1,72a	21,67 \pm 8,59b	19,09 \pm 10,63b	18,30 \pm 4,07b
Isoleucine	90,02 \pm 49,61a	62,80 \pm 23,65a	71,10 \pm 19,94a	65,27 \pm 42,62a
Leucine	186,40 \pm 30,45a	125,41 \pm 13,93a	125,56 \pm 41,84a	109,04 \pm 61,92a
Lysine	161,76 \pm 7,26a	99,40 \pm 39,03	136,73 \pm 13,46a	125,14 \pm 69,63a
Proline	10,09 \pm 1,50b	14,36 \pm 2,20a	15,23 \pm 2,10a	12,77 \pm 4,71ab

Different letters in the same line are significantly different (P<0.05)

As can be seen in Table 1, different curing mix had significant (P<0,05) or very significant (P<0,01) effects on the contents of aspartic acid, histidine, arginine, tyrosine, phenylalanine, proline, serine, glycine and valine, while it had no any significant effect (P>0,05) on glutamic acid, threonine, alanine, methionine, isoleucine, leucine and lysine. The highest levels of aspartic acid, serine, cystine, valine and phenylalanine were determined in pastırma cured with 150 ppm KNO₃, whereas the lowest tyrosine amount was detected in pastırma cured with 150 ppm KNO₃+150 ppm NaNO₂. In the present study, amount of free aspartic acid varied between 4,62 \pm 2,16 and 11,35 \pm 3,25 mg/100 g dry matter. However, it is known that aspartic acid amount depends on muscle type used as raw material and processes of products such as ham, lacon and iberian ham (Toldra *et al.* 1997; Toldra *et al.* 2000; Janes *et al.* 2012).

The lowest total free amino acid content was detected in pastırma cured with 150 ppm KNO₃+150 ppm NaNO₂, while the highest total free amino acid content was determined in pastırma cured with 150 ppm KNO₃. It was determined that alanine, glutamic acid, arginine, leucine and lysine were predominant amino acids in pastırma samples. Similarly, alanine was the predominant amino acid in other studies on free amino acid content of pastırma (Ceylan and Aksu 2011; Erdemir and Aksu 2017).

In the present study, cystine amount was lower than other free amino acid contents. There are similar results in the literature. Janes *et al.* (2012) found that cystine amount was lower than 50 mg/100 g dry matter in dry-cured products produced with different muscles. This could be due to the fact that the production time of the ham is longer than that of pastırma production. However, aspartic acid, glutamic acid, arginine, valine, alanine and lysine amounts were generally similar to those of the literature (Ceylan and Aksu 2011; Deniz *et al.* 2016; Erdemir and Aksu 2017). The amount of histidine was determined between 6,92 \pm 3,10 and 22,87 \pm 9,63 mg/100 g dry matter; however, this result is quite different from that of Erdemir and Aksu (2017). This result could be due to decarboxylation of histamine or convert to new products by other reaction. Serine amount varied between 46,28 \pm 29,81 and 145,34 \pm 32,12 mg/100 g dry matter in the samples. On the other hand, it was determined that serine could be higher in dry-cured products produced with the larger pieces and longer process (Zhao *et al.* 2005; Janes *et al.* 2012).

In conclusion, different curing mix had a significant effect on total free amino acid composition. However the effects of different curing mix on free amino acids varied depending on the amino acid type.

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Evaluation of Agro-Industrial Wastes as Prebiotic

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Abstract: Consumers prefer to eat functional foods containing probiotics and prebiotics that have beneficial health effects. Researchers have focused on novel prebiotic components derived by-products of food processing. Among by-products of food processing industry agro-industrial wastes contain some ingredients such as fermentable sugars, valuable nutrient components, and fibers. This is a mini review providing insights on the detailed current knowledge about to production of new prebiotics from agro-industrial wastes.

Keywords: Agro-Industrial Wastes, Probiotic, Prebiotic

1.INTRODUCTION

Functional foods provide a beneficial effect on human health beyond nutritional needs when consumed at efficacious levels as part of a varied diet on a regular basis. Currently, consumers prefer to consume functional foods containing biologically active components, as they become more aware of the link between food and health. Among these functional components, probiotics and prebiotics have a promising field of developing novel foods, strategies and tools to improve health. Therefore, recently the researchers have focused on novel probiotics and prebiotics in importance due to the fast-paced *research* in human microbiome science (Farnworth and Champagne, 2015).

Probiotics, viable non-pathogenic microorganisms, contribute beneficial health effects when administered in sufficient amounts. The suggested health benefits of probiotics are managing lactose intolerance, stimulating the immune system, reducing the cholesterol and blood pressure, preventing certain cancer types, improving the gut microbial balance and inhibiting intestinal pathogens. In order to exert the positive effects on health of the host, it was recommended that probiotic foods should contain probiotic bacteria at minimum levels of 10^6 - 10^9 per gram or milliliter at the time of consumption. Lactobacillus and Bifidobacterium species, usually found in the gastro-intestinal microbiota, are the most commercially used probiotic microorganisms in foods (Kolida and Gibson, 2011; Duncan and Flint, 2013; Adebola et al., 2014).

Prebiotics, non-digestible food ingredients, have long been used to stimulate the growth of probiotic microorganisms and enhance the functional properties of foods. Prebiotics are not digested in the stomach and small intestine, however, when fermented by gut microbiota they stimulate the growth of the limited number of Lactobacillus and Bifidobacterium species, and thus, help to prevent the growth of the pathogens. To define a food component as a prebiotic; a component should i) be resistant to enzymes of gastro-intestinal tract, ii) be fermented by intestinal microbiota, iii) stimulate the growth of beneficial microorganism, iv) inhibit the growth of pathogen microorganism, and v) produce biologically active metabolites such as short-chain fatty acids (acetate, propionate, and butyrate) as result of fermentation. Fructooligosaccharides, galactooligosaccharides, soybean oligosaccharides, inulin, guar gum, resistant starch, pectin and chitosan are the widely used prebiotics derived from plants such as onions, leek, artichoke, garlic and beans through various biochemical and/or enzymatic techniques (Figure 1) (Adebola et al., 2014; Bindels et al., 2015; Yu et al., 2015; Hutkins et al., 2016; Ozcan et al., 2016; Singla and Chakkaravarthi, 2017; Usta and Yilmaz-Ersan, 2017).

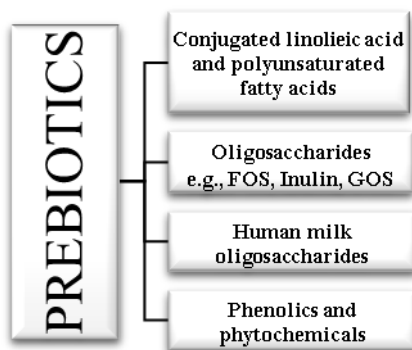


Figure 1. Classification of prebiotics

Agro-Industrial Wastes as Prebiotic

Agro-industrial wastes pose a serious problems of disposal and environmental pollution, however, they contain fermentable sugars, valuable nutrient components, fibers and water. Hence the production of value-added ingredients such as novel prebiotic ingredients from agro-wastes could be very challenging for prevention of environmental pollution and waste management. In recent studies, it has been reported that different agro-industrial wastes such as almond skins, fruit peels, potato peel, wheat straw and corn cob stimulated the growth of probiotic bacteria, and thus could serve as a potential source for prebiotics (Paseephol, 2008; Jain et al., 2015; Samantan et al., 2015; Yadav, 2016).

Perez-Chabela et al., (2015) evaluated the effect of apple marc and cactus pear peel on physiological parameters of Wistar rats in vivo. Inulin containing diet was used as a control. Lactic acid bacteria and Bifidobacteria counts were higher in cactus peel diet, although apple marc diet resulted in better fatty acid production. Due to higher insoluble fiber, apple marc flour and cactus pear peel flour in higher non-digestible carbohydrates. Apple marc flour showed similar physiological effects as compared to inulin and was suggested as a promising prebiotic source.

Paseephol (2008) examined inulin from tubers of Jerusalem artichoke and lactulose from milk concentration permeate (MCP) to develop prebiotic compound preparations. Inulin concentrate, powder and lactulose-enriched MCP syrup were tested for their prebiotic power in media broth and in fermented milk models. Based on the growth and acidification abilities of the probiotic strains tested, the combination of *Lactobacillus casei* LC-01 with inulin and *Lactobacillus acidophilus* LA-5 with lactulose-enriched MCP syrup were found to be the best for development of synbiotic yoghurt.

Mandalari et al., (2010) investigated the potential prebiotic effect of natural and blanched almond skins, the latter being a by-product of the almond-processing industry. Both natural and branched skins significantly increased the population of Bifidobacteria and *Clostridium coccoides*/*Eubacterium rectale* group, resulting in a prebiotic index (3.2 for branched and 3.3 for natural skins) that compared well with the commercial prebiotic fructo-oligosaccharides (4.2) at a 24-h incubation. They showed that dietary fiber from almond skins altered the composition of gut bacteria, and thus, could be used as potential prebiotic.

Vernazza et al., (2005) carried out with fecal inoculum and various chitosans as a by-product of seafood processing to investigate the fermentation of chitosan derivatives by the human gut flora. Low, medium and high molecular weight chitosan caused a decrease in Bacteroides, Bifidobacteria, Clostridia and Lactobacilli counts. Chitosan oligosaccharides were more easily utilised and when added to an in vitro colonic model led to increased production of butyrate, but some populations of potentially detrimental bacteria were also increased.

Cactus pear peel flour and pineapple peel flour were employed by Díaz-Vela et al., (2015) as a functional extensor in cooked meat sausages, inoculated with thermotolerant lactic acid bacteria, in order to promote the development of a synbiotic cooked meat product. The use of cactus pear peel flour and pineapple peel flour in the inoculated sausages led to changes in textural properties, which could be due to the growth of thermotolerant lactic acid bacteria during storage. They concluded that fruit peels could be employed as a source of bioactive compounds (fiber and antioxidants) that could enhance the development of beneficial bacteria after and before processing, such as thermotolerant lactic acid bacteria. Xylooligosaccharides (XOS) are the carbohydrates built from xylose residues linked mainly by β -(1 \rightarrow 4)-glycoside bonds. They can be produced from lignocellulosic biomass. Production of XOSs from agricultural residues including cotton, sunflower and corn stalks, corn cobs, wheat straw, poplar wood, green coconut husks offers great scope to the nutraceutical industries as the raw material is cheap and abundantly available. The major advantages of XOSs consumption, apart from selective growth stimulation of beneficial gut microflora, include reduction of blood glucose and cholesterol, reduced pro-carcinogenic enzymes in gastrointestinal tract, enhanced mineral absorption from large intestine and immune-stimulation (Samantan et al., 2015).

Gullón et al., (2011) obtained three XOS concentrates with different composition and/or molecular weight distribution from industrial solid wastes containing barley husks, spent grains. XOSs were assayed as carbon sources for fermentation with faecal inocula to assess their prebiotic potential, and the metabolic products (succinate, lactate, formate, acetate, propionate and butyrate) confirmed their prebiotic potential.

2.CONCLUSION

Agriculture is done to grow and process the raw material to final consumable products, however during processing a significant amount of agro-waste is also obtained. Such wastes like rice straw, wheat straw, corncob, guar gum could be effectively used for production of added-value compounds like oligosaccharides, xylose, mannose, arabinose, glucose and fructose. Among oligosaccharides, mannooligosaccharides, xylooligosaccharides and arabinooligosaccharides are the major ones and have displayed potential as prebiotics having a non-digestible nature with bacterial growth stimulating response in the colon.

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Attention to Saffron (*Crocus sativus* L.) with Various Aspects and Possibility of Growing in Kastamonu

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Abstract: Saffron (*Crocus sativus* L.) is known as one of the earliest cultivated plants (at least 3500 years). The word "saffron" originate from French term "safran", from Latin word "safranum", from Italian "Zafferano", Spanish "Azafran", from Arabic "asfar" which means "yellow". Saffron which gave Safranbolu (Turkey) its name is an important culture plant. Saffron is one of the world's highest priced medicinal and aromatic plants from which dried stigmas are used. The Mediterranean environment is recognized worldwide as the best area to produce saffron. Saffron is cultivated mostly in Iran, India and Greece in the World. Iran is the leading exporter country in world saffron trade. Kashmir (in India) is one of the three prominent cultivating places of saffron the World. Despite the very high market price, production has also decreased, as profits have decreased as a result of the increase in labor costs. Saffron is used in food, cosmetics, dying, medicinal and pharmaceutical uses. The researches has shown the presence of more than 150 components in the stigmas of saffron. The major components of saffron are crocins, picrocrocin and safranal. Crocins is responsible for the color of saffron, whereas picrocrocin and safranal are responsible for its bitter taste and aroma. Crocins dissolve easily in water to provide an orange-red solution. This is the reason for its application as a food colorant. Due to difficulties in its cultivation, harvesting and handling and due to value, saffron is the world's most expensive spice. For this reason, and because of stigma colour, it is known as "red gold". In addition, saffron has long been considered a medicinal plant for its therapeutic properties. Saffron contains high concentrations of bioactive compounds that can contribute to its beneficial effects. Despite the importance of safran in medicine and food industry, the prominence in paint industry is gradually decreasing. Because, it is very expensive. The purpose of this review, saffron is being cultivated in Safranbolu in Turkey, in terms of climate and soil due to the similarity Safranbolu, Kastamonu is to draw attention to also bred in the region.

Keywords: Saffron, *Crocus sativus* L., Food additives, Medicinal, aromatic and dye plants

1. INTRODUCTION

Saffron (*Crocus sativus* L.) is known as one of the earliest cultivated plants (at least 3500 years) (Rahimi et al., 2014; Arslan, 2018). The word "saffron" originate from French term "safran", from Latin word "safranum", from Italian "Zafferano", Spanish "Azafran", from Arabic "asfar" which means "yellow" (Shah et al., 2017). Saffron which gave Safranbolu (Turkey) its name is an important culture plant (Anonymous, 2015). Saffron is a perennial crop well adapted to arid and semi-arid lands which produce stigmas annually. It is also adaptable to temperate and sub-tropical climates, and can be grown on soils varying from sandy to well-drained clay loams. The Mediterranean environment is recognized worldwide as the best region to produce saffron (Lage and Cantrell, 2009). The collection of the flower should be done carefully and early in the morning to facilitate separation of the petals from the stamens and stigmas. The separated stigmas are dried at 50-80 °C for 30-35 minutes. The dried stigmas are then cooled and stored in a dry place (Baytop, 2007; Aytekin and Acikgoz, 2008).

Saffron is one of the world's highest priced medicinal and aromatic plants from which dried stigmas are used. The Mediterranean environment is recognized worldwide as the best area to produce saffron (Ünal and Çavuşoğlu, 2005). Saffron is cultivated mostly in Iran, Kashmir and Greece in the World. It is also an important spice plant which is grown in countries like Spain, China, India, Morocco, Nepal, Australia, New Zelenda, Egypt, Mexico, Italy, Turkey, France, Switzerland, Israel, Pakistan, Azerbaijan, United Arab Emirates, Japan, Afghanistan and Iraq. Iran is the leading exporter country in world saffron trade. Kashmir (in India) is one of the three prominent cultivating places of saffron the World (Sivakkolundu and Loganathan, 2012; Shah, et al, 2017; Sharma, 2017; Arslan, 2018). Despite the very high market price, production has also decreased, as profits have decreased as a result of the increase in labor costs. The world's annual saffron production is estimated around 300 tons per year (Iran produces 76% of total) and also saffron is considered to be the most expensive spice in the world (Gohari et al., 2013).

One of the endangered endemic plants of Turkey is saffron. Its home is Anatolia and East Mediterranean regions. It has been known in Anatolia since Hittites, and that was exported to abroad during Ottoman Empire. A total of 40 taxa, including 21 out of the 19 species and sub-species endemic to Turkey (Yıldırım et al., 2016). However nowadays, plantation and production of saffron has decreased behind significantly. Today, it is symbolically produced in some villages in Safranbolu by some families According to literarure, saffron plant has been cultivated on the two small plantations in Safranbolu, Karabük, Şanlıurfa province and in other some areas (Yıldırım et al., 2016).

The dried saffron stigmas could be best preserve under dark conditions (Rahimi et al., 2014). In addition to its use as a spice, saffron has long been considered a medicinal plant for its therapeutic properties. With therapeutic diets using safran, neurodegenerative diseases are less common in Asia than in the western world. The spice contains high concentrations of bioactive compounds that can contribute to its beneficial effects. Due to the high antioxidant capacity of saffron carotenoids, value is increasingly understood, depending on the importance of human health. Despite the importance of safran in medicine and food industry, the prominence in paint industry is gradually decreasing. Because, it is an expensive substance (Rahimi et al., 2014; Shah et al., 2017).

Use Areas of Saffron

In recent years, the use of spices and herbal resources has been increasing in order to help treat some diseases. Safran is used in food, dye, cosmetic and medicine industries (Lage and Cantrell, 2009). Due to the unique sensorial properties attributes of saffron, and the difficulties involved in its cultivation, harvesting and handling, it has high value and is considered the most expensive spice in the world. For this reason, and because of stigmas' colour, it is known as "red gold" (Bagur et al., 2018). Chemical analysis has shown the presence of more than 150 components in the stigmas of saffron (Bagur et al., 2018). In addition to the three main components in saffron (crocetin esters, picrocrocin and safranal), it also contains other carotenoids, carbohydrates, raw fiber, proteins, fats, anthocyanins, flavonoids, vitamins (riboflavin and thiamine), minerals and many other elements which confer nutritional properties and are beneficial to health (Lage and Cantrell, 2009; Surgun Acar and Bürün, 2017; Bagur et al., 2018). More recently, however, scientific interest in revisiting saffron's known bioactivity has been growing. The bioactive properties observed in recent scientific publications are attributed to the main components, mentioned above, but also to the synergistic activity of all the compounds present in the spice (Ferrara et al., 2014). The most important use for saffron is in food, where it is valued for its colouring, flavouring and aromatizing in the production of some traditional dishes (Lage and Cantrell, 2009; Shah et al., 2017; Bagur et al., 2018).

Saffron is used in food, cosmetics, dying and medicinal and pharmaceutical uses. It is highly valued as a culinary spice for its flavouring and colouring properties. Due to the high antioxidant capacity of saffron carotenoids, value is increasingly understood, depending on the importance of human health (Abdullaev, 2002). The major components of saffron are crocins, picrocrocin and safranal. Crocins is responsible for the color of saffron, whereas picrocrocin and safranal are responsible for its bitter taste and aroma. The aroma of saffron comes from an essential oil, which is primarily composed of the terpene aldehyde, safranal, being the most abundant volatile component in the stigmas of saffron (Bagur et al., 2018). Crocins dissolve easily in water to provide an orange-red solution. This is the reason for its application as a food colorant (Rahimi et al., 2014).

In addition to its use as a spice, saffron has long been considered a medicinal plant for its therapeutic properties. Saffron is regarded as tonic and antidepressant and has been used in various ancient cultures for strengthening digestion, relieving coughs, smoothing menstruation, relaxing muscle spasms, calming anxiety and improving mood. Saffron use in hair tonics and in folk medicine. It is also used in the treatment of many diseases such as digestive, respiratory, reproductive and circulatory system and gut, eye, some cancer diseases, hypertension and high cholesterol. With therapeutic diets using safran, neurodegenerative diseases are less common in Asia than in the western world. The potential healthy effect of saffron will depend on the amount consumed and its bioavailability (Anjum et al., 2015; Başer, 2016; Shah et al., 2017; Surgun Acar and Bürün, 2017; Bagur et al., 2018).

Reliability of saffron as a spice has enabled it to be used as a food additive that gives color and flavor for centuries (Çakmakçı, 2015; Yıldırım et al. 2016). Traditionally, extracts and tinctures of saffron have allowed it to be used in the treatment of diseases without toxic side effects. Despite the importance of safran in medicine and food industry, the prominence in paint industry is gradually decreasing. Because, it is an expensive substance. But, its dyeing power is very high and it gives a bright yellow color. It is said that it can dye 100 thousand of its own weight (Ünaldı, 2007). Synthetic paints are much cheaper and have taken the place of saffron. The amount of saffron consumed varies between different regions and kitchen diets, and is used as a spice for color and flavor. The spice contains high concentrations of bioactive compounds that can contribute to its beneficial effects (Bagur et al., 2018).

2.CONCLUSION

One of the endangered endemic plants of Turkey is saffron. Its home is Anatolia and East Mediterranean regions. It has been known in Anatolia since Hittites, and that was exported to abroad during Ottoman Empire. However nowadays, plantation and production of saffron has decreased behind significantly (Yıldız, 2017). Today, it is symbolically produced only in Davutbaşı village in Safranbolu by some families. According to some literature, in Turkey, saffron plant has been cultivated only on the two small plantations in Safranbolu, Karabük province and Harran region, Şanlıurfa province (Ünal

and Çauşoğlu, 2005; Çavuşoğlu and Erkel, 2005). Including 36 species and 36 endemic taxa are also grows naturally including a total of 72 subspecies. A total of 40 taxa, including 21 out of the 19 species and sub-species endemic to Turkey (Yıldırım et al., 2017).

Knowing the importance and profitability of saffron is necessary to increase saffron production. There is a very important problem in the growth of the plant. Saffron can not be propagated by the seed because it is a vicious plant. Growing is not economical and reproducible because it requires a strong work force (Yıldız, 2017). For this reason, it is necessary to try different production methods in order to multiply saffron kormes and to obtain bigger onions in a shorter time. For example, animal fertilizer applications not only provide nutrients to the plant, but also affects soil structure and water retention capacity positively (Yıldırım et al., 2017). For this it is important to bring new incentives to the farmers, to expand the production areas of the plant, to create new production areas. In this context, knowing the economic value of saffron and acting on it again is very important not only for the socio-economic development of the place where it is produced, but also for the economy of the country.

The purpose of this study, saffron is being cultivated in Safranbolu in Turkey, in terms of climate and soil due to the similarity Safranbolu, Kastamonu is to draw attention to also bred in the region. Its potential use as a functional food or nutraceutical is important.

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Low-Fat Foods: Functionality of Fat Replacers

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Abstract: Currently, health problems associated with coronary artery disease, colon cancer and diabetes are triggered by obesity. As a consequence, recent interest by consumers is to decrease their fat intake and increase their consumption of low-fat products. Fat replacers can be used to decrease the rheological and sensory problems of reduced-fat products and to improve the functionality of fat as well as to decrease the calorific value of the food. In the present paper the specific application, functional properties and potential health effects of fat replacers will be reviewed.

Keywords: Reduced-Fat, Low-Fat, Fat Replacers, Fat Substitutes, Fat Mimetics

1. INTRODUCTION

Lipids are among the three vital macronutrients of the diet since they are the primary source for energy since having a high energy density (9 kcal/g), fat-soluble vitamins (A, D, E, and K) that perform regulatory activity, and essential fatty acids, and serve as precursors for hormone-like substances. Besides being an essential component to maintain good health and the proper functioning of the human body, lipids serve many chemical, physical, and nutritional functions in the foods such as satiety, flavor, and palatability. They also function as building blocks and play a thermoregulatory role (Delas, 2011; McClements, 2015).

The food industry is faced with the challenge of producing reduced-fat food products depending on consumers' diet and health preferences. While consumption of daily recommended values is beneficial for health, the over consumption could lead to various complications such as cancer, overweight, atherosclerosis, hypertension, cerebral apoplexy, and coronary heart diseases (Chapkin et al., 2007; Aranceta et al., 2009; Russell et al., 2016).

In recent years there has been an increasing interest for the development of fat-reduced or fat-free products as a result of consumer expectations and market requirements formulated by the introduction of specific food additives that exhibit similar functional and sensorial properties similar to those of lipids (Pirozzo et al., 2003; Aydinol and Ozcan, 2018).

People are willing to consume low-fat products in order to ensure overall metabolic health and reduce the risk of diseases related to over consumption of calorie-rich foods. Since fat droplets are important to achieve the desirable physicochemical, textural, sensory, and physiological attributes of foods as assisting in the sensation of lubricity, creaminess, appearance, palatability in foods, and overall flavor, it is often challenging to compensate for these attributes in fat-reduced foods (Mistry, 2001; Ritvanen et al., 2004; Verbeke, 2006; Karimi et al., 2015; Chung et al., 2016).

Functionality of Fat Replacers

In search for fat reduction fat replacers have facilitated the development of "reduced fat" and "fat-free" foods that maintain the desirable sensory attributes and texture of high fat foods with less fat and fewer calories. Based on chemical composition fat replacers are classified as follows: starch-derived, bulking agents, fiber-based, low-calorie fats, protein-based, fat extenders, gums, gels and thickeners, synthetic fat substitutes and emulsifiers (Ramchandran, 2009; Chavan et al., 2016). In Table 1 some applications of fat replacers are summarized.

Fat replacers have different chemical structures, either being carbohydrate- or protein-based, as i) fat substitutes (fat-based) and ii) fat mimetics (protein-carbohydrate-based). Fat replacers considerably lower the energy value than lipids, however, the bioavailability of fat-soluble vitamins should not be reduced or limited by the addition of low-fat alternatives to counteract potential vitamin deficiency (Sandrou and Arvanitoyannis, 2000; Chavan et al. 2016). Terminology of fat replacers are given as following;

Fat replacer: It is used to describe any ingredient used to replace fat.

Fat substitute: A synthetic compound designed to replace fat on a weight-by-weight basis, usually having a similar chemical structure to fat but resistant to hydrolysis by digestive enzymes. They have similar physicochemical properties as fat and contribute lower calories on per gram basis. Fat substitutes are either chemically synthesized or derived from conventional fats and oils by enzymatic modification. Many fat substitutes are stable at cooking and frying temperatures.

Fat mimetic: This term refers to a fat replacer that requires high water content to achieve its functionality. They are most widely used ingredients for producing emulsion-based reduced-fat products. They have different chemical structures from fat. They have diverse functional properties that mimic some of the characteristic physicochemical attributes and desirable eating qualities of fat: viscosity, mouthfeel and appearance. The caloric value of fat mimetics ranges from 0–4 kcal/g. Fat mimetics generally adsorb a substantial amount of water. They are not suitable for frying because they bind excessive water and denature or caramelize at high temperatures. Many fat mimetics, however, are suitable for baking and retorting. Fat mimetics are generally less flavorful than the fats that the mimetics are intended to replace; they carry water- soluble flavors but not lipid-soluble flavor compounds. Successful incorporation of lipophilic flavors into foods that are formulated with fat mimetics may, therefore, require emulsifiers. Several fat replacers are derived from a variety of protein sources, including egg, milk, whey, soy, gelatin, and wheat gluten. Some of these protein-based fat mimetics are micro-particulated (sheared under heat) to form microscopic coagulated round deformable particles that mimic the mouthfeel and texture of fat. Protein-based fat mimetics are generally used in dairy products, salad dressings, frozen desserts, and margarines. Many carbohydrates serve as thickeners or gelling agents in foods. Gums, starches, pectin, cellulose, and other carbohydrate ingredients provide some of the functions of fat in foods by binding water. They also provide texture, mouthfeel, and opacity. Carbohydrate-based fat mimetics are not suitable for frying but can be used as fat barriers for frying and for baking. Gums are high molecular weight negatively-charged carbohydrates used as thickeners to increase viscosity and as stabilizers and gelling agents. Gums are used in fat replacing systems with other gums, fat replacers, or bulking agents include guar, xanthan, locust bean gum, carrageenan, gum arabic, and pectins.

Low-calorie fat: A synthetic triglyceride combining unconventional fatty acids to the glycerol backbone which results in reduced caloric value.

Fat extender: It is a fat replacement system containing a proportion of standard fat or oil combined with other ingredients.

Table 1. Selected Applications and Functions of Fat Replacers

Specific Application	Fat Replacer	General Functions
Baked goods	Lipid based	Emulsify, provide cohesiveness, tenderize, carry flavor, replace shortening, prevent staling, prevent starch retrogradation, condition dough
	Carbohydrate based	Retain moisture, retard staling
	Protein based	Texturize
Frying	Lipid based	Emulsify, provide flavor and crispiness, conduct heat
Salad dressing	Lipid based	Emulsify, provide mouthfeel, hold flavorants
	Carbohydrate based	Increase viscosity, provide mouthfeel, texturize
	Protein based	Texturize, provide mouthfeel
Frozen desserts	Lipid based	Emulsify, texturize
	Carbohydrate based	Increase viscosity, texturize, thicken
	Protein based	Texturize, stabilize
Margarine, shortening, spreads, butter	Lipid based	Provide spreadability, emulsify, provide flavor and plasticity
	Carbohydrate based	Provide mouthfeel
	Protein based	Texturize
Confectionery	Lipid based	Emulsify, texturize
	Carbohydrate based	Provide mouthfeel, texturize
	Protein based	Provide mouthfeel, texturize
Processed meat products	Lipid based	Emulsify, texturize, provide mouthfeel
	Carbohydrate based	Increase water holding capacity, texturize, provide mouthfeel
	Protein based	Provide mouthfeel, texturize, water holding
Dairy products	Lipid based	Provide flavor, body, mouthfeel and texture; stabilize, increase overrun
	Carbohydrate based	Increase viscosity, thicken, aid gelling, stabilize
	Protein based	Stabilize, emulsify
Soups, sauces, gravies	Lipid based	Provide mouthfeel and lubricity
	Carbohydrate based	Thicken, texturize, provide mouthfeel
	Protein based	Texturize
Snack products	Lipid based	Emulsify, provide flavor
	Carbohydrate based	Texturize, aid formulation
	Protein based	Texturize

The research studies indicated that fat substitutes in short-term under carefully-controlled conditions could decrease both dietary fat intake and percentage of calorie intake from fat, however, the long-term effects are unknown, and thus, daily consumption of fat replacers should be limited in the diet (Delas, 2011; McClements, 2015; Chung et al., 2016).

2.CONCLUSION

The development of healthier food products with low caloric content has become a key target for the food industry. Consumer acceptance of food products depends largely on sensory attributes. Although many consumers prefer foods with lower fat and energy, they also look for foods with good taste and texture. Fat replacers are used to overcome the textural defects in low-fat/no-fat products.

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Place of Utility Principle in Environmental Law and the Approach of the Judge in terms of Utility about Nature

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Abstract: Judicial system is born by to schime social targets in healty, peaceful and safe environment. In a state of law, to carry out the missions and targets of the state, legislative power make laws, laws and regulations are launched by the executive power and investigation/resolution of conflict in laws are performed by the judicial power. Legal regulations are based on “utilitarianism principle”. The history of this principle goes back when the first law rights are announced and the basic principle of it is to prevent the suffering and maintain the well-being of public. Utilitarianism principle which also known as “Bentham Philosophy” existed in the field of law, policies, international relations, theology and education, first in England and then European and United States. Turkish judicial system and also in the time of Ottomans it is reflected as “Public Interest”. Public interest is the reason, base and the result of the laws. According to the public interest, the benefit for the community is preferred over individual one and it is a path finder for the judgement of conflicts. Enviromental rights are among the fundamental rights and freedoms and it is also based on utilitarianism principle. There is only one way which is the public interest, to limit fundamental rights and freedoms. That is why public interest has to be defined clearly by the determining the standarts and criterias of it. In this study, elements of enviromental rights as an human right and the reflection of utitarianism on the laws and the regulations are investigated. Regulations towards the enviromental rights in order to protect public interest and the type of conflicts born by these regulations are investigated by looking at the rulings of the judicial systems.

Keywords: Utilitarianism principle, enviromental rights, legislation, jurisdiction.

1.INTRODUCTION

Jeremy Bentham, who has been working on the subject of reorganizing and reforming the English legal system, has argued that the principle of utilitarianism is a fundamental criterion for the emergence of ethics and law as a scientific discipline (Özkurt, 2013). He described the principle of benefit as a fundamental principle in the field on behavior of the legislature, and the amendment of law. Bentham has been examining the nature of man before revealing this principle. As a result of his observations, he came to the conclusion that human behaviors are happiness and suffering. He has argued that people tend to get happiness by doing things they are pleased with, and they tend to run away from the actions they are suffering (Bentham, 2011). He emphasized that the purpose of the benefit principle in this case is to prevent pain and increase happiness. Benefit principle first appeared in such fields as law, politics and education in countries like France, England and America. Bentham, aimed pimarily the amendment of law, has emphasized that laws and the attitudes of lawmakers should be based on the principle of benefit (Anay, 2011). Bentham argues that the Laws should be created to increase the happiness of individuals and to prevent their suffering (Gürbüz, 2012). Bentham's suggestion for the way to be followed in the event of conflict between individual interests and community interests; it has been the most happiness in the society (Cevizci, 2004). These views of Bentham have been widely accepted over time and have been a guide in the reorganization of the law of many countries (Cengiz, 2016).

The concept of public interest is based on the legal system of the Republic of Turkey, it is considered to be the point of origin principle benefits. It is stated that the primary purpose of the laws enacted in the Turkish legal system is the provision of public benefit. 1982 Constitution of the Republic of Turkey, titled “the basic objectives and tasks of the state” Located in the Article 5, the expression of...” society ensure the welfare, peace and happiness ...” is compatible with the objective of increasing happiness of benefit principle. The concept of public benefit is also in the literature; is defined as a criterion used to control the legality of public activities conducted by the state and a concept considered in the determination of the competence of the judge (Saraç, 2002). Thus, it can be argued that the concept of public benefit is influenced by Jeremy Bentham's utilitarianism principle.

In this study, it was tried to determine the reflections of the benefit principle in the laws that constitute and regulate the environmental right. In the event of violation of the environmental right, the effect of the concept of public benefit (benefit principle), which guides the judiciary, has been evaluated.

2.MATERIALS AND METHODS

The revealing of this work began primarily with the researching of Jeremy Bentham's life and works. The work on philosophical science, which is based on Bentham's utility principle, has been scanned and studied through the Google Scholar page. Afterwards, it was concluded that the benefit principle took place in the Turkish legal system with the public interest statement, and the literature survey was made about what the concept of public benefit is. It was concluded that the benefit principle took place in the Turkish legal system as public interest, and then literature survey was made about what the concept of public benefit is. In addition, examples of the public interest of the judiciary as a basis for resolving the disputes have been screened by the national judiciary informatics system web page and added to the study.

The main points of the study, the emergence of the environmental right and the basis on which it is legally based, have been reviewed and evaluated through literature and legislative survey. The materials of this work are Constitution of Turkey, Environmental Law No. 2872, Forest Act No. 6831, Cultural and Natural Heritage Protection Act No 2863, National Parks Act No 2873, Mining Law No 3213, Pasture Law No. 4342, and the Law for the Encouragement of Tourism No. 2634, because of containing the environmental regulations.

3.RESULTS AND DISCUSSION

The Attitude of the Judisdiction Towards the Concept of Public Interest (Benefit Principle)

“There is no constitutional obstacle to enabling the use of the relevant territory outside the purpose of agricultural production, even if the removal of the agricultural land of an area from the ground, in particular, is more public benefit than the continued use of the land as agricultural land.” (Constitutional court decision, 5.3.2015, M(merits no). 2014/147, D. (Decree no) 2015/25).

“In the event that the authority is granted authority in any matter concerning the right to property, it is necessary that the legal limits of the administrative authority and the general framework and the obligations imposed on the individuals should not conflict with the public interest.” (CCD, 22.10.2015, M. 2015/29, D. 2015/95).

“According to Article 13 of the Constitution, the right to property can be restricted to the extent necessary for public interest, lawful and democratic society. Moreover, these limitations can not touch the essence of the Constitution and can not be contrary to the spirit of the Constitution, the requirements of democratic society order and the principle of proportionality.” (CCD, 22.10.2015, M. 2015/29, D. 2015/95)

“Limitation of fundamental rights and freedoms by a law may in particular be of benefit to the society, even if at the expense of those whose liberty is restricted. In the case of restrictions on fundamental rights and freedoms, the benefit of society, if it outweighs the amount of damages that people will suffer should be regarded as the existence of public interest.” (CCD, 8.2.1979, M. 1978/54, D. 1979/9).

“The principle of state of law contained in Article 2 of the Constitution includes the constitution of laws for public good purposes.” (CCD, 22.11.2007, M. 2004/67, D. 2007/83)

“The fact that the laws are aimed at ensuring public good, including general, objective, fair rules and observing the criteria of justice, is the principle of state of law. For this reason, legislators should exercise their discretionary powers recognized in legal regimes by considering justice, equity, and public benefit criteria within constitutional boundaries.” (CCD, 3.7.2014, M. 2013/96, D. 2014/118)

“Limitation of fundamental rights and freedoms by a law may in particular be of benefit to the society, even if at the expense of those whose liberty is restricted. In this case, it is natural that the benefit of the society should be kept superior when the benefit of the individual clash with the society.” (CCD, 21.10.1992, M. 1992/13, D. 1992/50).

“The discretion of administrative granted by the laws is not absolute, but is limited to the public good and service requirements. According to the principle of state of law, the administration is obliged to explain why it appreciates; it is also imperative that the reason for the administrative action is lawful and legitimate.” (Council of state, 6D., M. 2012/3972, D. 2013/4556). (URL-1)

The Environment Right in Turkish Law System

The environment right is regulated by Article 56 of the 1982 Constitution. According to this; “Everyone has the right to live in a healthy and balanced environment. It is the duty of the state and the citizen to improve the environment, protect the environment and prevent environmental pollution.” Our Constitution is regulated in three respects as the right to the environment, the duty of the state, the duty of the citizen and everyone's right.

It is seen that the 1982 Constitution indirectly includes the articles that affect the environment.

It is seen that the 1982 Constitution indirectly includes the substances that affect the environment. For example; After it is stated that the provision of Article 43 and the coasts of the state are under the control of the state, “The public interest is primarily taken into account when utilisation coastal lanes surrounding the shores of the sea, lakes and rivers, sea and lakes.”

With Article 63, The Constitution has laid down principles on the preservation of history, culture and nature assets. Article 57 on the right to housing also states that; It has been mentioned that the State will apply the matter in the context of a plan that considers the characteristics of the cities and environmental conditions. Another important substance that affects the environment is the 169th item related to the protection and development of forests. At the same time, Article 23 of the Constitution is an important guarantee for environmental problems as it carries the purpose of “achieving a healthy and balanced urbanization”.

Based on the 56th article of the Constitution, in the first article of the Environmental Law No. 2872, Is to “ensure that the environment, the common heritage of all living things, is protected in accordance with sustainable environmental and sustainable development principles.”

The Forestry Law no. 6831 aims to ensure the management and operation of natural resources and heritage forests within the framework of sustainable development principles in order to meet the current generation needs and transfer them to future generations.

In article 1 of the National Parks Act numbered 2873; “The aim of this law is to regulate the principles of preserving, developing and managing national parks, nature parks, natural monuments and natural protection areas with national and international values in our country without disturbing their characteristics and characteristics.”

Law No. 2634 on Tourism Encouragement Article 1- “Purpose of this Law; to organize the tourism sector, to develop, to provide a dynamic structure and arrangements to ensure that the arrangements and measures to be taken. “The above mentioned undertakings are committed to ensuring the fulfillment of specific objectives by taking the necessary precautions for the protection and observance of the environment right and by giving priority to the right to the environment by ensuring social welfare and happiness on behalf of the public interest.

In the resolution of the disputes reflected in the judiciary regarding the right to environment; ““In Article 1 of the Environmental Law No. 2872, the purpose of this law is to protect and improve the environment, which is the common existence of all citizens; the optimal use and protection of rural and urban area land and natural resources; water, soil and air pollution prevention; it is stated that the regulations and the measures to be taken for securing the health, civilization and the level of life of these present and future generations by protecting the natural and historical assets of the country and the plant and animal existence of the country are regulated according to the legal and technical principles in accordance with the aims of economic and social development.”(Council of state, 6.D., 13.05.1997,D.1997/231 .is the decision in the form of the general attitude of the judge.

However, in some cases it appears that there are contradictions in judicial decisions. For example, in decision (14.D., 21.09.2011 datedandD.2011/796) of the Council of State, it was concluded that when the barons were taken into consideration the establishment purposes mentioned above, it was understood that a legitimate, personal and current benefit was not affected and therefore no interest relation was found. However, in decision 2004/2163 M. and 2004/788 D of the General Assembly of Administrative Litigation Offices, it has been concluded that the baro, which is responsible for advocating and protecting the supremacy of the law, is related to as a stakeholder with leading decision that is not applied the judicial decision. There are two different opinions on whether or not the baro's capacity to act as a defendant in two different cases, independent of each other, is present.

Again in the decision of the Council of State number 6, 1996/5477 M., 1997/2312 D; there is a statement that the priority of the public benefit and the priority of this concept should be examined in the judicial control of the proceeding administrative process by considering the provisions of the Constitution and the law in the face of the fact that the objections created by the case of gold mine operation method (cyanide lynching method) are directly and indirectly related to human life.

What stands out here is; the criteria of public benefit will be determined according to criteria and criteria and will be applied in such a way as to provide the greatest happiness in society.

- As a result, environmental pollution reaches important dimensions and the urgency of resolving the problem does not make it possible to settle with a single policy tool.
- Taking into consideration the positive and negative aspects of the vehicles, it is necessary to combat these problems with an effective political blend.
- Because of the belief that the ecosystem can renew itself, it is about to lose its means of defense mechanism of ecosystem as a result of damage to the environment.
- Due to increasing population and consumption habits, the future of ecosystems is at risk.
- If necessary protection can not be achieved, many species will be more generational, many areas will not be able to renew themselves and there will be no natural resources.
- The value nature of environmental pollution caused by many production and consumption activities can not be measured and punished.
- Nowadays, increasing public awareness of the environment and acting together with non-governmental organizations to overcome negative pressures on the environment also increases the reaction to mining activities. It is accepted that the mining activities are damaging to nature in a wide scale and that it takes a very long time and expense to restore the area to its original state even if measures are taken.
- In addition, policies should be prepared by introducing new criteria in the case of natural resources which are public property and which are under the control and saving of the State are allocated to activities such as tourism and mining.
- Public legal criteria and criteria should be included in the legal system organized for the purpose of ensuring the welfare and happiness of the society.
- It is important to ensure the participation of the people in the arrangements related to the environment.

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