

The Chemical Composition of Birch Leaves and the Vital State of Birch Stands in the Gradient of Aerotechnogenic Emissions of JSC “Karabashmed”

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Abstract: The aim of the work is to assess the vital state of silver birch stands and the content of macronutrients and heavy metals in the leaves of silver birch (*Betula pendula* Roth) in the gradient of aerotechnogenic emissions of JSC “Karabashmed” (Chelyabinsk region, Russian Federation). We selected five test areas of varying degrees of pollution at a distance of 1.5 km to 24 km from Karabashmed. The assessment of the condition of birch stands was carried out by the bioindication method, using the indicators of defoliation (loss of foliage) and dechromation (discoloration) of tree crowns and the category of weakness (sanitary condition). Birch forests located closer to the source of pollution (C-1.5) have the greatest degree of damage. The level of defoliation is 59.5%, dechromation is 52% and the damage index is 3.3, which is 1.5 and 2 times more than in more remote test areas. The sulfur content increased by 35% ($p < 0.05$) on the test area closest to the source of pollution. Severe damage to birch leaves by sulfur dioxide in the affected area was indicated by an increased concentration of sulfur in the leaves, as well as deterioration of the vital condition of the stand. Macronutrients analysis results showed that the content of nitrogen varies from 22 to 24 mg/g, potassium from 9 to 15 mg/g, phosphorus from 6.5 to 7 mg/g, calcium from 5.5 to 8 mg/g, magnesium from 3.6 to 6.4 mg/g, sulfur from 1.7 to 2.7 mg/g, sodium from 1.8 to 2.5 mg/g. Heavy metal analysis results showed that the concentrations of cadmium, lead and zinc, copper and chromium in birch leaves in the area closest to the source of pollution increased by 2.8-8 times. The parameters of the vital state positively correlated with the content of sulfur, cadmium, lead, copper and zinc (correlation coefficients 0.4-0.6) and negatively correlated with the content of nitrogen, phosphorus, potassium.

Keywords: *Betula pendula*, Macronutrients, Heavy metal, Aerotechnogenic emissions.