

## Biochar/Slag Composite: A Novel Adsorbent for CO<sub>2</sub> Capture

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**Abstract:** Carbon dioxide (CO<sub>2</sub>) is one of the main greenhouse gases which contribute to global warming. CO<sub>2</sub> concentration is increasing around the world day by day. It is estimated that CO<sub>2</sub> concentration will be approximately 570 ppm in 2100. Many carbon capture and storage techniques have been developed to reduce CO<sub>2</sub> emission. Adsorption with using low-cost solid adsorbents is a promising CO<sub>2</sub> capture technique. In this study, low-cost biochar/slag composites were evaluated as a CO<sub>2</sub> adsorbent. Firstly, neat slag was modified with different concentrations of HCl solution (0.25, 0.50, 1.00, 3.00 and 5.00 M). Maximum surface area and pore volume were achieved through the 1.00 M HCl modification. So, biochar/slag composites were prepared using 1 M HCl modified slag and various amount of biochar (1, 3 and 5 wt%). Structural and morphological properties of the biochar/slag composites were investigated by Fourier transform infrared spectroscopy (FTIR) and field emission scanning electron microscopy (FESEM) analyses, respectively. To examine surface charge of the biochar/slag composites, point of zero charge (pHpzc) measurements were conducted. CO<sub>2</sub> adsorption studies were carried out with volumetric sorption analyzer at ambient conditions. The biochar/slag composite including 3 wt% biochar showed maximum CO<sub>2</sub> adsorption capacity. With the addition of 3 wt% biochar, CO<sub>2</sub> adsorption capacity of the 1 M HCl modified slag increased from 0.10 mmol g<sup>-1</sup> to 0.18 mmol g<sup>-1</sup>. The possible CO<sub>2</sub> adsorption mechanisms of the biochar/slag composites are thought to be electrostatic attractions and hydrogen bonds as well as pore filling. The results revealed that the biochar/slag composites can be used as novel and low-cost CO<sub>2</sub> adsorbents.

**Keywords:** Biochar, Slag, Composite, CO<sub>2</sub> adsorption.