



## The adsorption properties of biochar derived from woody plants or bamboo for cadmium in aqueous solution

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### ABSTRACT

Biochar may potentially absorb heavy metals from aqueous solutions. In this study, biochar was derived from the pyrolysis (~600°C) of 11 plants that are widely distributed across the mid-west forest land of China. The three kinds of biochar with the highest cadmium (Cd) adsorption capacities were further investigated to establish their adsorption kinetics and isotherms. The results showed that biochar derived from walnut trees (W-Biochar), wild cherry trees (C-Biochar), and bamboo (B-Biochar) had the greatest adsorption capacity. Their order was B-Biochar (19.12 mg/g) > C-Biochar (18.8 mg/g) > W-Biochar (18.06 mg/g). The optimal biochar dosage was 2 g/L at pH = 5. A pseudo-second-order model explained the adsorption kinetics with rate constants of 0.043 g·mg<sup>-1</sup>·min<sup>-1</sup> (B-Biochar), 0.321 g·mg<sup>-1</sup>·min<sup>-1</sup> (C-Biochar), and 0.157 g·mg<sup>-1</sup>·min<sup>-1</sup> (W-Biochar). It took 40 min to reach adsorption equilibrium, which was responsible for the Langmuir isotherm. The Fourier Transform Infrared spectrophotometer (FTIR) results showed that the hydroxyl and carboxyl groups on the biochar surface improved Cd<sup>2+</sup> adsorption. The scanning electron microscope results showed that the three biochars had different microstructures, which were probably responsible for their different adsorption capacities.

**Keywords:** Biochar; Cadmium; Woody plants; Bamboo; Adsorption

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