Cadmium removal by activated carbon, carbon nanotubes, carbon nanofibers, and carbon fly ash: a comparative study

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ABSTRACT

Four types of carbonaceous adsorbent materials were applied for the removal of cadmium ions from water. These materials include fly ash (FA), activated carbon (AC), carbon nanofibers (CNFs), and carbon nanotubes (CNTs). The adsorption mechanisms and the kinetics of cadmium (II) removal from water were investigated. The effects of pH, the adsorbent dosage, the contact time, and the agitation speed on the removal process were studied and optimized. The four carbon adsorbents were characterized by field emission scanning electron microscopy and transmission electron microscopy. Adsorption isotherms were used to find the model of the adsorption behavior and to calculate the percentage removal. A 95% removal was obtained by using FA at pH 7, a dosage of 50 mg, a contact time of two hours, and an agitation speed of 150 rpm. In case of CNTs, CNFs, and AC, the percentage removals were found to be 27, 34, and 38%, respectively. The experimental data of the four-based carbon adsorbents were well fitted with Langmuir and Freundlich adsorption models.

Keywords: Activated carbon; Carbon nanotubes; Carbon nanofibers; Carbon fly ash; Cadmium removal

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