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The effect of activated carbon produced from remnants of walnut shell and ox tongue leftover on removing cadmium metal from water

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ABSTRACT

Heavy metals are dangerous pollutants in surface water and groundwater resources causing health risks for human and environment. In this study, activated carbons extracted from walnut shell (ACWS) and ox tongue leftover (ACO), as two low-cost and green sorbents, were synthesized via chemical activation with different concentrations of phosphoric acid (20%–80% w/w) at two temperatures (500°C and 700°C) for removal of cadmium ions from aqueous solutions. To compare ACWS and ACO, Fourier-transform infrared spectroscopy, X-ray powder diffraction analysis, field-emission scanning electron microscopy, and energy-dispersive X-ray spectroscopy were performed. The effect of initial concentration of cadmium, contact time, pH, and amount of adsorbent on the adsorption process was studied through a batch process mode. Both ACWS and ACO successfully removed cadmium metal with about 90.66% and 89.33% efficiency, at 25 mg L^{-1} of cadmium, 150 mg adsorbent, and pH = 10 at 100 min, respectively. The concentration of phosphoric acid was an important variable in the adsorption rate because at higher concentrations glycosidic linkage and aryl bond in lignin will be hydrolyzed which could be attributed to the fact that the electrostatic interactions will be decreased between the cadmium and activated carbon. Results showed that cadmium adsorption isotherms fitted to Langmuir and Freundlich isotherm models. Adsorption kinetic data indicated that pseudo-first-order is the best model fitted for cadmium adsorption in ACO and pseudo-second-order for ACWS.

Keywords: Adsorption; Cadmium; Activated carbon; Walnut shell; Ox tongue leftover; Water

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