Comparative study on removal of cadmium(II) from simulated wastewater by adsorption onto GAC, DB, and PR

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ABSTRACT

This investigation deals with the utilization of granular-activated carbon (GAC), dead biomass (DB) and phosphate rocks (PR) as adsorbents for the removal of cadmium(II) from simulated wastewater. A series of experiments were conducted in a batch system to evaluate the effect of system variables. The effect of pH, initial cadmium(II) concentration, dose of adsorbents, and contact time were considered. The equilibrium data were analyzed using Langmuir, Freundlich and Redlich–Peterson isotherm models at different doses of GAC, DB, and CGA. The Langmuir model was found to fit the equilibrium data very well with high-correlation coefficient (R²). The maximum uptake capacities were found to be 17.757, 24.677, and 31.379 mg/g onto GAC, DB, and PR, respectively. Adsorption kinetic data were tested using pseudo-first-order, pseudo-second-order, and intra-particle diffusion models. The adsorption process was found to follow a pseudo-first order reaction. The thermodynamic studies showed that the adsorption was spontaneous and exothermic in nature. The study showed that locally available adsorbents, such as DB and phosphate rocks, can be used as efficient adsorbents for the removal of cadmium(II) as compared with commercial GAC.

Keywords: Adsorption; Cadmium(II); Granular-activated carbon (GAC); Dead biomass (DB); Phosphate rocks (PR); Langmuir; Pseudo-first-order