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Kinetic, equilibrium, and thermodynamic studies for adsorptive removal of cobalt ions by rice husk from aqueous solution

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ABSTRACT

Herein, batch adsorptive removal of cobalt ions (Co(II)) from aqueous solution was studied at room temperature. Adsorption of cobalt ions onto rice husk (RH) was confirmed by utilizing Fourier transform infrared, scanning electron microscopy, and energy diffraction energy-dispersive X-ray analysis. The effect of contact time, mass of RH, initial concentration of cobalt ion solution, temperature, and pH on the percentage discharge of Co(II) was revealed. The nonlinear models such as pseudo-first-order model, pseudo-second-order model, intraparticle diffusion model, and Elovich model were utilized to study kinetics for adsorptive removal of cobalt ions (Co(II)) from aqueous solution. Results showed that experimental data fitted well to nonlinear pseudo-second-order kinetic model. Nonlinear isotherms such as Langmuir, Freundlich, and Dubinin–Radushkevivh (D–R) were used to reveal experimental data of cobalt ion adsorption onto RH. Results represented that experimental data fitted well to nonlinear isotherms. Adsorption thermodynamic study showed that adsorption of Co(II) onto RH was an endothermic and spontaneous process. Moreover, desorption of cobalt ions was also revealed. Therefore, RH could be utilized as a good adsorbent for the removal of Co(II) from aqueous solution at room temperature.

Keywords: Cobalt ion; Rice husk; Adsorption; Nonlinear isotherms; Endothermic process

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