Removal of cobalt ions from water by ion-exchange method

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ABSTRACT

In the present work, the removal of Co(II) ions from aqueous solutions using an ion-exchange resin (Lewatit MonoPlus SP 112) was investigated. For this purpose, batch adsorption studies were carried out with various parameters such as pH and contact time. The Langmuir and Freundlich isotherm models were applied to analyze the experimental data. The best interpretation for the experimental data was given by the Langmuir isotherm and the maximum adsorption capacity was found to be 21.93 mg/g. The kinetic data were tested using pseudo-first-order, pseudo-second-order, liquid film diffusion, and intraparticle diffusion kinetic models. In addition, diffusion models were applied to explore the rate-determining step in cobalt diffusion behavior. The numerical values of the different rate constants, correlation coefficients, and effective diffusion coefficients as well as activation energy were determined. Data clarified that the adsorption process followed pseudo-second order reaction-based kinetic model. The magnitudes of the effective particle diffusion coefficient indicated that cobalt adsorption on resin was not controlled by film diffusion and pore diffusion and the chemical sorption was the rate-limiting step. The activation energy \( E_a \) confirmed that the nature of the adsorption was chemical sorption. The desorption studies were carried out using various reagents. The maximum percent desorption of the adsorbed metal ions were obtained, when 2 M HCl and 2 M H\(_2\)SO\(_4\) was used as the reagent.

Keywords: Resin; Cobalt; Ion-exchange; Diffusion coefficient; Activation energy

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