Adsorption of copper from aqueous solution onto natural sepiolite: equilibrium, kinetics, thermodynamics, and regeneration studies

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\textbf{ABSTRACT}

The adsorptive properties of natural sepiolite in the removal of copper (Cu\textsuperscript{2+}) from aqueous solution were investigated. The results show that the amount of adsorption of copper ion increases with initial copper concentration, contact time, and solution pH. The pseudo-first-order, pseudo-second-order, and Elovich models were used to describe the kinetic data and the rate constants were evaluated. The adsorption of the copper onto natural sepiolite at different operating conditions followed the pseudo-second-order model. The equilibrium data were analyzed using the Langmuir, Freundlich, Temkin, and Dubinin–Radushkevich (D–R) isotherm models. The equilibrium adsorption results are fitted better with Langmuir isotherm compared to the other models. The Langmuir monolayer adsorption capacity of sepiolite was estimated as 9.64 mg/g at pH 6.0 and temperature of 20°C. An increase in temperature was found to induce a positive effect on the sorption process. Sorption of Cu\textsuperscript{2+} onto sepiolite was spontaneous and endothermic. The values of the enthalpy (\(\Delta H\)) and entropy of activation (\(\Delta S\)) were 14.892 kJ/mol and 96.342 J/mol K, respectively, at pH 5.0.

\textit{Keywords:} Adsorption; Sepiolite; Kinetics; Isotherms; Thermodynamics; Regeneration

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