

Removal of cu(II) from aqueous solutions by sorption onto a kenyan micaceous mineral

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The efficacy and applicability of a micaceous mineral of Kenyan origin (Mica-K) in the removal of Cu²⁺ ions from water and wastewater systems has been tested.

Adsorption of Cu²⁺ was found to be dependent on experimental conditions, particularly; time, concentration, pH, particle size, sorbent dose and temperature. The sorption pattern of Cu²⁺ ions onto Mica-K followed Langmuir, Freundlich, and Dubinin-Kaganer-Radushkevich (DKR) isotherms with correlation factors and other parameters confirming good agreement between theoretical models and experimental results.

Positive but small enthalpy, (ΔH°) value suggests that sorption of Cu²⁺ is endothermic and involves moderately weak bonding between the metal ions and Mica-K. Entropy (ΔS°) value is positive indicating that there are some structural changes at the solid-liquid interface and that metal ion adsorption likely occurs spontaneously at normal and high temperatures. Negative values for Gibbs free energy, ΔG° shows that adsorption is spontaneous in nature without any induction period and the degree of spontaneity of reaction increases with increasing temperature.

Kinetic modeling using; Elovich, pseudo-first order, pseudo-second order, intra-particle diffusion, mass transfer and intra-particle diffusivity equations showed that pseudo-second order equation was the most appropriate model for Cu²⁺ transport with chemical sorption as its rate limiting step.

X-ray photoelectron spectroscopic (XPS) analysis for Cu²⁺ ion-equilibrated Mica-K, demonstrated that Cu²⁺ containing nodules existed on the surface of the mineral.

Mica-K adsorbent compares well with commercially available Elgalite ion exchange resin from Elga Company UK, when used to treat different Kenyan water samples and industrial effluents.

Biography

John N. Wabomba completed his Ph.D. at the age of 39 years from Nairobi University with part of his research work carried out at the University of Western Ontario, Canada on an exchange program. He is a lecturer at the department of Chemistry, University of Nairobi, Kenya. He is currently readying several papers for publication based on his work on water and sanitation studies. He is an active member of the Kenya chemical society.

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