Characterization, adsorption, and electrokinetic properties of modified sepiolite

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ABSTRACT

The metal ion adsorption and electrokinetic properties of sepiolite modified by 3-trime-toxysilylpropyl metaacrylate was studied. The characterization of modified sepiolite was made by Fourier transform infrared spectroscopy (FTIR), X-ray powder diffraction (XRD), scanning electron micrograph (SEM), and differential thermal analysis/thermogravimetry (DTA/TG). The adsorption behavior of Fe(III), Mn(II), Co(II), Zn(II), Cu(II), and Cd(II) metal ions on modified sepiolite from aqueous solutions was investigated as a function of equilibrium pH, temperature, and ionic strength. The adsorption experiments were carried out using a batch method. The initial and final concentrations of heavy metals were determined by means of atomic absorption spectrophotometry. The zeta potential of the modified sepiolite suspensions was measured as a function of metal ion concentration and equilibrium pH using a Zeta Meter 3.0. The results showed that the amount of adsorbed metal ions increased with solution pH, and that the modified sepiolite adsorbed Cu(II) and Mn(II) ions more than other metal ions. It was found that the temperature had an important effect on metal ion adsorption and that the adsorption process was endothermic in nature. Equilibrium isotherms for the adsorption of metal ions were measured experimentally. Results were analyzed by the Freundlich and Langmuir equations and determined the characteristic parameters for each adsorption isotherm. The isotherm data were reasonably well correlated by Langmuir isotherm. Maximum monolayer adsorption capacity of modified sepiolite for Cu(II), Mn(II), Zn(II), Fe(III), Co(II), and Cd(II) metal ions was calculated from 12.3 × 10^{-5}, 11.7 × 10^{-5}, 9.0 × 10^{-5}, 8.2 × 10^{-5}, 5.7 × 10^{-5}, and 1.8 × 10^{-5} mol L^{-1}, respectively. The affinity order of adsorption was Cu(II) > Mn(II) > Zn(II)–Fe(III) > Co(II) > Cd(II). The results indicate that modified sepiolite is good adsorbent for the removal of metal ions from aqueous solutions.

Keywords: Modified sepiolite; Metal ions; Zeta potential; Adsorption; Characterization

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