ABSTRACT

Surface modification of solids can have much influence on adsorptive removal of solutes. The removal of Mn(II), Ni(II) and Cu(II) from aqueous solution on prepared surfactant-modified alumina (SMA) has been extensively studied first time in the present work. The bilayer of sodium dodecyl sulfate (SDS; an anionic surfactant), formed on alumina surface can adsolubilize Mn(II), Ni(II) and Cu(II) in a fast process. The effect of contact time, initial concentration of metal ions, adsorbent dose, pH, temperature, agitation speed has been studied by using batch mode. The results obtained were used for the applicability of Freundlich and Langmuir adsorption isotherm. The experimental and theoretical q_e values for both models have been compared. The percentage deviation, R^2, comparison of experimental and theoretical Freundlich isotherm and error analysis shows that the adsorption follows Freundlich isotherm better. The adsorption kinetics obey pseudo-second order model. Thermodynamic properties (ΔG, ΔH and ΔS) have been calculated and the process was found to be endothermic, favorable and spontaneous. The Mn(II), Ni(II) and Cu(II) desorption from Mn(II) adsorbed SMA, Ni(II) adsorbed SMA and Cu(II) adsorbed SMA could be possible by 0.2 M Na_2-EDTA. Fixed bed column study showed promise for Mn(II), Ni(II) and Cu(II) removal by SMA. Bed depth service time (BDST) model were best fitted to adsorption data for Mn(II), Ni(II) and Cu(II), respectively. The theoretical and experimental breakthrough curves are comparable for all heavy metals. The metal removal was in the order of Cu(II)>Ni(II)>Mn(II) under the different experimental conditions. The SMA was used for the removal of Mn(II), Ni(II) and Cu(II) ions from the Mn(II)-spiked, Ni(II)-spiked and Cu(II)-spiked wastewater. The treatment method was further applied to real wastewater obtained from a steel tube manufacturing industry and electroplating industry. The SMA adopted was found to be an efficient adsorbent for the removal of Mn(II), Ni(II) and Cu(II) from water environment.

Keywords: *Surfactant-modified alumina, heavy metal removal, batch study, desorption, column study, real wastewater*