Rapid adsorption of copper(II) and lead(II) by rice straw/Fe3O4 nanocomposite: optimization, equilibrium isotherms, and adsorption kinetics study

ABSTRACT

Rice straw/magnetic nanocomposites (RS/Fe_3O_4-NCs) were prepared via co-precipitation method for removal of Pb(II) and Cu(II) from aqueous solutions. Response surface methodology (RSM) was utilized to find the optimum conditions for removal of ions. The effects of three independent variables including initial ion concentration, removal time, and adsorbent dosage were investigated on the maximum adsorption of Pb (II) and Cu (II). The optimum conditions for the adsorption of Pb(II) and Cu(II) were obtained (100 and 60 mg/L) of initial ion concentration, (41.96 and 59.35 s) of removal time and 0.13 g of adsorbent for both ions, respectively. The maximum removal efficiencies of Pb(II) and Cu(II) were obtained 96.25% and 75.54%, respectively. In the equilibrium isotherm study, the adsorption data fitted well with the Langmuir isotherm model. The adsorption kinetics was best depicted by the pseudo-second order model. Desorption experiments showed adsorbent can be reused successfully for three adsorption-desorption cycles.

Keyword: Rapid adsorption; Copper(II); Lead(II); Rice straw/Fe3O4 Nanocomposite; Equilibrium isotherms; Adsorption kinetics