Competitive Adsorption of Heavy Metals onto Natural and Activated Clay: Equilibrium, Kinetics and Modeling

Authors : L. Khalfa, M. Bagane, M. L. Cervera, S. Najjar

Abstract : The aim of this work is to present a low cost adsorbent for removing toxic heavy metals from aqueous solutions. Therefore, we are interested to investigate the efficiency of natural clay minerals collected from south Tunisia and their modified form using sulfuric acid in the removal of toxic metal ions: Zn(II) and Pb(II) from synthetic waste water solutions. The obtained results indicate that metal uptake is pH-dependent and maximum removal was detected to occur at pH 6. Adsorption equilibrium is very rapid and it was achieved after 90 min for both metal ions studied. The kinetics results show that the pseudo-second-order model describes the adsorption and the intraparticle diffusion models are the limiting step. The treatment of natural clay with sulfuric acid creates more active sites and increases the surface area, so it showed an increase of the adsorbed quantities of lead and zinc in single and binary systems. The competitive adsorption study showed that the uptake of lead was inhibited in the presence of 10 mg/L of zinc. An antagonistic binary adsorption mechanism was observed. These results revealed that clay is an effective natural material for removing lead and zinc in single and binary systems from aqueous solution.

Keywords : heavy metal, activated clay, kinetic study, competitive adsorption, modeling

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