Investigation of heavy metal ions adsorption by magnetically modified aloe vera leaves ash based on equilibrium, kinetic and thermodynamic studies

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ABSTRACT

Magnetically modified aloe vera leaves ash (MALA) was prepared, characterized, and used for simultaneous removal of Pb(II), Cu(II), Zn(II), and Cr(III) ions from aqueous solutions. MALA was prepared by treating ALA with Fe₃O₄ nanoparticles. Effects of different parameters on the batch adsorption experiments were studied and optimized by both the magnetic and non-magnetic ALA. The kinetic and isotherm experimental data were well described by the pseudo-second-order kinetic model and the Langmuir isotherm model, respectively. Thermodynamic studies indicated that the adsorption processes were spontaneous and exothermic in nature. The adsorption process of MALA was fast and removal efficiencies were higher than 98% under the optimized conditions. MALA could be reused with suitable recovery after hydrochloric acid washing. It was indicated that the developed method based on MALA is very simple, low cost, fast, and reliable for removal of heavy metal ions from water samples.

Keywords: Removal; Heavy metals; Magnetic aloe vera leaves ash; Isotherm; Kinetic

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