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Removal of Lead and Copper metal ions in single and binary systems using biopolymer modified spinel ferrite

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Abstract

In present study, Zinc Ferrite-Alginate beads (ZFN-Alg beads) were prepared and characterized by Fourier Transform-Infra Red (FT-IR); X-Ray Diffraction (XRD); Scanning Electron Microscope (SEM); Energy Dispersive Spectra (EDS); Thermogravimetric-Differential Thermal analysis (TG-DTA); Brunauer-Emmett-Teller (BET) and pH point zero charge (pH_{PZC}) method. The adsorption of Pb(II) and Cu(II) ions on ZFN-Alg beads as function of contact time, varying pH, adsorbent dose, initial concentration at different temperatures were investigated in single as well as binary system through batch mode. The adsorption kinetic data of Pb(II) and Cu(II) ions in both type of systems was well followed by the Lagergren pseudo second order model. Among different isotherm models, the equilibrium data was well correlated by Langmuir isotherm model in single as well as binary system. In single system, the maximum adsorption capacities of Pb(II) and Cu(II) ions for ZFN-Alg beads were 108.8, 106.6mg/g and for binary system were 68.6 and 48.0 mg/g, respectively. For both types of systems, the calculated adsorption thermodynamic parameters indicated that the adsorption process was spontaneous and exothermic in nature. The regeneration performance of ZFN-Alg beads was examined in both types of systems up to five cycles. The results revealed that ZFN-Alg beads were retained around 80% regeneration efficiency even after five successive cycles in both types of systems. The present study concluded that magnetic biopolymer beads might be suitable and cost effective alternative for removal of Pb(II) and Cu(II) metal ions from single as well as binary system.