

Kinetic and Equilibrium Modelling of Lead, Zinc and Copper Ions Sorption from Aqueous Solution Using Charcoal Fines

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Abstract

The potential of chemically modified charcoal fines UCF (unmodified charcoal fine) and MCF (modified charcoal fines) as low cost adsorbents for the removal of Pb^{2+} , Cu^{2+} and Zn^{2+} ions from aqueous solution was studied. MCF was prepared by chemical modification of UCF with HNO_3 and KOH followed by pyrolysis. The factors influenced the effectiveness of biosorption process were pH, contact time, initial metal concentration, temperature and adsorbent dosage. FT-IR spectra confirmed the existence and interaction of the adsorbents with the effluent pollutants. MCF exhibited optimum pH, temperature, contact time, initial metal ion concentration and biosorbent dosage values of 5, 35 °C, 90 minutes, 15 mg/L and 2 g, respectively. UCF exhibited optimum pH, temperature, contact time, initial metal ion concentration and biosorbent dosage values of 6, 35 °C, 100 minutes, 20 mg/L and 2.5 g, respectively. The adsorption isotherm modelling using both adsorbents showed that the equilibrium data conformed more to Langmuir than the Freundlich model. Kinetic studies showed that the adsorption processes followed a pseudo-second order kinetic model. Thermodynamic studies confirmed the spontaneity and feasibility of the adsorption process. The results showed that both adsorbent have the potential to be applied as alternative low cost biosorbent.

Keywords: Charcoal Finest; Optimum Conditions; Metal Ion; Sorption; Modification; Characterization; Commercial Wastewater.