

Adsorption of Pb(II) ions by using mangrove-alginate composite beads(MACB):Isotherm, Kinetics and Thermodynamics studies

ABSTRACT

Present study explored the potential of using mangrove-alginate composite bead (MACB) as adsorbent for the removal of Pb(II) ions from aqueous solution. The batch sorption was studied under different initial concentration (20 to 100 mg/L), contact time (5 to 210 min) and solution temperature (35 to 65 °C). The Langmuir, Freundlich, and Temkin isotherm models were used to analyze the experimental equilibrium data and isotherm constants. A comparison of kinetic models applied to the adsorption of Pb(II) ions on MACB beads was evaluated using pseudo-first order and pseudo-second order kinetics models. The experimental data were fitted well with the pseudo-second order kinetic model, means the mechanism of diffusion process is controlled by the adsorption reactions and not depend by the mass transfer during adsorption. Based on thermodynamics parameters, the results show that the adsorption capacity increases with an increase in temperature. The negative value of ΔH° (-1.402 kJ mol⁻¹) and the decreasing k_d value with increasing temperature, which indicate the sorption of Pb(II) onto MACB beads was feasible and an exothermic reaction. The positive value ΔS° (8.256 Jmol⁻¹ K⁻¹) reflects good affinity of Pb(II) ions towards the MACB beads. The results described the potential for the MACB beads to be used as adsorbent for the removal of Pb(II) ions from wastewater.

Keyword: Alginate; Composite beads; Adsorption; Modeling; Equilibrium; Kinetics