Detoxification of lead(II) ions in aqueous solutions using chemically modified *Ziziphus jojoba* and *Eriobotrya japonica* leaves: thermodynamic and kinetics considerations

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ABSTRACT

The current study deals with the Pb(II) ions removal by chemically modified (HNO_3 and $CaCl_2$) *Ziziphus jojoba* (CMZJL) and *Eriobotrya Japonica* leaves (CMEJL). Batch experiments were conducted to find out the optimal conditions of pH, temperature, biosorbent dose, initial metal concentration and contact time for maximum metal biosorption. The maximum biosorption capacity onto CMZJL and CMEJL were 80 and 73.10 mg/g respectively at optimal conditions i.e. contact time 120 min, temperature 50°C and pH 6.0. The Tempkin, Langmuir and Freundlich isotherms were applied to find out best fit for the equilibrium data. The Langmuir model best fitted the equilibrium data with regression correlation coefficient (R^2) of 0.999. Kinetic studies suggested that the process obeys the pseudo second order kinetic model in a better way than the first order kinetic model with $R^2 = 0.999$ for both the adsorbents. The calculated thermodynamics functions like change in enthalpy ($\Delta H° = -51.366$ and -42.202), entropy ($\Delta S° = 21.975$ and 18.149) and Gibbs free energy ($\Delta G° = -6.598$, -6.709, -6.929, -7.149 and -5.450, -5.541, -5.722, -5.904 corresponding to 298, 303, 313 and 323K) revealed the removal of Pb(II) ions onto the CMEJL and CMZJL was feasible, exothermic and spontaneous in nature.

Keywords: Biosorption; Pb(II); Kinetics; Equilibrium; Thermodynamics

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