



Adsorptive removal of copper(II) from aqueous solution onto the waste sweet lime peels (SLP): equilibrium, kinetics and thermodynamics studies

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ABSTRACT

Heavy metal pollution has become one of the most serious environmental problems today. Keeping in view of the economic and pollution considerations; there is indeed need to develop process and practice for the waste management, for the disposal of industrial waste containing Cu(II) in a scientific manner. In the present study, sweet lime peels (SLP), an agricultural waste was utilized as an adsorbent for Cu(II) removal from aqueous solution. The biosorption mechanism and characteristics of SLP was studied by Fourier transform infrared. Kinetic studies based on pseudo-first-order and pseudo-second-order rate expressions have also been carried out. The pseudo-second-order kinetics was found to provide the best correlation with the experimental data. The effect of two parameters, namely, temperature (20, 30, 40, 50 and 60°C) and pH (2, 3, 4, 5, 6), were studied. The particle size effect in relation to biosorption capacity is also discussed. The experimental data were analysed using Langmuir, Freundlich, Redlich–Peterson, Temkin and Dubinin–Radushkevich isotherms. The Langmuir model was found to exhibit the best fit to experimental data. The maximum adsorption capacity was found to be 37.45 mg/g at 293 K. Thermodynamic parameters such as free energy (ΔG°), enthalpy (ΔH°) and entropy (ΔS°) were also determined. Thermodynamic study showed that the biosorption was exothermic, spontaneous and favourable.

Keywords: Sweet lime peels (SLP); Kinetics; Adsorption isotherm; Adsorption thermodynamics

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