

Adsorptive removal of Co(II) in aqueous solutions using *Strychnos potatorum* seed powder

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Contamination of natural water bodies due to improper discharge of heavy metals has become a worldwide environmental problem. Development of low cost adsorbent materials for the removal of heavy metals, utilizing the technique of adsorption is an effective solution to this problem. The present study explores the potential use of clearing nut seed powder (*Strychnos potatorum*) as an adsorbent for the removal of Co(II) from aqueous solutions. Batch adsorption studies were carried out by varying contact time, initial pH, initial Co(II) concentration, adsorbent dosage and temperature.

An equilibrium adsorption capacity of 1.8619 mg/g was observed at an optimal pH of 5.0 for initial metal ion concentration of 20 ppm, 0.3 g/100.00 cm³ adsorbent dosage with 250-500 μm particle size, within the contact time of 120 minutes at 303 K. Adsorption isotherm experiments indicated both Langmuir and Freundlich isotherm models fit well to the experimental data with correlation coefficients greater than 0.98. The best isotherm model can be considered as Langmuir model with highest correlation coefficient and the maximum monolayer adsorption capacity obtained was 4.2452 mg/g. The adsorption kinetic data fitted well with pseudo second order kinetic model. The calculated thermodynamic parameters showed that adsorption process is spontaneous and exothermic in nature. The Gibbs free energy change in Co(II) adsorption process at 303 K was -20.580 kJ mol⁻¹ while the enthalpy change was -23.04 kJ mol⁻¹. The negative entropy change of -8.002 J mol⁻¹ K⁻¹ indicates the decrease in randomness of Co(II) at solid-liquid interface.¹ The surface properties of the adsorbent were analyzed by FT-IR spectroscopy and SEM analysis. FT-IR analysis indicated the presence of hydroxyl, amide and C-O functional groups on the adsorbent and SEM analysis confirmed the presence of irregular surface structure with tiny pores on it, which is important for adsorption. The clearing nut seed powder obtained after surface modification by acid treatment showed a higher adsorption capacity of 2.8381 mg/g when compared with surface unmodified clearing nut seed powder. Therefore clearing nut seed powder

and surface modified clearing nut seed powder can be considered as potential adsorbents for the removal of Co(II) in aqueous solutions.

Keywords

adsorption, isotherms, kinetics, Cobalt (II)

References

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