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Development of Method for Recovery of Nickel from Aqueous Solution Using 2-Hydroxy-5-Nonyl- Acetophenone Oxime Impregnated on Activated Charcoal

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Abstract : Investigations on the recovery of nickel from aqueous solution using 2-hydroxy-5-nonyl- acetophenone oxime (LIX-84I) impregnated on activated charcoal was carried out. The LIX-84I was impregnated onto the pores of dried activated charcoal by dry method and optimum conditions for different equilibrium parameters (pH, adsorbent dosage, extractant concentration, agitation time and temperature) were determined using a simulated solution of nickel. The kinetics and adsorption isotherm studies were also evaluated. It was observed that the efficiency of recovery with LIX-84I impregnated on charcoal was dependent on the pH of the aqueous solution as there was little or no recovery at pH below 4. However, as the pH was raised, percentage recovery increases and peaked at pH 5.0. The recovery was found to increase with temperature up to 60ºC. Also it was observed that nickel adsorbed onto the loaded charcoal best at a lower concentration (0.1M) of the extractant when compared with higher concentrations. Similarly, a moderately low dosage (1 g) of the adsorbent showed better recovery than larger dosages. These optimum conditions were used to recover nickel from the leachate of Ni-MH batteries dissolved with sulphuric acid, and a 99.6% recovery was attained. Adsorption isotherm studies showed that the equilibrium data fitted best to Temkin model, with a negative value of constant, b (-1.017 J/mol) and a high correlation coefficient, R^2 of 0.9913. Kinetic studies showed that the adsorption process followed a pseudo-second order model. Thermodynamic parameter values (ΔG^0, ΔH^0, and ΔS^0) showed that the adsorption was endothermic and spontaneous. The impregnated charcoal appreciably recovered nickel using a relatively smaller volume of extractant than what is required in solvent extraction. Desorption studies showed that the loaded charcoal is reusable for three times, and so might be economical for nickel recovery from waste battery.

Keywords : charcoal, impregnated, LIX-84I, nickel, recovery
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