

Extraction and separation of Cu(II), Ni(II) and Zn(II) by sol-gel silica immobilized with Cyanex 272

The extraction and separation of Cu(II), Ni(II) and Zn(II) from aqueous sulfate-acetate solution were carried out using solid phase sol-gel silica containing immobilized Cyanex 272 {bis(2,4,4-trimethylpentyl)phosphinic acid, HA} (SGSIC). Characterisation of SGSIC by FT-IR, EDX, SEM, TG-DTA and BET proved the presence of Cyanex 272 in the sol-gel silica. It was found that SGSIC can extract about 95% Zn(II) at equilibrium pH 3.0, 99% Cu(II) at pH 5.3 and 91% Ni(II) at pH 6.2 from synthetic solutions containing 20 mg/L of each metal ion. Various parameters such as pH of the aqueous solution, ratio of solid to liquid, Cyanex 272 to silica, initial Cu(II) concentration and temperature were studied. The adsorption data fitted the Langmuir adsorption model, but at higher Cu(II) concentrations (8.9-82 mM), it followed the Freundlich adsorption model. The maximum adsorption capacity of Cu(II) was found to be 20.9 mg/g (0.33 mmol/g). SGSIC was easily regenerated and reused in the subsequent removal of Cu(II) in five cycles. By varying the aqueous pH and solid to liquid ratio, the separation and recovery of Cu(II), Zn(II) and Ni(II) from a dilute leach solution of printed circuit board was demonstrated.