Removal of copper(II) ions from synthetic electroplating rinse water using polyethyleneimine modified ion-exchange resin

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\begin{abstract}
Removal of copper ions (Cu(II)) from synthetic electroplating rinse water (SEPRW) by using modified ion-exchange resin was investigated. Modification of the cationic exchange resin was carried out by impregnating polyethyleneimine (PEI). Impregnation was confirmed by scanning electron microscopy–energy dispersive X-ray analysis and Fourier transform infrared spectroscopy analyses. Batch studies were conducted to optimize the various experimental parameters such as contact time, pH, and dosage. The influence of other process parameters including the presence of chelating agent ethylene diamine tetra acetic acid (EDTA) and co-ions were examined. A maximum adsorption capacity (Q_{max}) of 667.5 mg g\(^{-1}\) was observed at the optimum conditions. Cu(II) removal efficiency of the polyethyleneimine modified ion-exchange resin (PMR) was compared with the unmodified resin (UMR). After the impregnation of PEI, adsorption capacity of the resin varied and the removal rate of Cu(II) removal became fast. Continuous column experiments were conducted in a glass column of desired dimensions. The maximum Cu(II) uptake was obtained at the bed height of 1.65 dm and flow rate of 0.015 L min\(^{-1}\). The breakeven point of the column was obtained after the treatment of 19.5 L of SEPRW. Adam–Bohart and Yoon Nelson models were applied to the column data and desorption studies were conducted in batch mode using hydrochloric acid (HCl), nitric acid (HNO\(_3\)) and sulphuric acid (H\(_2\)SO\(_4\)) as eluant.

\textbf{Keywords:} Polyethyleneimine modified ion-exchange resin; Copper; Electroplating rinse water; Batch study; Column study
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