Continuous foam fractionation of chromium(VI) ions from aqueous and industrial effluents

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ABSTRACT

The purpose of this study was to investigate the use of foam fractionation to recover Cr(VI) ions from simulation aqueous solution and tannery effluent. The effects of operation parameters, such as air flow rate, liquid pool height, feed concentration, surfactant concentration, pH of the feed, and feed flow rate on the separation characteristics were studied in the continuous operation. Enrichment ratios of 5.2 and 4.8 with percentage removal of 65% and 61% were achieved for the removal Cr$^{6+}$ ions from simulation aqueous solution and tannery effluent on the basis of optimization of parameters, respectively. As the optimized results, the air flow rate and liquid pool height were 0.1 lpm and 30 cm, feed concentration and surfactant concentration were 10 ppm and 0.1% (w/v), pH of the feed was 6 and feed flow rate was 4 lph. The Cr(VI) concentration in the effluent was around 0.5 ppm which could meet the Bureau of Indian standards (BIS2490) wastewater discharge standards. Box–Behnken model and Analysis of Variance (ANOVA) were applied to the experimental foam fractionation studies. Response surface method with three levels of variances was used in the identification of significant effects and interaction of the above mentioned six variables in the continuous foam fractionation studies. A second order polynomial regression model has been developed using experimental data. From the results it was found that the selected variables have a strong effect on the foam fractionation and also the experimental values were in good agreement with predicted values.

Keywords: Foam fractionation; Sodium lauryl sulphate (SLS); Metal ion (Cr$^{6+}$); Tannery effluent; Box–Behnken response surface method

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