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Factorial experimental design for optimizing the removal of lead ions from aqueous solutions by cation exchange resin

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ABSTRACT

Full factorial design of experiments were used to screen the factors affecting the lead removal effiency using cation exchange resin. The obtained linear model was statistically tested using analysis of variance (ANOVA), Student's *t*-test, lack of fit test, and test of curvature. The percentage removal of lead was examined by varying experimental conditions with center points. The factors and levels used during the experiments were; initial pH (3.5, 4.5 and 5.5), temperature (25, 35 and 45°C), initial lead concenteration (20, 60, and 100 mg/L) and resin dosage (0.02, 0.26, and 0.5 g). A steepest ascent based optimization procedure was implemented to seek better conditions in terms of maximizing the removal of lead(II) ions. The results showed that approximately 99% removal of Pb(II) was obtained when initial pH, temperature, initial lead concentration, and resin dosage are roughly set to 5, 34, 32, and 0.74, respectively.

Keywords: Lead; Heavy metal removal; Cation exchange resin; Factorial design; Optimization; Steepest ascent

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