Environmental Engineering and Management Journal

January 2017, Vol.16, No. 1, 93-104
http://omicron.ch.tuiasi.ro/EEMJ/

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TECHNO-ECONOMICAL EVALUATION OF HEXAVALENT CHROMIUM REMOVAL BY ELECTROCOAGULATION PROCESS WITH THE AID OF POLYALUMINUM CHLORIDE AS COAGULANT: OPTIMIZATION THROUGH RESPONSE SURFACE METHODOLOGY

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Abstract

In this research, Response Surface Methodology (RSM) was employed to optimize five operating variables including initial pH, current, reaction time, initial hexavalent chromium concentration and dosage of polyaluminum chloride as a coagulant for the removal of hexavalent chromium and its relative operating cost by electrocoagulation process. Central Composite Design (CCD) was applied for the optimization process. The results showed that increase of polyaluminum chloride dosage was beneficial for enhancing hexavalent chromium removal efficiency. With the decrease of pH and initial hexavalent chromium concentration, hexavalent chromium removal efficiency improved; however, pH had no effect on operating cost. On the other hand, the increase of current and reaction time significantly influenced on operating cost. According to the ANOVA (analysis of variance) results, the R^2 values of 99.3% and 99.5% for hexavalent chromium removal efficiency and operating cost, indicating that the accuracy of the polynomial models were good for both models. Hexavalent chromium removal of 95%, which was close to the model predicted result of 90.32%, was observed in the experiment at optimum conditions: initial pH 5, current 2 A, reaction time 60 min, initial hexavalent chromium concentration 50 mg/L and dosage of polyaluminum chloride 1010 mg/L.

Key words: chromium removal efficiency, electrocoagulation process, operating cost, response surface methodology

Received: November, 2012; Revised final: August, 2013; Accepted: August, 2013

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