Optimization of Chromium Removal from Tannery Wastewater by Electrocoagulation

Abstract

The treatment of tannery effluent is of great interest as tannery wastewater contains a complex mixture of pollutants including chromium. The disposal of this chromium-contaminated wastewater to any water stream causes adverse effects on the surrounding land and aquatic life, which is an emerging problem for the environment. The objective of this research is to determine the optimum conditions for the removal of chromium from tannery wastewater using electrocoagulation.

Electrocoagulation experiments were conducted using an electrochemical reactor by passing a DC current between two iron electrodes immersed in a specific volume of tannery wastewater. The electrical current causes the oxidation or electrochemical dissolution of the sacrificial anode, which was made of iron. The metal species released in the solution at certain pH enhance the formation of coagulated species. The operating parameters such as concentration, pH and current density as well as power consumption were studied to determine the maximum removal of chromium.

Optimization of the chromium removal was performed using Response Surface Methodology (RSM), with the central composite design (CCD). The experimental design was performed to study the effects of current density, pH and concentration on the removal of chromium. The analysis of variance ANOVA was applied for analyzing the response, residual, probability, 3D surface and contour plots. The maximum chromium removal was 100 % at the optimum conditions of 13 mA/cm^2, 10.7 and 750 ppm for current density, pH and concentration, respectively.

Key words:

Electrocoagulation, Chromium, Current Density, pH, power consumption. Optimization, Response Surface Methodology.