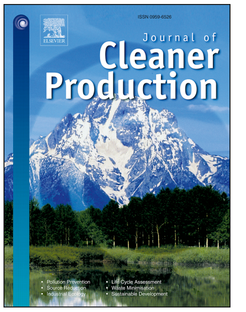

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Modeling and optimization study on sulfamethoxazole degradation by electrochemically activated persulfate process

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Abstract

In this work, empirical kinetics, response surface method (RSM) and artificial neural network (ANN) were employed to model and optimize the electrochemically activated persulfate process. Electrochemically activated persulfate using a sacrificial iron anode was used as a cost effective method to degrade sulfamethoxazole (SMX) in aqueous solution. The individual and the interaction effects of operation parameters such as pH, applied current, persulfate concentration and electrolysis time were investigated. Eight unseen experiments beyond the experimental design were performed to test the accuracy of the generalization ability of the models. Based on unseen experiments, ANN demonstrated the superiority in predicting the results when compared to empirical kinetics and RSM modeling. Response surface analysis was used to illustrate the interactions between parameters pH/applied current, pH/persulfate concentration and pH/electrolysis time. Sensitivity analysis indicated that the relative importance of the influencing parameters were of the following order: electrolysis time > pH > applied current > persulfate concentration. The highest degradation efficiency was achieved with optimal conditions of pH of 3.43, the applied current of 18.4 mA, the persulfate concentration of 3.54 mM, and the electrolysis time of 60 min. The electrical energy consumption was also calculated at this optimized condition (0.04 kWh $\cdot$ $m^{-1}\cdot order^{-1}$). The work provides a novel predictive and optimized model for SMX removal under different conditions by electrochemically activated persulfate.

1. Introduction

Antibiotics are widely used for medicine and livestock. The overuse of antibiotics can result in the contamination of underground water, wastewater discharges and surface water

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