

Model optimization of PPCPs removal from simulated wastewater by electrocoagulation

1.Introduction

With the increasing presence of pharmaceuticals and personal care products (PPCPs) in the aqueous environments, PPCPs have posed serious biological and environmental impacts and threatened human health. Due to their environmental persistence, bioaccumulation, and high toxicity, PPCPs cannot be effectively removed by the conventional wastewater treatment techniques.

2.Methods

The present study focuses on the treatment of two typical PPCPs involving diclofenac sodium (DCF) and cefixime (CFX) by the periodically reverse electrocoagulation (PREC) using Al-Zn electrodes, with an in-depth study of the treatment conditions and removal mechanisms. The aqueous samples were analyzed using a UV-Vis spectrophotometer. Moreover, the response surface methodology (RSM) model was applied for the optimization and prediction of removal efficiency. In addition, the flocs produced by the reaction were analyzed by SEM-EDS, XRD, and Fourier transform infrared (FTIR) spectroscopy.

3.Results

The removal rates of DCF and CFX could reach 90.8% and 97.4%, respectively, after 50 min of treatment, with an initial concentration of 20 mg/L, a current intensity of 0.6 A, an initial pH of 7.0, and a stirring speed of 600 rpm. Through the optimization of RSM, the removal rates of DCF and CFX were increased to 93.7% and 98.8%, respectively. In addition, the flocs possessed significant adsorption capacity and interacted with the functional groups of DCF and CFX.

4.Conclusions

The present study demonstrated that the PREC technique can effectively remove PPCPs from wastewater and provide a strategy for optimizing the operating parameters.

Keywords: diclofenac sodium (DCF); cefixime (CFX); response surface methodology (RSM); periodically reverse electrocoagulation (PREC); model optimization; removal mechanisms