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The treatment of printing and packaging wastewater by electrocoagulation–flotation: the simultaneous efficacy of critical parameters and economics

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ABSTRACT

In this work, electrocoagulation–flotation (ECF) following sedimentation was applied as a printing and packaging wastewater treatment using four Al electrodes with a parallel monopolar configuration. A sedimentation process was applied after the ECF as a post-treatment phase to remove large pollutants. The simultaneous efficacy of the operating parameters initial color content (1,843.44–12,156.56 ADMI), initial pH (3.56–10.44), current density (6.02–22.18 mA/cm^2), and treatment time (5.62–74.38 min) on color and chemical oxygen demand (COD) removal efficiencies were evaluated alongside processing costs. Response surface methodology (RSM) and central composite design (CCD) optimized these key parameters to achieve the highest removal efficiencies and lowest operating costs. Based on the results analyzed by RSM-CCD, using initial color content of 5,576.38 ADMI, initial pH of 7.29, the current density of 18.49 mA/cm^2, and treatment time of 59.76 min as optimum operational conditions can result in 97.8% and 92.1% for color and COD removal efficiencies, respectively. At these optimum conditions, operating costs (OPCs), including electrodes material and energy consumption, were 0.07 US$/(kg color removed) and 0.4 US$/(kg COD removed). The results confirm ECF-sedimentation as a promising and cost-effective tool for the treatment of printing and packaging wastewater.

Keywords: Printing and packaging wastewater; Electrocoagulation–flotation; Optimization; Operating cost

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