

Comparison of phthalic acid removal from aqueous solution by electrochemical methods: Optimization, kinetic and sludge study

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Abstract:

In this work, comparative study between electrochemical processes such as electrocoagulation (EC), peroxi-coagulation (PC) and peroxi-electrocoagulation (PEC) was performed for the removal of phthalic acid (PA) and chemical oxygen demand (COD) from aqueous medium. Initially, acid treatment was studied at various pH (1–3) and temperature (10–55 °C). Subsequently, the supernatant was re-treated by electrochemical processes such as EC, PC and PEC separately. Independent parameters viz. pH, current density (CD), electrolyte concentration (m), electrode gap (g), H₂O₂ concentration and electrolysis time (t) were optimized by Central Composite Design (CCD) for these electrochemical processes. All three processes were compared based on removal, energy consumption, kinetic analysis, operating cost and sludge characteristics. In this study, PEC process was found more efficient among EC, PC and PEC processes in order to get maximum removal, minimum energy consumption and minimum operating cost. Maximum removal of PA- 68.21%, 74.36%, 82.25% & COD- 64.79%, 68.15%, 75.21% with energy consumption - 120.95, 97.51, 65.68 (kWh/kg COD removed) were attained through EC, PC and PEC processes respectively at their corresponding optimum conditions. Results indicated that PA and COD removals are in order of PEC > PC > EC under optimum conditions. First order kinetic model was found able to describe the degradation kinetics and provided best correlation for the removal rate within the acceptable error range.

Keywords:

Phthalic acid, Acid precipitation, Electrochemical treatment, Central composite design, Kinetic study

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