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Terephthalic acid removal from aqueous solution by electrocoagulation and electro-Fenton methods: Process optimization through response surface methodology

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Abstract:
The present work deals with the treatment of terephthalic acid (TPA) and chemical oxygen demand (COD) from synthetic aqueous solution. Initially the aqueous solution was treated by acid precipitation at different pH (2–5) and temperature (15–60 °C). Approximately 87.1% of TPA and 68.85% of COD were removed by acid precipitation treatment at optimum conditions. After acid precipitation, the filtered supernatant was further treated by electrocoagulation (EC) and electro-Fenton (EF) techniques separately. Operating parameters viz. pH—(4–12), current density (A/m2)—(15.24–45.72), Na2SO4 concentration (mol/L)—(0.02–0.04) and time (min)—(10–70) for EC treatment and pH—(1–5), current density (A/m2)—(15.24–45.72), H2O2 concentration (mg/L)—(50–250) and time (min)—(10–70) for EF treatment were optimized and modeled by Central Composite Design (CCD) in response surface methodology (RSM). Maximum removal of TPA—82.76%, 91.87% COD—79.56%, 89.68% with electrical energy consumption (kWh/kg COD removed)—22.65, 18.11 were obtained through EC and EF treatment respectively at optimum conditions. Sludge generated at optimum conditions via electrochemical treatments was characterized by FTIR, XRD, SEM/EDX and TGA/DTA techniques.

Keywords
Terephthalic acid, Electrocoagulation, Electro-Fenton, Graphite cathode, Sludge analysis, Optimization

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