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Electro-oxidation of Quinoline Simulated Wastewater Containing Chloride in a Swirling Flow Reactor: Influence Factors, Kinetics, Biotoxicity, and Energy Consumption

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In this research, we used a swirling flow reactor to remove quinoline from aqueous solutions containing chloride using electro-oxidation (EO). We evaluated the effect of several operational variables, including current density, initial pH, Cl^- concentration, and initial quinoline concentration, on EO effectiveness. Our results revealed a maximum total organic carbon (TOC) removal efficiency of 68.0% at a current density of 40 mA cm^{-2}, Cl^- concentration of 2000 mg L^{-1}, and initial quinoline concentration of 250 mg L^{-1}. Of the variables tested, current density had the largest effect on TOC abatement. Kinetic analysis showed that quinoline abatement followed pseudo-first-order kinetics and was limited by charge transfer. The biotoxicity of quinoline simulated wastewater increased and then decreased during EO. Energy consumption and mineralization current efficiency during 90 min of electrolysis in the swirling flow reactor were 1.67 kWh (g TOC)$^{-1}$ and 8.1%, respectively, indicating superior performance compared to the parallel plate reactor. This paper provides information on developing electrochemical reactors and their application to reduce the organic load of saline wastewater.

Keywords: Quinoline; Electro-oxidation; Biotoxicity; Energy consumption; Swirling flow reactor

FULL TEXT