Short Communication

High removal efficiency of dye pollutants by anodic Fenton treatment

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doi: 10.20964/2020.01.21

Received: 4 August 2019 / Accepted: 12 October 2019 / Published: 30 November 2019

Anodic Fenton treatment (AFT) has been extensively applied for water remediation. In general, three different bench-scale divided (salt bridge or ion membrane) reactors have been focused to treat small volumes (90-350 mL) and low concentration (20-400 μM) of organic pollutants in short treatment periods (2-40 min). The best experimental condition of AFT was found by performing several trials with different H_2O_2 concentrations continuously added. In this work a modified AFT reactor is proposed: a divided electrochemical flow cell ($7.58 \times 10^{-3} \text{ m s}^{-1}$) separating the catholyte from the anolyte by a treated cation permeable membrane. This electrochemical process has been focused to treat 2L of aqueous solutions of 1 mM acid orange 7 (AO7), 0.5 mM methylene blue (MB), and 0.12 mM reactive black 5 (RB5). The stoichiometric amount of H_2O_2 required was added in a single dose at the beginning of the electrolysis. At 40 min of electrolysis, a near complete discoloration of all dye solutions and COD reductions of 85%, 84% and 76% for AO7, MB and RB5 were obtained, respectively. Additionally, an industrial textile effluent (300 ppm COD) was successfully oxidized in 40 minutes of electrolysis, lowering 95% of the initial COD using the proposed AFT reactor. The energy requirements were low for the treatment of all the synthetic dye solutions ($\leq 0.041 \text{ kW h m}^{-3}$) and for the oxidation of the industrial wastewater ($0.075 \text{ kW h m}^{-3}$). Furthermore, the AFT electrochemical reactor allows an economic cogeneration of H_2 ($19.85 \text{ kW h kg}^{-1} \text{ H}_2$) together with the treatment of textile effluents.

Keywords: Anodic Fenton treatment; Azo dyes; Catalytic H_2O_2 activation; H_2 production; Textile industry wastewater

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