ELECTROCHEMICAL OXIDATION OF SYNTHETIC ORGANIC DYES BY FERRATE (VI), USING COMMERCIAL STEEL WOOL ELECTRODES

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ABSTRACT

This paper deals with the in-situ electrochemical oxidation of Reactive Black 5 (RB-5), Reactive Blue 19 (RB-19) and Allura Red AC (AR-AC), using commercial steel wool as electrodes. At the optimal conditions (18 V and NaOH 0.33M), the decolorization of RB-19 (anthraquinone-type dye) is much more rapid than those of azo dyes RB-5 and AR-AC. The reaction rates based on a first order reaction model were 0.134 min^{-1} for RB-19, 0.043 min^{-1} for RB-5 and 0.028 min^{-1} for AR-AC. Color removal efficiencies were higher than 95% achieved in 120 min. The analyses of spectra of the three dyes in the visible region indicate a complete cleavage of both azo and quinoid chromophores. In the case of RB-19 no new absorption peaks occurred in the UV region, showing a partial oxidation of aromatic groups without the generation of intermediates. In case of both azo-type dyes RB-5 and AR-AC, formation/accumulation of intermediates followed by their partial oxidation may have occurred. All these observations indicate that the predominant mechanism for decolorization was the oxidation of the three dyes. We conclude that that the electrochemical oxidation by ferrate (VI), under low voltages and low NaOH concentrations, using commercial steel wool as electrodes is an efficient and cost-effective alternative for the decolorization of azo and anthraquinone type dyes. For future studies a COD analysis should be made in order to correlate the decolorization and the elimination of the organic load in the dye solutions.

Keywords: Ferrate (VI), Synthetic Organic Dyes, Electrochemical Oxidation, Decolorization.

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