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Decolorization of ethyl orange azo dye by oxidation process with acidified chloramine-T: spectrophotometric, kinetic and mechanistic approaches

A.S. Manjunatha, Puttaswamy*

Department of Chemistry, Bangalore University, Central College Campus, Bangalore 560 001, India, Tel. +91 080 22961340; Fax: +91 080 22961331; emails: madhumanjuas@gmail.com (A.S. Manjunatha), pswamy_chem@yahoo.com (Puttaswamy)

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ABSTRACT

Ethyl orange (EO) is a mono-azo dye, which is chiefly used as a dye in textile, food, and cosmetic industries. Removal of this dye from wastewater generated by these industries is a main concern in wastewater treatment. Hence, there is a need for a simple and inexpensive method to abolish this dye present in wastewater. A search through literature revealed that very few reports are available on the decolorization of EO dye and also no kinetic and mechanistic studies have been carried out about this dye. Consequently, an attempt is made to develop an oxidative decolorization method for EO dye with chloramine-T (CAT). The present study also aims to investigate the kinetics and mechanism of oxidative decolorization of EO dye with CAT in $HClO_4$ medium spectrophotometrically ($\lambda_{max} = 474$ nm) at 303 K. The reaction exhibits a first-order dependence of rate on $[EO]_o$ and fractional-order dependence, each on $[CAT]_o$ and $[H^+]$, respectively. The dielectric effect is positive. Activation parameters have been deduced. Oxidation products were identified as *N*-(4-diethylamino-phenyl)-hydroxyamine and 4-nitroso-benzenesulfonic acid. Suitable mechanism and related rate law have been worked out. Importantly, the present decolorization method is definitely an advantageous alternative technique in treating the EO dye present in wastewater.

Keywords: Ethyl orange; Chloramine-T; Oxidative decolorization; Kinetics; Mechanism

*Corresponding author.