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Oxidative decolorization of Mordant Black 17 by peroxydisulfate facilitated by Fe^{2+}

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The present study focuses on investigating the decolorization of Mordant Black17 (MB17) in aqueous solutions using peroxydisulfate. The impact of the initial dye concentration, as well as the concentrations of peroxydisulfate and Fe^{2+}, temperature, and *p*H on the decolorization of MB17 has been investigated. The experimental data have been examined employing kinetics of both first and second order. The decolorization kinetics of MB17 in the peroxydisulfate process adhered to the principles of second-order reaction kinetics, with a rate constant of 2.75×10^{-4} M^{-1} min^{-1} at 3.0 mM $S_2O_8^{2-}$ concentration. Decolorization efficiency above 93% has been achieved in 120 minutes under optimal reaction conditions. The rate constants pertaining to the second-order chemical process demonstrate a positive association with both $S_2O_8^{2-}$ concentration and temperature. Fe^{2+} activates $S_2O_8^{2-}$ to generate sulfate radical ion, amplifying MB17 decolorization. At higher *p*H, sulfate-free radical production decreases, limiting MB17 decolorization. Peroxydisulfate decolorized MB17 with a low activation energy of 45.36 kJ mol^{-1} at 3.0 mM starting concentration. The positive ΔG value indicates the non-spontaneity of the decolorization process.

Keywords: Peroxydisulfate, Mordant Black17, Decolorization, Kinetics, Activation parameters