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Degradation of methylene blue dye by UV/H_2O_2 advanced oxidation process: reaction kinetics, residual H_2O_2 and specific energy consumption evaluation

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ABSTRACT

In the present study, the degradation of methylene blue (MB) dye, a common pollutant from textile and printing industries was observed using UV/H_2O_2 advanced oxidation process. Effect of process variables like pH (3–11), H_2O_2 dosage (2.5–12.5) mM and initial MB dose (10–100) mg/L on decolorization efficiency of dye was investigated. An acidic pH of 3 was found to be favorable for decolorization of MB. Degradation of MB followed pseudo-first-order removal kinetics. Rate constants of MB decolorization increased with increase in H_2O_2 concentration and decrease in initial dye concentration. The results showed that about 89.85% residual H_2O_2 remained in the system even after 75 min treatment time. To ensure the minimum residual H_2O_2 in effluent and optimum MB removal, H_2O_2 dose was optimized at 12.5 mM with specific energy consumption of 271.6 kWh/kg dye. Thus, in the described experimental range of conditions, UV/H_2O_2 oxidation of MB may be an efficient, inexpensive and clean alternative treatment for decolorization of textile wastewater containing this dye.

Keywords: Advanced oxidation process; Methylene blue; Removal kinetics; Residual H_2O_2; Specific energy consumption; UV/H_2O_2 process

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