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Magnetite Nano Particles Activated Persulfate Oxidation for Decolorization of New Coccine

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Extended Abstract

Azo dyes are characterized by the bearing of azo-bonds (N=N-) in association of aromatic rings, which are the major synthetic colorants used in printing and dying industries. Most azo dyes are refractory to biodegradation, the effluent containing azo dyes treated by conventional biological treatment process may no longer considered as a promising process. The commercially available magnetic nano particles (MNP-Fe_3O_4) has advantages of fast-effective and ease of operation in removing dyes from aqueous solution. The present study was evaluate the use of MNP to activate persulfate oxidation (MNP/PS) for decolorization of New Coccine (NC), an acid azo dye.

PS decolourization experiments were performed in aluminium-foil-wrapped glass beakers containing 1 L of fresh dye solution. After adjusting the pH of the dye solution, MNP and PS were immediately agitated with a mechanical stirrer for 30 min. At pre-set time intervals, 10 mL of solution was filtered immediately separated with a magnetic bar to collect the supernatant. The residual dye concentration in the supernatant was determined by a spectrophotometer. In the experiments of PS in conjuction with ultrasound, the dye solution was sonicated by an ultrasonic generator with direct sonication of 120 W/L and a fixed frequency of 60 kHz.

Findings showed that significant enhancement of NC decolorization was achieved when ultrasound (US) was added in the MNP/PS system. Results also showed that the adsorption of NC onto MNP-Fe_3O_4 plays an crucial role in the MNP/PS decolorization process. Crucial operating factors, including solution pH, MNP-Fe_3O_4 dosage, and temperature, could influence the dye removal to some extent. Increasing both temperature and MNP dosage led to release of a greater amount of Fe^{2+} for activating the persulfate reaction, which generated more $SO_4^{-\bullet}$ radicals to oxidize NC and resulted in accelerating the decolorization rate. The Arrhenius activation energy for the PS activated with MNP was estimated, suggesting NC decolorization reaction is highly depend on temperature. In the MNP/PS system, a 95% decolorization efficiency was achieved within 20 min under the reaction temperature of 60°C for the treatment of 2×10^{-5} M NC. The assisting of ultrasound in MNP/PS system did not incur a substantial increase in electricity while the NC was decolorized quickly. Findings indicated that both ultrasound and heat could be used as enhancement tools in MNP/PS system for effective removal of acid azo dye.

***Keywords*:** Magnetite Nano Particles; Persulfate Oxidation; Dye; Wastewater treatment