

Degradation of Dyeing Wastewater by the UV/TiO₂ Process

詹巧如、吳忠信

E-mail: 9805414@mail.dyu.edu.tw

ABSTRACT

This study employed the UV/TiO₂-based systems to evaluate the treatment efficiency and possibility of textile wastewater. The parent compounds were C.I. Reaction Red 198 (RR198) and C.I. Reaction Black 5 (RBK5). The parameters of this research were pH, dye concentration, TiO₂ dosage, light intensity and wavelength and oxidant addition. The oxidants included hydrogen peroxide, sodium persulfate, sodium periodate, sodium bromate and sodium chlorate.

This study indicated the most appropriate dosage of TiO₂ was 1 g/L. The decolorization rate increased with the dye concentration and light wavelength decreasing, conversely, the decolorization rate increased as light intensity increased. The experimental results of pH effect showed the decolorization rate followed the order pH 4 > pH 7 > pH 10; additionally, RBK5 was more easy to decolorize than RR198. The photodegradation efficiency of UV/TiO₂ system was promoted by the addition of NaCl and Na₂SO₄.

In UV (254 nm)/oxidant systems, the decolorization efficiency increased with the dosage of oxidant increasing; however, sodium chlorate exhibited no photocatalytic ability. For UV/H₂O₂ system, the most appropriate dosage of H₂O₂ was 12 mM. In UV/TiO₂/oxidant systems, only sodium periodate can accelerate the decolorization rate of UV/TiO₂. The inhibition of dye decolorization by adding C₂H₅OH reveals that the primary decolorization pathway involves hydroxyl radicals, and that direct oxidation by photogenerated holes is probably important in the UV/TiO₂-based system. In UV/H₂O₂ system, the decolorization pathway only involves hydroxyl radicals; however, in UV/Na₂S₂O₈, UV/NaBrO₃ and UV/NaIO₄ systems, the oxidation of persulfate, bromate and periodate radicals cannot be ignore.

Keywords : TiO₂、Photocatalytic、Hydrogen peroxide、Sodium Persulfate、Sodium Periodate、Sodium Bromate、Sodium Chlorate

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