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Heterogeneous and Homogeneous Photocatalytic Degradation of Acid Orange 10 in Aqueous Solution

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Abstract : Advanced oxidation processes (AOPs) utilizing Homogenous photocatalysis (Fenton and photo-Fenton reactions), and Heterogeneous photocatalyse (TiO2 and ZnO) were investigated for the degradation of commercial azo dye 'Orange G' wastewater. Fenton and photo-Fenton experimental conditions were: Hydrogen peroxide concentration (10-2 M), Ferrous ions concentration (5.10-4 M), pH (2.8 – 3), UV lamp power (6 watt). Adding more ferrous ions enhanced the oxidation rate for the H2O2/Fe2+ and UV/H2O2/Fe2+ processes. The optimum catalyst loading was found 2.0 g.L-1 in our case for both catalysts TiO2 and ZnO. A comparative study of the photocatalytic degradation showed that these two catalysts have a comparable reactivity; it follows a pseudo-first-order kinetics. The degradation trends followed the order: UV365/Fenton > UV365/TiO2 > Solar Fenton > Solar TiO2 > Fenton ~UV365/ZnO. Among AOPs, processes using Fenton type reagent are relatively cheap and easy to operate and maintain. Moreover, UV365/Fenton process has been shown as effective in the treatment of OG dye. Dye was degraded following second-order kinetics. The rate constants was 0,041 .10+6 L.M-1.min-1. The degradation was followed by spectrophotometric method, chemical oxygen demand (COD) measures and high performance liquid chromatography analyses (HPLC). Some aromatic and aliphatic degradation compounds were identified. Degradation of Orange G by UV Fenton mechanism was also proposed.

Keywords : AOPs, homogeneous catalysis, heterogeneous catalysis, acid orange 10, hydroxyl radical
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