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Photochemical oxidation of phenolic wastewaters and its kinetic study

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ABSTRACT

The present work was carried out to study the photochemical oxidation of phenol and *p*-chlorophenol in a batch recycle photochemical reactor using ultraviolet irradiation, hydrogen peroxide and TiO_2 (as photocatalyst). The study revealed that the combined treatment process was the most effective process under acidic conditions and showed a higher rate of degradation of phenol and *p*-chlorophenol at a very short radiation time. The reaction was found to follow the first order kinetics and was influenced by the pH, the input concentration of H_2O_2 and the dosing amount of the TiO_2 photocatalyst. The experimental results showed that the maximum % degradation were obtained at a pH value of 4, with H_2O_2 concentration ranging from 200 to 550 ml l^{-1}, and TiO_2 dosing ranging from 1.0 to 2.5 g l^{-1} for UV/H_2O_2/TiO_2 combined system under bubbling of air. The results indicate maximum (74.6% and 79.8%) degradation of phenol and *p*-chlorophenol respectively within 90 min of radiation time. The work also covered the few other aspects related to the advanced oxidation processes such as chemical oxygen demand (COD) analysis, energy consumption and dechlorination efficiency.

Keywords: Advanced oxidation; Photochemical oxidation; Degradation; First-order kinetics; *p*-Chlorophenol; UV/H_2O_2/TiO_2 system; phenol

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