The Application of Photocatalytic Oxidation in Removing Pentachlorophenol from Contaminated Water

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Abstract

The degradation of sodium salt of pentachlorophenol (PCPS) by photocatalysis with titanium dioxide (TiO_2) as the catalyst was investigated. The residual PCPS after photo-degradation was analyzed by high performance liquid chromatograph (HPLC) while the concentration of the chloride ion (Cl^-) was measured by ion chromotography. The results show that the degradation of PCPS by heterogeneous photocatalysis with UV/TiO_2 reaction was much faster and more complete compared to the rate of UV irradiation alone. The suitable dose of catalyst to degrade the [PCPS] with a concentration of 10-40 mg. L^{-1} was found to be as low as 0.05 g. L^{-1}. As the influent PCPS concentration increased to 60-80 mg. L^{-1}, the required TiO_2 dose doubled. The first order and Sips (combination of Langmuir – Hinshelwood kinetics) kinetics were used to predict the degradation rate of organic contaminants treated by illuminated TiO_2. The results showed that the Sips model fitted well with the experimental data. During the photocatalytic degradation of PCPS, the pH value reduced (from 8.1 to 3.5) with the reaction time while the concentration of Cl^- increased significantly. This finding indicates the decholorination and formation of intermediates during the oxidation process.