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SIMULATED SOLAR DEGRADATION OF DICHLOFLUANID USING TiO_2 SUSPENSIONS

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EXTENDED ABSTRACT

Due to the worldwide general application of intensive agricultural methods during the last few decades and to the large-scale development of the agrochemical industry, the variety and quantities of agrochemicals present in continental and marine natural waters has dramatically increased. Their persistence and stability to natural decomposition in the environment has been the cause of much concern to societies and regulating authorities around the world. The critical nature of this environmental problem has prompted the development of more efficient methods for the destruction of the pesticides dispersed in the environment.
Advanced oxidation processes (AOPs) are at present considered to have considerable potential in this area and photochemical oxidation processes such as H_2O_2/UV or TiO_2/UV have been applied for their treatment. Photocatalysis using TiO_2, is a relatively recent decontamination method suitable for the treatment of water and waste water containing inorganic or organic pollutants present at low concentration levels. It is based on a sequence of light-induced redox transformations, occurring at the semiconductor/water interface upon irradiation with light of proper energy and involves both the generated electron/hole pairs and oxidizing radical species coming from water and from adsorbed oxygen.
The photocatalyzed degradation of the biocide dichlofluanid has been investigated in aqueous suspensions of titanium dioxide (TiO_2) under simulated solar irradiation. The primary degradation of the micropollutant follows a pseudo-first-order kinetics following the Langmuir-Hinshelwood model.
In our conditions total disappearance of dichlofluanid was achieved in 20 min whereas the mineralization of organic carbon to carbon dioxide after 240 min of irradiation was found to be 78% for dichlofluanid. The evolution of heteroatoms (Cl, N, S, F) followed by ion chromatography showed a mineralization into chloride, nitrate, sulfate and fluoride anions respectively. In addition microtox bioassay (*Vibrio fischeri*) was employed in evaluating the ecotoxicity of solutions treated by photocatalysis.
Photocatalytic intermediates detected during the degradation of biocide were identified by GC-MS techniques. Based on this byproduct identification a simple degradation scheme was proposed including dechlorination, oxidation, and dealkylation of the starting molecules.

Key words: Photocatalysis, TiO_2, mineralization, dichlofluanid