Proceedings of the 8th International Conference on Environmental Science and Technology
Lemnos Island, Greece, 8 – 10 September 2003
Full paper Vol. A, pp. 674 - 681

PHOTOCATALYTIC OXIDATION OF AGROCHEMICAL INDUSTRY LIQUID WASTEWATERS

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EXTENDED ABSTRACT

The present investigation concerns with the feasibility of processing liquid waste, produced by agrochemical industry, using photocatalytic oxidation method. Among the different approaches to pesticide elimination, Advanced Oxidation Processes (AOPs) have been recognized as especially efficient compared to technologies consisted mainly of conventional phase separation techniques (adsorption processes, stripping techniques) and methods which destroy the contaminants (chemical oxidation/reduction). Advanced Oxidation Processes, although making use of different reacting systems, are all characterized by the same chemical feature: production of OH radicals. Photo assisted Fenton, H_2O_2 photolysis and TiO_2 photocatalysis are the most intensively investigated technologies.

The reactions were performed in a batch recycle photoreactor, at room temperature. The pesticide wastewater supply has been fixed at 50ml/min. The illumination wavelength range of the ultraviolet radiation (mercury lamp-12W) was predominantly 254.7nm. UV radiation activates H_2O_2 destruction producing the extremely reactive species OH radicals. The oxidation products were identified by gas chromatography with a mass selective detector. The influence of basic photocatalytic parameters such as the pesticide concentration, the oxidative agent (H_2O_2) concentration, and the mass of catalyst were studied.

From experiments for different concentrations of wastewater and H_2O_2 it was demonstrated that the wastewater was decolorized, with or without the presence of $FeCl_3 \bullet 6H_2O$ catalyst. The study of two characteristic elements of the wastewater, Prometryn and Chlorpyriphos, showed that very high levels of degradation (more than 80 % in the case of Prometryn and between 70 – 80 % in the case of Chlorpyriphos). The catalyst did not increase the effectiveness of the reaction but accelerated the process. After two hours of reaction COD showed a significant reduction of 70 % on average. During photooxidation processes studied the pH of the reaction decreased.

The oxidation of organophosphorus pesticide such as Dimethoate, was investigated in a UV-H_2O_2 system. This study showed that the reaction follows first order kinetics with a specific rate k = $0.022442 s^{-1}$.

Heterogeneous photocatalysis with TiO_2 catalyst has been also examined. The results suggest that the addition of H_2O_2 is more effective on the photocatalytic oxidation of organophosphorus pesticides than the use of TiO_2 only.

Key words: Advanced Oxidation Process, Wastewater treatment, Prometryn, Chlorpyriphos, Photo Fenton, H_2O_2, TiO_2 Photocatalysis, Organophosphate pesticides.