REMEDIATION OF DIURON-CONTAMINATED WATER BY ADVANCED OXIDATION PROCESSES

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Abstract

Water contamination with diuron (a substituted phenylurea compound widely used as a systemic herbicide and antifouling biocide) is a problem of general concern since this compound is commonly toxic and highly persistent in the environment. Among the advanced oxidation processes (AOPs) which are currently recognized as effective techniques in water treatment are heterogeneous photocatalysis with titanium dioxide and homogeneous photocatalysis by photo-Fenton. Therefore, the remediation of diuron-contaminated water (1mg/L) by TiO_2 was studied using a solar simulator under different conditions such as pH, photocatalyst concentrations and addition of several electron acceptors beside molecular oxygen. The effect of combined TiO_2/photo-Fenton process was studied as well. The degradation rates were found to be strongly influenced by all the above parameters. The efficiency of the degradation rate for decomposition of diuron increased with the increase in reaction pH from 5 to 9 and a further increase in pH (11) led to a decrease in the degradation. It has been observed that the degradation rate for diuron pesticide increases with the increase in photocatalyst TiO_2 concentration up to 1g/L. The decrease of total organic carbon (TOC) as a result of mineralization of diuron was clearly enhanced with TiO_2 plus peroxydisulphate (10mM) compared to TiO2 alone, and TiO2 plus hydrogen peroxide (20mM). The combined solar TiO2/photo-Fenton process was the most effective method for the decomposition and mineralisation of diuron from water. Eight kinds of intermediate products were identified by GC–MS analysis during the decomposition of diuron.
Keywords: Diuron, Photo-Fenton, Titanium dioxide, hydroxyl radicals.

INTRODUCTION

The Green revolution's heavy reliance on pesticides has created different environmental problems. The majority of pesticides after deliberate or inadvertent release enter the soil and water, where they are either broken down to simpler forms or remain unaltered for a long time because of their persistent nature, posing a great threat to the ecosystem (Alexander, 1981).