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Solar photocatalytic degradationof different fungicides in water using $TiO_2$for its reuse asirrigationwater

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Topic: The elements and the Periodic Table for sustainable chemistry

Abstract

Water scarcity is becoming a global concern. Spain is characterized by periods of special drought, mainly in the south and south-east of Spain, which cause an increasingly severe water shortage. All this has caused society to be increasingly aware of the need to increase water saving and reuse. Region of Murcia (SE of Spain) allocated about 95% of the reclaimed water in 2017 for agricultural reuse [1]. And *what do we do with water polluted with pesticide residues*? In this context,Advanced Oxidation Processes (AOPs) are widely used fordetoxification of water polluted with pesticide residues[2]. In our case, heterogeneous photocatalytic process using TiO_2 P-25 has been optimized to remove 6 fungicides under natural solar radiation during the summer months. The fungicides under study wereazoxystrobin, flutriazol, myclobutanil, triadimenol,pyrimethanilandprochloraz.Separation and detection of the target compounds were carried out by means of HPLC/MS^2, after liquid-liquid extraction (LLE) [3]. According to pseudo-first order kinetics, the reaction rates of oxidation for the six fungicides werevery similar at different catalyst loading (200, 350 and 500 mg $L^{-1}$of TiO_2).The use of sodium persulfate ($Na_2S_2O_8$), as electron acceptor significantly increased the previous rates. Thus, in order to save costs, 200 mg L^{-1} of $TiO_2$was chosen as the optimal concentration of this process together with 200 mg L^{-1} of $Na_2S_2O_8$ and circum-neutral pH (Figure 1). Degradation was successful in 240 minutes for all fungicides with DT_{90} ranging from 10 to 60 min. In addition, TiO_2 is can be recovered by ultrafiltration for reuse later [4]. Based on the results obtained in this work, it can be concluded that solar photocatalysis with TiO_2 is aneffective and sustainable method to reclaim water polluted with pesticides.

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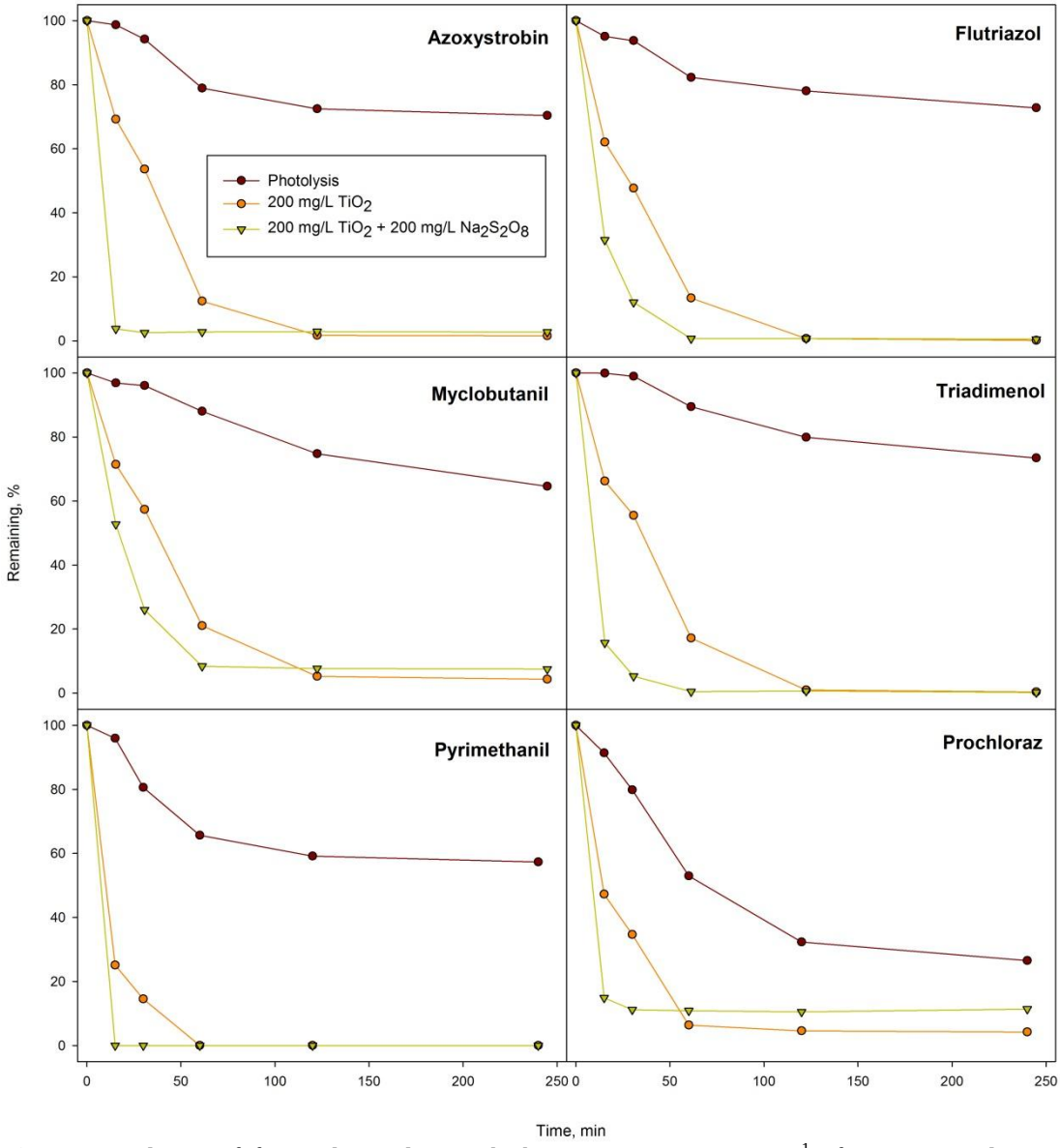

Figure 1. Evolution of fungicide residues with the time using 200 mg L^{-1} of TiO_2 P-25 alone or in tandemwith 200 mg L^{-1} of $Na_2S_2O_8$ under sunlight. Photolysis curves represent solar degradation in absence of catalyst.

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