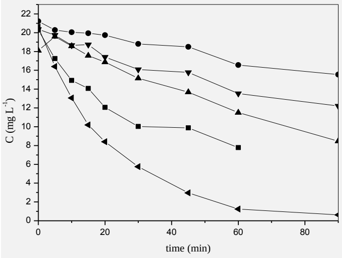
Heterogenous Photocatalytic Degradation And Mineralization Of The Herbicide Bentazone

will be filled in by SPEA8

***C. Berberidou**[1], V. Kitsiou[1], E. Kazala[1], D. Lambropoulou[1], A. Kouras[1], I. Poulios[1]. (1) Laboratory of Physical Chemistry, Department of Chemistry, Aristotle University of Thessaloniki, Thessaloniki, Greece, cberber@chem.auth.gr.*



Photocatalytic degradation of 20 mg L^{-1} of bentazone in the presence of 0,5 g L^{-1} of photocatalyst and UV-A: (■) TiO_2 P25 (●) TiO_2 Kronos 7500 (▲) TiO_2 Kronos 7000 (▼) TiO_2 UV 100 and (◄) ZnO.

Degradation and mineralization of bentazone, a selective herbicide reported to occur in drinking water, by heterogeneous photocatalysis in the presence of UV-A and visible light has been studied. The effect of various operating conditions such as different commercial TiO_2 products, the addition of H_2O_2, the effect of initial pH on the degradation and the organic content reduction (DOC) of the wastewater was examined. The use of TiO_2 P25 in the presence of UV-A, led to higher initial degradation rates in comparison to other commercial TiO_2 photocatalysts.

The widespread use of pesticides in agricultural activity has led to problems related with pesticide waste management. The United Nations estimate that less than 1% of all pesticides used in agriculture actually reaches the crops. The remaining contaminates the land, the air and particularly the water. [1] These contaminants are in many cases toxic and non-biodegradable, they have the ability to accumulate in the environment and to magnify through the global trophic network with unpredictable consequences for the mid-term future. [2]

Bentazone is a selective post-emergence herbicide (3-isopropyl-1H-2,1,3-benzothiadiazin-4-(3H)-one-2,2-dioxide, CAS No: 25057-89-0, M_r: 240.28), used to control many broadleaf weeds and sedges. Bentazone has the potential to contaminate both ground and surface water because of its low soil sorption and high water solubility. It is stable to hydrolysis and has a half-life of less than 24 h in water because it is readily broken down by sunlight [3].

Among various techniques developed in the past years, heterogenous photocatalytic processes have been shown to be potentially advantageous for degradation and mineralization of organic pollutants in aqueous suspension. A wide range of herbicides, herbicides, fungicides and insecticides can be completely mineralized in the presence of TiO_2, UV-A and oxygen [4]. Our current study investigates the heterogenous photocatalytic decomposition and mineralization of bentazone, in order to assess the effect of various operating conditions on pesticide degradation and mineralization.

Among the various photocatalysts employed in the study, TiO_2 P25 (Degussa) and ZnO (Merck) in the presence of UV-A, resulted in higher initial degradation rates of the herbicide. In contrast, Kronos 7000 or 7500 (Kronos Worldwide, Inc) in the presence of either UV-A, led to low initial degradation rates.

The determination of ecotoxicity and of major intermediate by-products is currently in progress, aiming to the determination of possible photocatalytic degradation pathways.

Acknowledgements

The present study is implemented within the framework of the research project entitled "*A novel method for detoxification and reuse of westewater containing pesticides by solar photocatalysis and constructed wetlands*" (project No: 957)of the Action *ARISTEIA* of the Operational Program "*Education and Lifelong Learning*" (Action's Beneficiary: General Secretariat for Research and Technology), and is co-financed by the European Social Fund (ESF) and the Greek State.

References

[1] E.M. Thurman, M.T. Meyer, *Acs Sym Ser* 630 (1996) 1-15.
[2] I.K. Konstantinou, T.A. Albanis, *Appl Catal B-Environ* 42 (2003) 319-335.
[3] Abernath.Jr, L.M. Wax, *Weed Sci* 21 (1973) 224-227.
[4] U.I. Gaya, A.H. Abdullah, *J Photoch Photobio* C 9 (2008) 1-12.