# Photocatalytic degradation of wastewater containing the pesticide bentazone in a novel pilot photocatalytic reactor

Chrysanthi Berberidou, Vasiliki Kitsiou, Dimitra A. Lambropoulou, Athanasios Kouras, Ioannis Poulios*
Department of Chemistry, Aristotle University of Thessaloniki, 54124, Thessaloniki, Greece
*e-mail: poulios@chem.auth.gr

The introduction of pesticides in agricultural activity has led to widespread contamination of the environment with these bio-recalcitrant organic compounds. 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. These xenobiotics are in many cases toxic and non-biodegradable, with the potential to cause adverse acute or chronic toxic health effects to non-target organisms and accumulate in the environment through the global trophic network with unpredictable consequences [1]. 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, Mr: 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 [2].

Homogenous photocatalytic processes have been shown to be potentially advantageous for degradation and mineralization of a wide range of herbicides, herbicides, fungicides and insecticides. Our study investigates the mineralization of simulated wastewater containing bentazone at an initial concentration of 20 mg $L^{-1}$ in a novel photocatalytic fountain type reactor the presence of the photo-Fenton or the Ferrioxalate reagent. The effect of various operating conditions on pesticide mineralization such as $Fe^{3+}$ or $H_2O_2$ concentration, light intensity or illuminated volume has been investigated. The efficiency of both systems was very high, since, within 45 min under artificial irradiation, mineralization was 68% and 86% for the $Fe^{3+}/H_2O_2$/UV-A and the Ferrioxalate/UV-A system, respectively. Experiments under solar light are in progress to provide further information on the potential of both methods to be employed alone or in integration with natural processes which also employ solar light, i.e. constructed wetlands, reducing the relevant environmental impact and creating water suitable for reuse applications (e.g. irrigation).

Acknowledgements
The present study is implemented within the framework of the research project entitled "A novel method for detoxification and reuse of wastewater 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] Abernath.Jr, L.M. Wax, Weed Sci 21 (1973) 224-227.