Photodegration of thiram in aqueous solutions in the presence and absence of humic substances – kinetics studies

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Thiram, a dithiocarbamate compound, is a contact fungicide with preventive action and is registered in the Annex I of the Council Directive 91/414/CEE of 15 July 1991. In Portugal, according to 2003-2008 available reports, thiram was considered the second most popular contact fungicide, after the traditionally used copper derivatives. During this five year period, thiram selling rate registered a significant increase [1]. In spite of the reported burst on thiram application, and in comparison to other pesticides, there is a lack of information on thiram behaviour in environmental matrices.

Photodegration is one of the main factors that can affect the persistence of pesticides in environmental matrices, namely, in natural waters. Pesticides can undergo either direct photodegration by absorbing UV radiation leading to important chemical transformations, or indirect photodegration, when transformation is indirectly caused by excited chromophor groups present in natural waters, such as humic substances. Concerning to thiram, there are some studies about photocatalytic degradation of thiram mediated by TiO2 [2] but few about direct photodegradation in aqueous solutions [3].

In this work, photodegration results of thiram in aqueous solutions in the presence and absence of humic substances are reported. To establish photodegration kinetics, thiram samples (2 mg L^{-1}) both in presence and absence of humic substances (10 mg L^{-1}), were irradiated by simulated solar radiation using a Solarbox 1500, equipped with a 1500W arc xenon lamp and outdoor UV filters that restrict the transmission of light with wavelengths below 290 nm; lamp irradiance was 55 W m^{-2} (290-400 nm). Irradiation was made in triplicate samples and during different time periods of irradiation. Simultaneously, dark controls (samples in quartz tubes covered with several layers of aluminium foil) were also irradiated. Results of experimental data fitting to a first order kinetic model showed that in the presence of humic matter the photodegration of thiram was slightly accelerated

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