PHOTODEGRADATION OF PESTICIDES IN FLOAT SYSTEM EFFLUENT FROM TOBACCO PLANTATION

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***Abstract*— Several crops can generate liquid effluent containing pesticide residues. In the region of the Vale do Rio Pardo, RS, Brazil, one type of effluent results from the float system used in the tobacco seedling plantation. This system is an alternative that substitutes for the conventional seedbeds of tobacco production. The tobacco is germinated on polystyrene tray beds on a water blade that may contain pesticides residues following the transplant of seedlings to the farm. In this paper, we have simulated in the laboratory, the photo-degradation of the pesticides present in the effluent of the float system, including the pesticides metalaxyl, iprodione and imidacloprid. Photolysis and photoperoxidation were the methods used. The experiments were performed with a mercury vapor light bulb of 80, 125 and 250 W. The obtained results show that the photodegradation of the metalaxyl, iprodione and imidacloprid in an optimized system presents considerable reproducibility and high degradation, requiring less time.**

***Keywords*— degradation; pesticide; photolysis; photoperoxidation; float.**

I. INTRODUCTION

The use of pesticides in crops is a common practice throughout the world. The contamination caused by pesticides is due to intensive and indiscriminate use of these pesticides in several crops, and their elimination compared to the magnitude in which they are used is impossible over a short time. Therefore, it is necessary to research alternatives in order to reduce the negative effect these pesticides have on the environment (Sanghi and Sasi, 2001; Sanghi and Tewari, 2001).

Alternatives include the reduction of the pesticides beginning with the substitution of present formulations by less aggressive formulations or remediation of the contaminated environment.

The minimization of the pesticide effect can be carried through Advanced Oxidation Processes (AOPs), which are potentially useful for treating pesticides in waste because they generate hydroxyl radicals (•OH), a powerful oxidant (Derbalah *et al*., 2004; Lhomme *et al.*, 2008)

The hydroxyl radicals react with most organic substances by hydrogen abstraction or electrophilic addition to double bonds, which promotes the reaction with molecular oxygen to yield a peroxyl radical, initiating a sequence of oxidative degradation until the pesticide or other organic molecules are mineralized. Additionally, the radicals may attack aromatic rings at positions occupied by a halogen (Chiron *et al*., 2000).

The use of AOPs for wastewater treatment has been extensively studied, and such methodologies are very important because in these processes it is not necessary so much chemical reactants in comparison to other methods used and in such processes it can be used solar radiation as an energy source for degradation of the molecules, especially for removal of the pesticides in liquid agricultural effluent. Complete elimination of the pesticides may not be attained (Mansour *et al*., 1997; Malato *et al*., 2003; Zamy *et al*., 2004; Kralj *et al*. 2007), however, the total destruction of pesticides is not always necessary.

AOPs operate at higher costs compared to biological treatments (Mercadier *et al*, 1997), and include the processes of photolysis and photoperoxidation, which may be very attractive once the methodology is simple and low cost, as it is with solar energy that contains UV-radiation between 300 and 400 nm (Fernandez-Alba *et al*., 2002). This is a central point, since solar irradiation is a clean, renewable energy source.

To evaluate the effect of UV-radiation on pesticides in liquid agricultural effluent, the assays utilizing light bulbs to produce artificial UV-radiation are adequate. In this case, the sample exposition can occur with wavelengths between 250 and 700 nm (with a major intensity at 360 nm) and is considered an accelerated process compared to the solar exposition. In those circumstances, species like hydroxyl radicals (•OH) or peroxyl radicals (•OOH) will generate progressive breaking of molecules yielding CO_2, H_2O and dilute inorganic acids in the attack against oxidizable contaminants. Therefore, the intensity of the UV-radiation that promotes the degradation is very important to evaluate the necessary time for the degradation of the pesticide in the environment (Malato *et al*., 2002a).

In the region of Vale do Rio Pardo in the south of Brazil, the liquid agricultural effluent is produced in great quantities, as 3,400 and 17,000 L is used per tobacco field during the seedling plantation using the float system (Fig. 1). This environmental problem occurs in 97,000 tobacco fields in this region of Brazil. This effluent presents pesticides residues and demands