SORPTION OF CHLORPYRIFOS AND ATRAZINE BY ALLOPHANIC TOP SOIL AND BIOMIX OF THE BIOBED

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Many pesticides used in protection of crops, weeds and diseases could be released into the environment due to a bad agricultural practice with a consequent risk to humans, flora and fauna. The adsorption and mobility of organic pesticides in soils depend on the ionic or neutral character of the molecule, on its water solubility and its polarity as well as on the content and nature of the colloidal fraction of the soil, clay and organic matter [1]. These contaminants could be removed using a biobed system based on the adsortion and degradation potential of the components of the biobed (top soil, peat and straw) [2]. The straw stimulates the growth of ligninolytic microorganisms, the soil enhanced the sorption capacity in the biobed and promotes microbial activity and the peat contributes to sorption capacity, moisture control and also abiotic degradation of pesticides [3]. The objective of this study was to evaluate the sorption of chlorpyrifos and atrazine, (two pesticide wide used in our country) in allophonic top soil (Andisol) and in the biomix of the biobed system.

The allophanic top soil used for the adsorption studies was an Andisol, belonging to the Temuco Series, located in Southern Chile, sampled from 0-20 cm depth, air dried at room temperature and sieved through a 2 mm mesh. The soil has pH 5.9, organic matter 14.6%, nitrogen 0.72%, sand 16.1%, silt 58.2% and clay 25.7%. The biomix was composed by a mixture of top soil (25%), commercial peat (25%) and straw (50%). The moisture content was adjusted (50-60% of its water holding capacity) by addition of distilled water. The sorption studies were conducted in triplicate in 50 mL glass tubes containing 0.2g of both substrates (top soil and biomix) for chlorpyrifos and 1g for atrazine, with 20 mL of increasing concentration of chlorpyrifos (10, 20, 40, 60, 80 mg L^{-1}) and atrazine (5, 10, 20, 30, 40 mg L^{-1}). $CaCl_2$ 0.1 mol L^{-1} was used as background electrolyte solution and at the natural pH value of the biomix (6.0) and top soil (5.6). After equilibrium (12 h) 5 mL of the samples were centrifuged at 11954 g (Eppendorf 5804 R centrifuge) for 10 min and passed through a membrane filter of 0.45 µm pore size. The pesticides concentration in the supernatant was determined by HPLC (Merck-Hitachi L-7100 pump, Rheodyne 7725 injector, and a Merck-Hitachi L-7455 diode array detector). The mobile phase for atrazine was 60/40% ammonium acetate (1mM)/acetonitrile, and for chlorpyrifos was 60/40% acetonitrile and water/acetic acid (95.3/4.7 v/v).

The isothems were fitted using the Freundlich soption model. Marked differences were observed between both pesticides due to the high differences in chemical properties. All adsorption isotherms could be adequately described by the Freundlich equation, with $R^2 > 0.94$. The K_f values for chlorpyrifos were 2612 and 2511, using top soil and biomix, respectively, instead for atrazine were 6.47 and 5.76, respectively. On the other hand, the 1/n values for chlorpyrifos were 0.403 and 0.47 using top soil and biomix, respectively, instead for atrazine were 0.785 and 0.955, respectively. These differences in sorption behavior can be explained by differences in hydrophobicity and reactivity of the molecules and suggests sorption of both compounds was due to interactions with mineral/oxide surfaces and soil organic matter [4]. Partitioning into soil organic matter is thought to be the main mechanism for sorption of wide range of pesticides; however these results are dependent of the K_{ow} constant of each compound.

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