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ABSORPTION OF THE PESTICIDE PROPANIL ON AGRICULTURAL WASTE PRODUCTS

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Abstract: Propanil is one of the major pesticides used in Sri Lankan rice cultivation. This agrochemical can cause serious environmental pollution on leaching into the ground water system. The absorption of propanil by paddy hull, paddy hull ash, coir dust and saw dust were studied under laboratory conditions. The absorption of the active ingredient of propanil, 3,4-dichloropropionanilide (3,4 DPA) from water solutions was studied by leaving the suspension for 48h at room temperature. The amount of 3,4 DPA left after this period was estimated by HPLC. Absorption rates of 3,4 DPA on different absorbents were studied by analysing the solutions at different time intervals. According to the results obtained paddy hull has the highest absorption capacity and paddy hull ash has the lowest absorption capacity.

Key words: Agricultural waste, paddy hull, pesticides, propanil.

INTRODUCTION

Environmental pollution due to pesticides has increased dramatically in recent times in the country. Pesticides used in agriculture are subjected to a number of processes such as surface run off, absorption by the soil, leaching into the ground water, metabolism by soil micro organisms, volatilization and photodecomposition. Pollution of the water system has a particularly pronounced effect on the rural population of Sri Lanka who depend on ground water and naturally occurring water bodies and rivers for their water supply. Biological control of pests and the use of biodegradable pesticides minimize the pollution, however where the existing non-biodegradable pesticides have to be used, absorbents may be used to reduce the pesticide concentrations in polluted waters.[1,2] The use of agricultural waste products as absorption materials is an attractive proposition.[3] Propanil is a commonly used pesticide in Sri Lanka. In this study the absorption of the active ingredient of propanil, 3,4-dichloropropionanilide (3,4 DPA) by four common agricultural wastes, paddy hull, paddy hull ash, coir dust and saw dust was investigated.

METHODS AND MATERIALS

The formulated product propanil with 36% of the active ingredient 3,4 DPA from Ceylon Petroleum Corporation was used. An authentic sample of 3,4 DPA in acetone (3.63mg/ml) was employed for calibration. Double distilled water was used in the preparation of the solutions. Paddy hull (PH), paddy hull ash (PHA), coir dust (CD) and saw dust (SD) collected from Gampaha district were used as absorbents. JASCO HPLC (PU 980) with a reverse phase column (Finepak SIL C-18-5) and a uv/visible detector coupled to an integrator were used for the analysis.

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After several trials the following set of conditions were set up for the optimization of sensitivity of the final analysis. Solvent system : 65% methanol - 35% water, Flow rate : 1.5 ml/min, Detection wavelength : 240 nm. A series of 1, 2, 5, 10 and 15 ppm 3,4 DPA in water solution were prepared as standards and 25 µl aliquots were injected for analysis.

Preparation of test samples and control samples : 25 ml of 20ppm formulated product in water was employed as the control sample. Three separate samples were prepared for each test material. In each case 1g of the absorbent was suspended in 25 ml of 20 ppm formulated product in water solution.

Analysis procedure - HPLC quantification : All test samples were allowed to stand at room temperature (29 ± 1^0C) for 48h before the HPLC analysis. In all cases peak area, peak height and the retention time of the quantifying peak were measured and the concentrations were calculated on the basis of peak area values.

Rate of absorption of pesticide by test material : 1g of each test material was suspended in 25 ml of 20 ppm formulated product in water solution and from each test material two samples were prepared. Then 20 µl samples were taken from each test sample after 0.5, 1.5, 4.0 and 7.0 h and subjected to HPLC analysis. Peak areas of the quantifying peak were measured and these values were then converted to concentrations using the standard curve. 25 ml of 20 ppm formulated product in water solution was employed as a control.

RESULTS

The concentration of 3,4 DPA in 20 ppm formulated product solution was found to be 5.433 ± 0.032 ppm.

Table 1 shows the results of the absorption study after 48 h, showing the remaining concentration of the 3,4 DPA of 20 ppm formulated product solution after absorption of the pesticide by each test material. The results of the rate of absorption study are shown in table 2.

Table 1: Absorption of 3,4 DPA by agricultural wastes after a 48h period.

	Remaining conc. of 3,4 DPA (ppm)	Amount absorbed (ppm)	% Absorption
PHA	3.563 ± 0.030	1.907 ± 0.044	35 ± 1
PH	0.431 ± 0.055	5.012 ± 0.064	92 ± 1
SD	0.612 ± 0.054	4.831 ± 0.063	89 ± 1
CD	1.046 ± 0.052	4.397 ± 0.061	88 ± 1

Table 2: Rate of absorption of 3,4 DPA by agricultural wastes.

	% absorption*			
Time (h)	0.5h	1.5h	4.0h	7.0h
PHA	15	21	21	27
PH	46	67	81	86
SD	58	75	82	85
CD	33	58	67	70

* Percentage absorption is the mean of duplicate experiments.

DISCUSSION

Paddy hull samples show the highest (92%) and paddy hull ash the lowest (35%) absorption of the pesticide after a 48 h period. Of the four samples tested, three (paddy hull, coir dust and saw dust) show more than 85% absorption of 3,4 DPA. The results of rates of absorption study suggest that saw dust has the highest initial rate of absorption of 3,4 DPA, but after 7 h the amounts of 3,4 DPA absorbed by saw dust, paddy hull and coir dust are about the same. The results indicate that paddy hull, saw dust and coir dust could be easily employed as absorbents for propanil pesticide. However their utilization under field conditions remains to be established.

References

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