UNDATED

DATA EVALUATION RECORD

CASE GS PROMETRYN STUDY 1 PM 25

CHEM 080805

BRANCH: ENVIRONMENTAL FATE AND GROUND-WATER

FORMULATION 00 - ACTIVE INGREDIENT

Rustrum, A.M. 1988. Determination of the Mobility of ^{14}C-Prometryn in Selected Soils by Soil Thin-Layer Chromatography. Study No. HLA 6015-383. Performed by Hazleton Laboratories. Submitted by Ciba Geigy Corporation. Accession Number 405737-99.

DIRECT RVW TIME = 1.5 days

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CONCLUSIONS:

This study is acceptable for partially fulfilling EPA requirements for registering pesticides (Subdivision N Guideline Section 163-1). The soil TLC R_f values for ^{14}C-prometryn are 0.81 (mobile) for Plainfield sand, 0.15 (low mobility) for California sandy loam, and 0.36 (intermediate mobility) for Mississippi silt loam. Prometryn appears to be less mobile than atrazine for the soils tested.

MATERIALS AND METHODS:

Soil thin-layer chromatography (TLC) plates were prepared using four sieved (1.18 mm) soils as the stationary phase. The soils were a Plainfield sand, California sandy loam, Mississippi silt loam, and a Hagerstown clay loam (reported as a silty clay loam). Textural analysis, organic matter, pH, and CEC were determined by the University of Wisconsin Extension Soil and Forage Laboratory. Bulk density and the water content at field capacity were determined by Hazleton. Apparently, analyses of the sample of Hagerstown soil used in this study were not conducted. Physical/chemical characteristics of the Hagerstown soil were obtained from the literature and personal communications with USDA personnel. Soil characterization data are summarized in Table 1.

The soil TLC plates (20x20cm) were prepared with water slurries of each soil, air dried at room temperature, and scored into 2.5-cm strips. The thickness of each plate was measured using a micrometer. Average soil thicknesses were 0.90 mm for the Plainfield sand, 1.02 mm for the California sandy loam, 0.75 mm for the Mississippi silt loam, and 0.70 mm for the Hagerstown clay loam. Uniformly ring-labeled ^{14}C-prometryn (supplied by Ciba-Geigy Corporation 29.3 u Ci/mg, 98.6% radiochemical purity) was spotted (~0.02 uCi) onto three strips of each TLC plate. Uniformly ring-labeled ^{14}C-atrazine (supplied by Ciba-Geigy Corporation, 20.6 uCi /mg, 98% radiochemical purity) and acid-labeled ^{14}C-2,4-D (supplied by Ciba-Geigy Corporation, 247 uCi/mg, 98% radiochemical purity) were each applied to two strips on each soil TLC plate.

The soil TLC plates were developed in water at room temperature. The plates were air dried at room temperature. Radioactivity on each strip was mapped using a radioactivity scanner. Results from the scanner were verified using autoradiography.

R_f values were calculated using the distance traveled to the leading edge of detectable radioactivity. Sorption coefficients (K) were calculated from the soil TLC R_f by the following equation:

$$K = \frac{1/R_f - \theta^{2/3}}{D\ (1-\theta^{2/3})}$$

where: θ = pore fraction of the soil (assumed to be 0.5)
D = specific gravity of the solids in the soil (assumed to be 2.5)

REPORTED RESULTS

All results are summarized in Tables 2 and 3.

STUDY AUTHOR'S CONCLUSIONS:

The mobility of ^{14}C-prometryn ranged from low mobility to high mobility: low mobility in California sandy loam and Hagerstown clay loam; intermediate mobility in Mississippi silt loam; and mobile in Plainfield sand. Both atrazine and 2,4-D were more mobile than prometryn.

REVIEWER'S DISCUSSION:

The Hagerstown soil sample used for this study apparently was not analyzed to determine its physical/chemical characteristics, but data characterizing the soil were obtained from references. Variation within a soil series can be substantial, and utilizing data from one subsample of soil to characterize another subsample may result in a significant error. Characteristics of the Hagerstown soil used in this study must be determined before EFGWB can utilize the mobility data from this soil.

The results demonstrated that prometryn is somewhat less mobile than atrazine. Retention may be higher in heavier textured soils relative to light soil, but the correlation between mobility and soil texture/organic matter is poor.

The sorption coefficients (K) reported were calculated from R_f values, and are reported to correlate with K_{oc} values (Hamaker, J.W. 1975. The Interpretation of Soil Leaching Experiments, in Environmental Dynamics of Pesticides, Plenum Press, NY). These calculated sorption coefficients may provide a rough estimate of pesticide mobility, but they are not adequate to replace actual measurements. Therefore, the R_f values alone are used to classify the mobility of prometryn.

Table 1. Characteristics of Soils

Soil	Sand (%)	Silt (%)	Clay (%)	Organic Matter (%)	Field Moisture Capacity (0.33 bar) (%)	pH	Cation Exchange Capacity (meq/100 g)	Bulk Density (g/mL)
Plainfield sand	97	1	2	0.3	2.1	5.4	1	1.59
California sandy loam	60	35	5	0.7	12.4	4.6	3	1.59
Mississippi silt loam	29	58	13	1.1	20.3	7.0	13	1.18
Hagerstown[1] clay loam	21	50	28	2.5	31.0	6.6	15	1.21

[1] Error in reported texture. Total percentages of sand, silt and clay equal 99%. Texture reported as silty clay loam. All physical/chemical properties taken from literature and personal communications.

Table 2. Relative Mobility of ^{14}C-Prometryn, ^{14}C-Atrazine, and ^{14}C-2,4-D on Two Soil TLC Plates Developed in Water

Compound	Replicate Number	Frontal R_f Value[1]	Mean Frontal R_f Value	Mobility Class[2]	Sorption Coefficient (K)[3]
Plainfield Sand					
^{14}C-Prometryn	1	0.85	0.81	4	0.65
	2	0.77			
	3	0.81			
^{14}C-Atrazine	1	1.0	1.0	5	0.40
	2	1.0			
^{14}C-2,4-D	1	1.0	1.0	5	0.40
	2	1.0			
California Sandy Loam					
^{14}C-Prometryn	1	0.15	0.15	2	6.5
	2	0.16			
	3	0.14			
^{14}C-Atrazine	1	0.53	0.56	3	1.2
	2	0.59			
^{14}C-2,4-D	1	0.74	0.74	4	0.78
	2	0.73			

1 Frontal R_f value determined from the linear analyzer scan of the TLC plate.

2 Mobility class assignment based on the mean frontal R_f value as defined by the EPA Pesticide Assessment Guidelines, Subdivision N, Page 67 (1982):
(1) = Immobile (R_f = 0.0 through 0.09)
(2) = Low mobility (R_f = 0.1 through 0.34)
(3) = Intermediate mobility (R_f = 0.35 through 0.64)
(4) = Mobile (R_f = 0.65 through 0.89)
(5) = Very mobile (R_f 0.90 through 1.0)

3 Sorption coefficient calculated from the mean frontal R_f value.

Table 3. Relative Mobility of ^{14}C-Prometryn, ^{14}C-Atrazine, and ^{14}C-2,4-D on Two Soil TLC Plates Developed in Water

Compound	Replicate Number	Frontal R_f Value[1]	Mean Frontal R_f Value	Mobility Class[2]	Sorption Coefficient (K)[3]
			Mississippi Silt Loam		
^{14}C-Prometryn	1	0.34	0.36	3	2.3
	2	0.36			
	3	0.38			
^{14}C-Atrazine	1	0.63	0.63	3	1.0
	2	0.62			
^{14}C-2,4-D	1	0.85	0.82	4	0.64
	2	0.79			
			Hagerstown Clay Loam[4]		
^{14}C-Prometryn	1	0.27	0.29	2	3.0
	2	0.30			
	3	0.31			
^{14}C-Atrazine	1	0.48	0.49	3	1.5
	2	0.49			
^{14}C-2,4-D	1	0.46	0.46	3	1.7
	2	0.45			

[1] Frontal R_f value determined from the linear analyzer scan of the TLC plate.

[2] Mobility class assignment based on the mean frontal R_f value as defined by the EPA Pesticide Assessment Guidelines, Subdivision N, Page 67 (1982):
(1) = Immobile (R_f = 0.0 through 0.09)
(2) = Low mobility (R_f = 0.1 through 0.34)
(3) = Intermediate mobility (R_f = 0.35 through 0.64)
(4) = Mobile (R_f = 0.65 through 0.89)
(5) = Very mobile (R_f 0.90 through 1.0)

[3] Sorption coefficient calculated from the mean frontal R_f value.

[4] Reported as a silty clay loam.

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