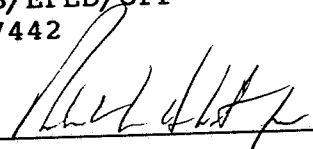CHEM 080805

BRANCH: ENVIRONMENTAL FATE AND GROUND-WATER

FORMULATION 00 - ACTIVE INGREDIENT

Rustrum, A.M. 1988. Determination of the Mobility of ^{14}C-Hydroxypropazine in Selected Soils by Soil Thin-Layer Chromatography. Study No. HLA 6015-381. Performed by Hazleton Laboratories America, Inc. Submitted by Ciba Geigy Corporation. Accession Number 405737-07.

DIRECT RVW TIME = 1 day

REVIEWED BY: R.C. DOYLE
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SIGNATURE:

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-2-hydroxy-4,6-bis(isopropylamino)-s-triazine (hydroxypropazine), a degradate of prometryn, were 0.14 (low mobility) for California sandy loam, 0.50 (intermediate mobility) for Mississippi silt loam, and 0.67 (mobile) for Plainfield sand. Hydroxypropazine mobility is less than or nearly equal to the mobility of atrazine and 2,4-D in these soils.

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 b 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 2.0-cm strips. Uniformly ring-labeled ^{14}C-hydroxypropazine (supplied by Ciba-Geigy Corporation, 22.3 uCi/mg, 94.3% radiochemical purity) was spotted ($\sim$ 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 uC(i/mg, 98% radiochemical purity) were each applied to two strips on each soil TLC plate. All materials were applied i acidified methanol.

After solvent evaporation, 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:

$$K = \frac{1/R_f - 0^{2/3}}{D\ (1-0^{2/3})}$$

where: 0 = 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 hydroxypropazine ranged from low to mobile in the soils tested: low mobility in California sandy loam, intermediate mobility in Hagerstown clay loam and Mississippi silt loam; and mobile in Plainfield sand. Atrazine and 2,4-D were more mobile than hydroxypropazine in all soils. Radioactivity scans showed that a higher percentage of radioactivity moved away from the origin for ^{14}C-atrazine and ^{14}C-2,4-D than for ^{14}C-hydroxypropazine.

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 R_f for the soils tested indicate that hydroxypropazine mobility varies from low mobility to mobile. Retention in the soil could not be correlated to soil texture or the organic matter content, although data from the Plainfield sand suggests that greater mobility may occur on very light soils with low organic matter. Hydroxypropazine is less mobile or nearly equal to the mobility of 2,4-D.

The study author's observation that a higher percentage of ^{14}C-activity moved away from the origin for ^{14}C-atrazine and ^{14}C-2,4-D than for ^{14}C-hydroxypropazine is evident for the Plainfield, California, and Mississippi soils. This trend was not apparent for the Hagerstown soil.

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 hydroxypropazine.

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	31	6	0.7	12.4	4.6	3	1.60
Mississippi silt loam	29	58	13	1.1	20.3	7.0	13	1.18
Hagerstown[1] clay loam	21	50	28	2.5	25.8	6.8	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.

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

Compound	Replicate Number	Frontal Rf Value[1]	Mean Frontal Rf Value	Mobility Class[2]	Sorption Coefficient (K)[3]
			Mississippi Silt Loam		
^{14}C-Hydroxypro-pazine	1 2 3	0.51 0.47 0.53	0.50	3	1.48
^{14}C-Atrazine	1 2	0.63 0.65	0.64	3	1.01
^{14}C-2,4-D	1 2	0.80 0.72	0.76	4	0.74
			Hagerstown Clay Loam[4]		
^{14}C-Hydroxypro-pazine	1 2 3	0.43 0.42 0.42	0.42	3	1.89
^{14}C-Atrazine	1 2	0.44 0.46	0.45	3	1.72
^{14}C-2,4-D	1 2	0.46 0.52	0.49	3	1.72

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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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Table 3. Relative Mobility of ^{14}C-Hydroxypropazine, ^{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-Hydroxypro-pazine	1	0.70	0.67	4	0.93
	2	0.64			
	3	0.68			
[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-Hydroxypro-pazine	1	0.11	0.14	2	7.0
	2	0.12			
	3	0.18			
[14]C-Atrazine	1	0.72	0.68	4	0.91
	2	0.63			
[14]C-2,4-D	1	0.77	0.74	4	0.78
	2	0.71			

[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

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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.