8-4-93

DATA EVALUATION RECORD

STUDY 3

CHEM 059101 Chlorpyrifos §163-1

FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 42493901
Racke, K.D., and R.N. Lubinski. 1992. Sorption of 3,5,6-trichloro-2-pyridinol in four soils. Laboratory Study ID: ENV91081. Unpublished study performed and submitted by DowElanco, Midland, MI.

DIRECT REVIEW TIME = 8

REVIEWED BY: R. Morris TITLE: Staff Scientist

EDITED BY: K. Ferguson TITLE: Task Leader
L. Parsons Staff Scientist

APPROVED BY: W. Spangler TITLE: Project Manager

ORG: Dynamac Corporation
Rockville, MD
TEL: 301-417-9800

APPROVED BY: S. Syslo
TITLE: Environmental Scientist
ORG: EFGWB/EFED/OPP
TEL: 703-305-6355

SIGNATURE: Stephanie Syslo 8/4/93

This report was submitted by DowElanco in support of the reregistration of chlorpyrifos. The experiment is pertinent to the Chlorpyrifos Registration Standard because the test substance, 3,5,6-trichloro-2-pyridinol, is a major degradate of chlorpyrifos.

CONCLUSIONS:

Mobility - Leaching and Adsorption/Desorption

1. This study can be used towards the fulfillment of data requirements.

2. 3,5,6-Trichloro-2-pyridinol (TCP), a major degradate of chlorpyrifos, was very mobile in sand, sandy loam, silt loam, and clay loam soils with Freundlich K_{ads} values of 0.53-1.95.

3. This study is acceptable and partially fulfills EPA Data Requirements for Registering Pesticides by providing information on the mobility (batch equilibrium) of [2,6-pyridyl-^{14}C]3,5,6-trichloro-2-pyridinol in sand, sandy loam, silt loam, and clay loam soils.

4. No additional information is needed on the mobility of 3,5,6-trichloro-2-pyridinol in soil at this time.

METHODOLOGY:

Sand, sandy loam, silt loam, and clay loam soils (Table I) were sieved through a 2-mm mesh screen. Based on the results of preliminary batch equilibrium experiments, equilibration periods of 18-20 hours for adsorption and 22-23 hours for desorption, and a 1:5 (soil:solution) ratio was selected for use with the four soils.

Duplicate portions (3 g) of each soil were weighed into dark brown centrifuge tubes, then mixed with 15-mL aliquots of 0.01 M calcium chloride solutions containing [2,6-pyridyl-^{14}C]3,5,6-trichloro-2-pyridinol (TCP; radiochemical purity 95.6%, specific activity 27.6 mCi/mMol, DowElanco) at 0.01, 0.1, 1, or 10 ppm. The soil:solution slurries were placed on a horizontal Eberbach shaker, covered with aluminum foil, and shaken at low speed overnight (approximately 18-20 hours) at "ambient room temperature (24°C)". Following equilibration, the slurries were centrifuged and the supernatants were decanted. Aliquots of the supernatants were analyzed using LSC.

To determine desorption, the adsorption supernatants were replaced with an equal amount of pesticide-free 0.01 M calcium chloride solution. The soil slurries were equilibrated overnight (approximately 22-23 hours) as previously described. Following equilibration, the slurries were centrifuged and aliquots of the supernatants were analyzed using LSC. The soils were air-dried, and subsamples were analyzed by LSC following combustion.

Aliquots of the 1 ppm adsorption and desorption supernatants were analyzed by HPLC using a Novapak C-18 column eluted with water:0.5% acetic acid:0.05% dimethyloctylamine and acetonitrile:0.5% acetic acid:0.05% dimethyloctylamine, and with radioactivity detection. Eluate fractions were collected and analyzed using LSC.

DATA SUMMARY:

[2,6-pyridyl-^{14}C]3,5,6-Trichloro-2-pyridinol (TCP; radiochemical purity 95.6%), in solution at 0.01, 0.1, 1, and 10 ppm, was determined to be very mobile in sand, sandy loam, silt loam, and clay loam soil:0.01 M calcium chloride solution (1:5, w:v) slurries that were equilibrated in the dark for approximately 20 hours at ambient room temperature (24°C). Freundlich K_{ads} values were 0.53 for the sand soil, 0.60 for the sandy loam soil, 1.69 for the silt loam soil,

and 1.95 for the clay loam soil; respective K_{oc} values were 242, 194, 81, and 77 (Table VII). K_{des} values ranged from 1.02 to 2.77. At the completion of the study, material balances were 95.4-123.02% of the applied and undegraded TCP was 96.0-99.5% of the recovered.

COMMENTS:

1. The solubility of TCP in water was reported to be approximately 117 ppm at 25°C.

2. The calcium chloride solution containing 0.1 ppm of TCP was made using only [2,6-pyridyl-^{14}C]TCP. The 0.01 ppm calcium chloride solution was made by diluting an aliquot of the 0.1 ppm solution 1:9 with pesticide-free calcium chloride solution. The 1 and 10 ppm solutions were made by mixing aliquots of the 0.1 ppm solution with unlabeled TCP (chemical purity 99.9%, Dow) at ratios of 1:9 and 1:99, respectively, prior to bringing the solutions to volume with additional calcium chloride solution.

3. The study authors stated that because TCP has a short photolytic half-life, extra precautions were taken to shield the TCP from light.

4. Although preliminary experiments demonstrated that TCP equilibrium was achieved after only 3-7 hours, the study authors elected to equilibrate the samples overnight in the definitive experiment.

Table I. Properties for TCP Adsorption/Desorption Soils

Property	Soil			
Soil ID #	M332	M354	M355	M404
Origin	Florida	North Dakota	Georgia	Illinois
Series	Immokalee	Barnes	Cecil	Catlin
Texture Class	Sand	Clay Loam	Sandy Loam	Silt Loam
USDA Soil Classification[a]	Arenic Haplaquods, sandy, siliceous, hyperthermic	Udic Haploborolls, fine-loamy, mixed	Typic Dunhapludults, clayey, kaolinitic, thermic	Typic Argiudolls, fine-silty, mixed, mesic
pH	7.0	7.8	7.1	6.9
% OC[b]	0.22	2.52	0.31	2.08
% Sand	94	39	71	20
% Silt	2	30	12	58
% Clay	4	31	17	22
CEC[c]	1.6	20.1	2.8	12.3
Air Dry Soil Moisture %	0.04%	2.26%	0.29%	1.47%

[a] DowElanco Soil Data Base from Soil Conservation Service, USDA, Lincoln, NE.
[b] Percent organic carbon in the soil.
[c] Cation exchange capacity, meq/100g.

Table VII. Freundlich Adsorption and Desorption Coefficients for TCP on Four Soils

Soil	%OC[a]	K_d (mL/g) Adsorption	K_d (mL/g) Desorption	K_{oc} (mL/g) Adsorption	K_{oc} (mL/g) Desorption
M332	0.22	0.53	1.02	242	465
M354	2.52	1.95	2.77	77	110
M355	0.31	0.60	1.16	194	373
M404	2.08	1.69	2.18	81	105
Average	–	1.19	1.78	149	263

[a] Percent organic carbon in the soil.