7-19-93

DATA EVALUATION RECORD

STUDY 5

CHEM 059101 Chlorpyrifos §163-2

FORMULATION--12--Emulsifiable Concentrate

STUDY ID 41829006
Racke, K.D., A.L. Kesterson, and S.B. Jackson. 1991. Laboratory volatility of chlorpyrifos from soil. Laboratory Project ID: PTRL Report No. 1277; PTRL Project No. 448; DowElanco Protocol No. 90049; DowElanco Report No. GH-C 2455. Unpublished study performed by PTRL East, Inc., Richmond, KY, and submitted by DowElanco, Midland, MI.

DIRECT REVIEW TIME = 13

REVIEWED BY: N. Shishkoff TITLE: Staff Scientist

EDITED BY: L. Mickley TITLE: Staff Scientist
W. Hurtt 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
7/19/93

CONCLUSIONS:

Mobility - Laboratory Volatility:

1. This study can be used to fulfill data requirements.

2. Chlorpyrifos (formulated as Lorsban 4E) volatilized with a half-life of >30 days from sterilized sand and silt loam, and nonsterilized silt loam soils incubated in the dark at 24.5-25°C for 30 days. Volatility of chlorpyrifos ranged from 2.0×10^{-4} to 1.63×10^{-2} ug/cm^2/hr; air concentrations ranged from 41.0 to 131.6 ug/m^3 for the sand soil and from 1.6 to 9.5 ug/m^3 for the silt loam soils.

3. This study is acceptable and fulfills EPA Data requirements for Registering Pesticides by providing information on the volatility of chlorpyrifos from sand and silt loam soils under laboratory conditions.

4. No additional information on the volatility of chlorpyrifos under laboratory conditions is required at this time.

METHODOLOGY:

Tavares sandy soil and Elburn silt loam (Table 1) were air-dried and sieved (2-mm screen). The sand soil and a portion of the silt loam soil were autoclaved (1 hour, temperature not reported). A mixture of ring-labeled [2,6-^{14}C]chlorpyrifos (radiochemical purity >99%, specific activity 25.6 mCi/mMole, DowElanco), unlabeled chlorpyrifos (purity 99.8%, DowElanco), and a formulation blank (Lorsban 4E), was prepared in acetone. Aliquots of the solution were incorporated into triplicate flasks of soil (50-g); the sterilized sandy soil was treated at 67.76 ug ai/cm^2 and the sterilized or unsterilized silt loam soil was treated at 11.18 ug ai/cm^2. The soil moisture content was adjusted to 75% of field capacity with sterile distilled water; each test system was fitted with glass inlet and outlet tubes (Figure 2). The flasks were then covered with foil and placed in an incubator maintained at 24-25°C for 30 days. Air at 100% humidity was continuously drawn through each flask (150 mL/minute), then through two polyurethane foam plugs (pre-extracted with methylene chloride), an ethylene glycol trapping solution, and a sodium hydroxide trapping solution. Plugs and trapping solutions were collected and radioassayed at 2, 4, 8, 14, 18, 22 and 30 days posttreatment; the plugs and trapping solutions were replaced at each sampling interval.

At 30 days posttreatment, the soil samples were extracted in the flask with acidified acetone (1% phosphoric acid, 1% water), followed by sonication and filtering; sterilized and nonsterilized silt loam soil samples were reextracted using the same method. The nonsterilized soil samples were extracted an additional time with methanol:water (1:1 v:v) with shaking, followed by centrifugation. Aliquots of the extracted soil were analyzed by LSC following combustion. Foam plugs were placed in amber jars, extracted with acetone, then air dried and analyzed by LSC. Following radioassay, the plug extracts and soil extracts were stored at 4 C until analysis by reverse-phase HPLC on a LC-18 column using mobile phases of water:glacial acetic acid:N,N,dimethyloctylamine (890:10:0.45, v:v:v) and methanol:glacial acetic acid: N,N,dimethyloctylamine (890:10:0.45, v:v:v) with UV (300 nm) and radioactivity detection. Reference standards of 3,5,6-trichloro-2-pyridinol and 2-methoxy-3,5,6,-trichloropyridine were cochromatographed with the extracts.

2

DATA SUMMARY:

[^{14}C]Chlorpyrifos (radiochemical purity >99%, formulated as Lorsban 4E) volatilized with a half-life of >30 days after application at 67.76 ug/cm^2 to sterilized sand or 11.18 ug/cm^2 to sterilized or nonsterilized silt loam at 75% of field moisture capacity that was incubated in the dark at 24.5-25°C for 30 days with a continuous air flow through the system (150 mL/minute).

Volatile parent material released from the soils and quantitatively trapped in polyurethane foam plugs was 0.1-1.3% of the applied radioactivity at 2 days posttreatment and increased to 2.4-10.2% by 30 days posttreatment. The air concentration of chlorpyrifos was 41.0-131.6 ug/m^3 from the sand soil and 1.6-9.5 ug/m^3 for silt loam soil (Table V). The volatility rates ranged from 5.1 x 10^{-3} to 1.63 x 10^{-2} ug/cm^2/hr for the sterilized sand, 4.0 x 10^{-4} to 1.1 x 10^{-3} ug/cm^2/hour for the sterilized silt loam soil, and 2.0 x 10^{-4} to 1.2 x 10^{-3} ug/cm^2/hour for the nonsterilized silt loam soil (Table V).

The only other volatile detected,

carbon dioxide

was produced by the nonsterilized silt loam soil, increasing from 5.6-7.2% of the applied radioactivity at 2 days posttreatment to 15.9-18.7% at 30 days posttreatment (Table IV). Volatile $^{14}CO_2$ was not detected from the sterilized sand or sterilized silt loam until 22 days posttreatment, when it was detected at <0.1 % from the sterilized soils; at 30 days posttreatment, it was detected at 1.1 and 2.0% of the applied in the sterilized sand and silt loam soils, respectively.

Radioactivity extracted from the soil after 30 days incubation was 88.4-89.0% of the applied for the sand soil, 90.4-92.5% for the sterilized silt loam soil, and 62.8-69.6% for the nonsterilized silt loam soil; unextracted radioactivity remaining on the soil was 3.4-4.7%, 2.6-2.8%, and 3.9-4.8% of the applied, respectively (Table III). In extracts of the sterilized soils,

3,5,6-trichloro-2-pyridinol

was 3.5-5.0% of the applied radioactivity at 30 days posttreatment; 83.3-85.5% of the applied remained as parent material. The radioactivity extracted from nonsterilized silt loam soil was entirely parent material. Uncharacterized radioactivity in the soil extracts was 1.4-4.2% of the applied (Table VI).

During the study, material balances ranged from 89.1-105.4% of the applied (Table III).

COMMENTS:

1. The test substance was applied to sand at a concentration which approximated the maximum Lorsban 4E single application rate of 12 pints/acre for citrus; it was applied to silt loam at a concentration approximating the typical Lorsban 4E single application rate of 2 pints/acre for corn.

2. The study authors reported the vapor pressure of chlorpyrifos as 2.0 x 10^{-5} Torr at 25°C. The study authors stated that the K_{oc} values ranged from 5060 to 13000 mL/g. The water solubility of chlorpyrifos at 25°C and pH 7 was 1.4 ppm.

3. The incubation flasks were rinsed with scintillation fluid after the soil was extracted and removed from the flask. The data from the radioassay of the scintillation fluid were not reported.

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