UNDATED

DATA EVALUATION RECORD

STUDY 10

CHEM 041402 Molinate §165-4

FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 40593303
Forbis, A.D. 1986. Uptake, depuration, and bioconcentration of ^{14}C-ordram by bluegill sunfish (Lepomis macrochirus). Final Report #34282. Unpublished study performed by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Stauffer Chemical Company, Richmond, CA.

STUDY ID 40635101
Cranor, W. 1987. Metabolite characterization of ^{14}C-ordram in bluegill sunfish (Lepomis macrochirus). Final Report #34936. Unpublished study performed by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Stauffer Chemical Company, Richmond, CA.

DIRECT REVIEW TIME = 16

REVIEWED BY: J. Harlin TITLE: Staff Scientist

EDITED BY: K. Ferguson TITLE: Task Leader
W. Martin Staff Scientist

APPROVED BY: W. Spangler TITLE: Project Manager

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

APPROVED BY: D. Spatz
TITLE: Chemist
ORG: EFGWB/EFED/OPP
TEL: 703-557-3463

SIGNATURE:

CONCLUSIONS:

Laboratory Accumulation - Fish

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

2. Molinate residues accumulated in bluegill sunfish exposed to 0.10 ppm of molinate, with maximum mean bioconcentration factors of 29x, 140x, and 72x, for edible, nonedible, and whole fish tissues, respectively. Five degradates were identified: molinate sulfone; carboxymolinate;

4-ketomolinate; 4-hydroxymolinate; and molinate sulfoxide. Depuration was gradual, with 75-90% of the accumulated [^{14}C]residues eliminated from the fish tissues by day 14 of the depuration period.

3. This study is acceptable and fulfills EPA Data Requirements for Registering Pesticides by providing information on the accumulation of ring-labeled [^{14}C]molinate in laboratory fish.

4. No additional information on the accumulation of molinate in laboratory fish is needed at this time.

METHODOLOGY:

Bluegill sunfish (Lepomis macrochirus; mean length and weight 60 mm and 8.3 g, respectively), were held in culture tanks on a 16-hour photoperiod for ≥14 days prior to the initiation of the study. Flow-through aquatic exposure systems were prepared using two 100-L aquaria. Aerated well water (15-20 C, pH 7.8-8.3, dissolved oxygen content 9.2-10.1 ppm; Table 1) was provided to each aquarium at a rate of approximately 6.8 turnovers per day. The aquaria were immersed in a water bath and maintained at 22 ± 2 C.

Bluegill sunfish (120) were transferred into each aquarium and allowed to acclimate for 24 hours. One aquarium was then continuously treated with ring-labeled [^{14}C]molinate (labeled in the 2 position; radiochemical purity 99%, specific activity 10.5 mCi/mmole, source unspecified) at 0.10 ppm. The second aquarium served as an untreated control. During the exposure period, water and fish (6, 15, or 25) samples were collected at 4 hours and at 1, 3, 7, 14, 21, and 25 days from both the treated and control aquaria. After 25 days, both aquaria were drained of water to a depth of 3 inches, then filled with approximately 70 L of pesticide-free well water; the fish remained in the aquaria during this procedure. During the 14-day depuration period, water and fish (6 or 15) were collected on 1, 3, 7, 10, and 14 days from each aquarium.

Aliquots of the water samples were quantified for total [^{14}C]residues using LSC; the detection limit was 0.002 ppm. Pooled samples (3 fish) of edible (body, muscle, skin, skeleton) and nonedible (fins, heads, internal organs) tissues, and whole fish (3 fish) were homogenized with dry ice and analyzed for total radioactivity by LSC following combustion. Recovery efficiencies from fortified fish samples averaged 95-96% for all tissue types (Table 7). The detection limits were 0.0805 ppm in edible tissues, 0.0843 ppm in nonedible tissues, and 0.0828 ppm in whole fish.

Edible and nonedible tissues from fish sampled on days 21 and 25 of the exposure period were analyzed for molinate and its degradates. The fish tissues were extracted twice with acetonitrile by shaking for 2 hours, followed by a third acetonitrile extraction with refluxing for 4 hours. The extracts were combined, and aliquots were analyzed for total radioactivity by LSC; the remainder was evaporated

under a nitrogen stream and redissolved in methylene chloride:cyclohexane (50:50, v:v). Aliquots of the concentrate were analyzed for total radioactivity by LSC; the remainder was filtered through a gel permeation chromatographic (GPC) column with methylene chloride:cyclohexane (50:50, v:v). Aliquots of the eluate were analyzed by LSC; the remaining solution was evaporated under a nitrogen stream and aliquots were analyzed by LSC. Additional aliquots of the extracts were analyzed using two-dimensional TLC on silica gel plates developed in hexane:acetone (1:1, v:v) in the first direction and toluene:ether (2:3, v:v) in the second direction. Unlabeled reference compounds (Table II) were cochromatographed with the extracts and visualized under UV light. Following development, radioactive zones on the plates were located using autoradiography and UV fluorescence of the reference compounds. Radioactive areas were quantified by scraping the radioactive areas from the plates and analyzing the scrapings by LSC. Recoveries for control edible and nonedible tissue samples fortified with 1.70 or 9.72 ppm of molinate averaged 88.3% following extraction and 92.6% following GPC concentration (Table V).

DATA SUMMARY:

[^{14}C]Molinate residues accumulated in nonedible, edible, and whole fish tissues from fish that were exposed to ring-labeled [^{14}C]molinate (radiochemical purity 99%) at 0.10 ppm in flow-through aquaria for 25 days. The maximum bioconcentration factors were 29x for edible tissues (body, muscle, skin, skeleton), 140x for nonedible tissues (fins, heads, internal organs), and 72x for whole fish (Table 3). The maximum concentrations of total [^{14}C]residues were 3.0 ppm for edible tissues (day 21), 14 ppm for nonedible tissues (day 3), and 7.2 ppm for whole fish (day 3, Table 3). Based on TLC analyses of the 21- and 25-day edible and nonedible tissue samples, molinate was 0.52-0.68 ppm in the edible tissues and 4.74-4.81 ppm in the nonedible tissues (Table VII). Five degradates were identified:

molinate sulfone, at 0.05-0.06 ppm in edible and 0.21-0.76 ppm in nonedible tissues;

carboxymolinate, at 0.77-0.87 ppm in edible and 0.11-0.46 ppm in nonedible tissues;

4-ketomolinate, at 0.13-0.18 ppm in edible and 0.02-0.07 ppm in nonedible tissues;

4-hydroxymolinate, at 0.14-0.16 ppm in edible and 0.09-0.23 ppm in nonedible tissues; and

molinate sulfoxide, at 0.14-0.27 ppm in edible and 1.18-1.32 ppm in nonedible tissues (Table VII).

Unextracted [^{14}C]residues comprised 0.89-0.98 ppm in the edible tissues and 1.87-2.46 ppm in the nonedible tissues, and "immobile"

(presumably [^{14}C]compounds remaining at the origin on the TLC plates) residues were 0.04-0.14 ppm and 0.13-0.32 ppm in the edible and nonedible tissues, respectively (Table VII).

Depuration was gradual; by day 14 of the depuration period, 75-90% of the accumulated [^{14}C]residues were eliminated from the fish tissues (Table 4).

Throughout the study, the temperature of the treated water was 21-22 C, the pH ranged from 7.9 to 8.2, and the dissolved oxygen content ranged from 6.1 to 8.7 mg/L. Total [^{14}C]residues in the water ranged from 0.080 to 0.12 ppm during the exposure period (Table 3).

COMMENTS:

1. Radioactive residues in the water were not characterized; however, since molinate is stable to photodegradation, it is probable that the majority of [^{14}]C residues in the water were parent material. The study author stated that additional water samples were collected on days 21 and 25 of the exposure period and on day 14 of the depuration period for possible metabolite characterization; no data were provided for these analyses and there was no evidence that the samples were ever analyzed.

2. The exposure phase of the study was terminated after 25 days because of the fish exhibited increasing mortality and abnormal behavior, including loss of equilibrium, quiescence, and lying on the bottom of the chambers. A total of four fish died; the remaining fish were "normal" at the termination of the study.

3. The 21- and 25-day fish samples collected for degradate identification purposes were analyzed to confirm that the concentration of [^{14}C]residues in the samples had not degraded during storage prior to analysis.

4. The study author suggested that the "immobile" residues identified in the 21- and 25-day fish tissues may be hexahydroazepine and/or molinate mercapturic acid.

5. Due to insufficient radioactivity in the extractable [^{14}C]residues of the 14-day depuration samples, no further characterization of these samples was attempted.

6. Control data from analyses of untreated water and fish were not provided.

7. During the study, the fish were fed a dry pelleted food daily equivalent to approximately 3% of their body weight.

8. The study author stated that the dissolved oxygen concentrations, which ranged between 6.1 and 8.7 mg/L, stayed between 66 and 95%

saturation at 20 C, respectively, and were considered adequate for testing.

9. A preliminary 7-day toxicity study was conducted to determine the acute toxicity of molinate to bluegill sunfish. The 7-day LC_{50} level was estimated to be 8.2 mg/L and the 7-day no-observed effect concentration was 5.3 mg/L. In view of these results, the registrant chose an exposure level of 0.10 ppm (1/82 of the 7-day LC_{50}) for the bioaccumulation study.