12-3-87

Shaughnessy No.: 128101

Date Out of EAB: DEC 3 - 1987

To: John Lee
Product Manager #31
Registration Division (TS-767C)

From: Therese Dougherty, Chief
Review Section #1
Exposure Assessment Branch
Hazard Evaluation Divison (TS-769)

Attached, please find the EAB review of...

Reg/File # : 707-RTL

Chemical Name: RH-5287: 4,5-Dichloro-2-n-octyl-3(2H)-isothiazolone

Type Product : Algaecide and barnicide

Product Name : Antifoulant C-9211M

Company Name : Rohm and Haas Company

Purpose : Application for full registration for use in antifouling marine coatings

Action Code(s): 116

EAB #(s) : 70104

Date Received : 11/21/86

TAIS Code :

Date Completed: 11/24/87

Monitoring Submitted: ___

Total Reviewing Time: 5.1 days

Monitoring Requested: ___

Deferrals to: _____ Ecological Effects Branch

_____ Residue Chemistry Branch

_____ Toxicology Branch

(1)

1. CHEMICAL: Common name:

None.

Chemical name:

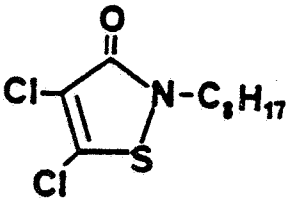
Old Formulation:
Mixture (7:1) of 4,5-dichloro-2-n-octyl-3(2H)-isothiazolone (RH-5287) and 4-chloro-2-n-octuyl-3 (2H)-isothiazolone (RH-085)

New Formulation:
Essentially RH-5287 in an organic solvent.

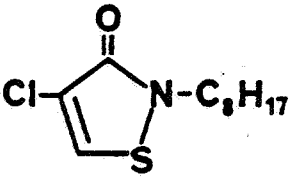
Trade name(s):

Antifoulant C-9211 M

Structures:



RH-5287



RH-085

CAS Registry Number

RH-5287: 64359-81-5
RH-085 : 64359-80-4

Molecular Weight/Molecular Formula:

RH-5287: 282.24/$C_{11}H_{17}Cl_2NOS$
RH-085 : 249.79/$C_{11}H_{18}ClNOS$

Formulations:

Old Formulation: 35% RH-5287
5% RH-085
60% Inert ingredients

New Formulation: 30-31% RH-5287
<0.5 RH-085
70% Inert solvent

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INERT INGREDIENT INFORMATION IS NOT INCLUDED

Physical/Chemical properties:

Appearance:	Dark brown, mobile liquid
Odor :	Faint [redacted] odor
pH:	Not applicable
Specific gravity:	1.03 (41.5% active ingredient; 20°C)
Viscosity:	6.4 cps (25°C; Brookfield Viscometer #1 spindle at 60 rpm)
Solubility:	Essentially insoluble in water (solubility of RH-5287 in water is given as 2.3-14 ppm) Miscible in most organic solvents
Flash point:	87°C

2. TEST MATERIAL:

See individual studies.

3. STUDY/ACTION TYPE:

Application for full registration for use in antifouling marine coatings (aquatic nonfood use).

4. STUDY IDENTIFICATION:

The following studies are new submittals:

Carpenter, M. and J. Warren. 1986a. Determination of photodegradation of ^{14}C-RH-5287 in aqueous solution. Amended Final Report No. 32117; Technical Report No. 310-86-27. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc No. 265902.

Carpenter, M. and J. Warren. 1986b. Determination of photodegradation of ^{14}C-RH-5287 in seawater. Amended Final Report No. 34232; Technical Report No. 310-86-29. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and and submitted by Rohm and Haas Company, Philadelphia PA. Acc. No. 265903.

Cranor, W. 1986a. Anaerobic aquatic metabolism of ^{14}C-RH-5287. Report No. 32115. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265904.

Cranor, W. 1986b. Aerobic aquatic metabolism of C-9211/RH-5287 in seawater. Report No. 32880. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265906.

Forbis, A.D. and L. Georgie. 1985. Time-independent flow-through toxicity of Rh-5287 to bluegill sunfish (Lepomis macrochirus). ABC Report No. 32113. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265911.

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Forbis, A.D., L. Georgie, and B. Bunch. 1985. Uptake, depuration, and bioconcentration of ^{14}C-RH-5287 by bluegill sunfish (Leopomis macrochirus). ABC Report No. 32970. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265912.

Leak, T. 1986. Characterization of RH-5287 in bluegill sunfish (Lepomis macrochirus). ABC Report No. 32971. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265913.

Warren, J. 1986. Determination of adsorption/desorption constants of C-9211/^{14}C-RH-5287. Report No. 32116. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265908.

5. REVIEWED BY:

S.C. Termes
Chemist
EAB/HED/OPP

Signature: _____

Date: DEC 3 - 1987

6. APPROVED BY:

Therese Dougherty
Supervisory Chemist
Review Section #1,
EAB/HED/OPP

Signature: _____

Date: DEC 3 - 1987

7. CONCLUSIONS

A. Determination of Photodegradation of ^{14}C-RH-5287 in Aqueous Solution Determination of Photodegradation of ^{14}C-RH-5287 in Seawater

These studies are unacceptable as presented. Up to 36 percent of the applied radioactivity could not be accounted for and, therefore, the material balance is incomplete.

In addition, EPA Data Requirements for Registering Pesticides are not fulfilled because degradates were inadequately characterized by thin-layer chromatography (TLC). In seawater experiments, approximately 73 percent of applied radioactivity in irradiated samples on day 30 were identified as "ring cleavage products" alone without any further attempts to characterize these materials.

In experiments in deionized water, the species left at the origin (57 to 67% of applied radioactivity after 30 days in sensitized media) was identified as the ring-cleavage product 3,3'-dithiobis-n-octylpropionamide (RH-893-I) by comparison to a standard and by assuming that two immobile compounds were identical. This is not an acceptable procedure. It was also implied that 2-N-(n-octyl)-3 (2H)-isothiazolone (RH-893) and 2-N-(n-octyl)-4-chloro-1-iso-thiazolin-3-one (RH-085) were identified, but they were not quantified. The identity of major degradates requires confirmation by adequate methodology.

Also, the artificial light source was incompletely characterized and no comparison to natural sunlight was presented.

B. Anaerobic and Aerobic Aquatic Metabolism of ^{14}C-RH-5287

In both of these studies, the purity of the [^{14}C]-RH-5287 was not specified. The total radioactivity of the parent compound accounted for at time 0 was 33.4% (aerobic) and 31.4% (anaerobic). Degradate identification by TLC was inadequate and incomplete. No attempts to confirm the identity of degradates by adequate methodology other than TLC were made. Therefore, because of the poor recoveries and erratic data, no valid conclusions can be drawn.

a. Anaerobic Aquatic Metabolism of ^{14}C-RH-5287

Even though two-dimensional TLC was used in addition to one-dimensional TLC, degradate identification was not adequate. Two-dimensional TLC data was obtained from extracts that were kept frozen for unspecified periods of time after completing one-dimensional TLC experiments and, unless storage stability data is known, care should be exerted in interpreting two-dimensional TLC results.

b. Aerobic Aquatic Metabolism of ^{14}C-RH-5287 in Seawater

Although degradates were separated by one-dimensional TLC, only R_f values were given without any attempt to identify them. A region labeled as Remainder was not properly identified. After 28 days the total radioactivity recovered by TLC was 21.6 percent at Remainder and 40 percent at the origin.

C. Determination of Adsorption/Desorption of C-9211/^{14}C-RH-5287 (batch equilibrium, unaged soil/sediment).

This study may be acceptable if the Registrant can clarify which kind of material was used in the study.

From the title, it appears that the commercial material may have also been used. However, it is not clear if experiments with C-9211 were conducted. The purity of the ^{14}C-RH-5287 was not given, but the lot number and specific activity indicate that it was the same material used in aquatic metabolism studies (purity also not specified).

The calculated Freundich K_{ads} values ranged from 13.7 for the loamy sand soil to 905 for the sandy-clay aquatic sediment. For the first desorption phase, K_{des} for the loamy sand was 31.7 and 49.1 percent for sandy-clay aquatic sediment. The K_{des} values for these soils (second desorption phase) were 31.6 and 200, respectively.

No attempts to characterize degradates were made. It appears that an inadequate solvent system was used for the TLC procedure. In some instances, as high as 81.7 percent of the applied material remained at the origin.

D. Time-Independent Flow-Through Toxicity of RH-5287 to Bluegill Sunfish (Lepomis macrochirus) Uptake, Depuration, and Bioconcentration of ^{14}C-RH-5287 Characterization of RH-5287 in Bluegill Sunfish (Lepomis macrochirus)

These studies are unacceptable as presented. In the studies involving radiolabeled RH-5285, the purity of the test substance was not specified.

Only the parent compound was identified and no attempts to identify and confirm other detected metabolites (by other than TLC) were made. The amounts of radioactive material remaining at the origin were as high as 20 times that identified as the parent compound.

8. RECOMMENDATIONS

Determination of Photodegradation of ^{14}C-RH-5287 in Aqueous Solution (161-2)
Determination of Photodegradation of ^{14}C-RH-5287 in Seawater (161-2)

New studies are required. particular attention should be addressed to the following aspects of the studies:

a. Light Source: Nature of source, intensity, wavelength distribution, and time of exposure, as well as a comparison to natural sunlight should be included.

b. Glassware: Because earlier experiments indicated that silanized glass adsorbed less parent compound than unsilanized glass, the former should be used to minimize adsorption.

c. Solubility in Water: Reported as "relatively insoluble in water" the actual value should be included in report. In a registrant's letter to Analytical Bio-Chemistry Laboratories, Inc., the solubility in water is given at 2.3 to 14 ppm.

d. Identification of Degradates: Adequate methodology (other than TLC) to identify and confirm major degradates is required.

e. Temperature of dark controls and irradiated samples should be kept within comparable ranges.

f. Recoveries be expressed in terms of applied radioactivity rather than as percents of recovered from TLC plates.

It is recommended that, if possible, the pH and dissolved oxygen content at the time of sampling are recorded and reported. If teflonware is used (Teflon-covered stirring bar, for example) is recommended that the teflonware also be rinsed with the extracting solvent (hydrophobic material tends to adhere to teflon).

Anaerobic Aquatic Metabolism of ^{14}C-RH-5287 (162-3)
Aerobic Aquatic Metabolism of ^{14}C-RH-5287 (162-4)

New studies are required. Particular attention should be addressed to the following aspects of the studies:

a. Purity of radiolabeled material and solubility in water should be specified

b. Identification and confirmation of major degradates by adequate methodology other than TLC is necessary. Prolonged periods of time between extraction of residues and their identification should be avoided, unless adequate storage stability data is provided.

c. Use (and specify, if used) silanized glassware to minimize adsorption of parent compound onto the vessels.

d. Analytical data on composition of seawater (pH dissolved oxygen content, metal ions, anions, dissolved solids, etc) should be included.

e. Data must be reported in consistent units. Parent residues and degradates should be reported as percents of applied radioactivity rather than as percents of recovered from TLC plates.

It is recommended that pH and dissolved oxygen content be monitored throughout the testing period or at least measured, recorded, and reported at each sampling time. Data on pH can be useful in assessing if any hydrolytic reaction has taken place.

C. Determination of Adsorption/Desorption Constants of C-9211/^{14}C-RH-5287 (163-1)

Additional information must be submitted to clarify the type of test material used and the radiochemical purity of the labeled compound for reevaluation of the batch equilibrium, unaged soil/sediment studies.

New studies are required using aged soil/sediment to assess the mobility of major degradates formed under anaerobic aquatic conditions. Because the product is intended for use in marine environments, it is recommended that experiments with seawater/representative soil (sand) be included. If seawater is used, analysis of the seawater should be reported. Individual major degradates should be used if adsorption/desorption studies are conducted. Alternatively, an aged column leaching study may be conducted.

It is also recommended that the pH and dissolved oxygen content of the water/soil system is recorded (and reported) at least at each sampling time (including time zero and final time).

D. Time-independent flow-through toxicity of RH-5287 to bluegill sunfish (Lepomis macrochirus) (165-4). Uptake, depuration, and bioconcentration of ^{14}C-RH-5287 (165-4). Characterization of RH-5287 in Bluegill Sunfish (Lepomis) macrochirus) (165-4).

New Studies are required. Particular attention should be addressed to the following aspects of the studies:

a. The purity of the radiolabeled material must be specified.
b. If silanized glassware was used, this should be specified.
c. Attempts should be made to characterize and confirm the identity of detected degradates by methodology other than TLC. When the percent of unextractable radioactivity is high, the use of another solvent(s) is recommended.
d. If unlabeled reference materials are used in TLC experiments, the report should indicate how they were located in the plate.
e. It is recommended that pH and dissolved oxygen content be measured at regular intervals during the test(s) period.

E. An Aquatic Field Dissipation Study (164-2) is required because at environmentally significant pH's (5 and 7) the half-life of the active ingredient in water is greater than four days.

9. BACKGROUND:

A. Introduction

Information on Previously Reviewed Studies

Brackett, C.K. 1981. The migration of antifoulant C-9211 from paint into simulated sea water. Technical Report No. 36F-81-26. Prepared and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265910.

This study was reviewed by EAB on 8/11/83 and considered ancillary. It demonstrated that the average daily movement of C-9211M from painted aluminum panels into simulates seawater during 32 days was 0.658 ug/cm^2/day for tributyltin fluoride-based paint and 0.560 ug/cm^2/day for cuprous oxide-based paint.

Fahley, J.W. 1981. ^{14}C-RH-5287 hydrolysis study. BRL Project No. 22-201-202-S. Technical Report 36F081-19. Prepared by Borriston Laboratories, Inc., Temple Hills, Md, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265901.

This study was reviewed by EAB (Manning, 8/11/83) and considered adequate to fulfill data requirements for hydrolysis Carbon-14 RH-5287 (purity unspecified), at 10 ppm, degraded rapidly in pH 5 and pH 9 buffered water: methanol (84:16,v:v), with half-lives of 9 days at pH 5 and 2.5 days at pH 9, but very little degradation was observed at pH 7. The major degradate was 4-chloro-5-hydroxy-2-(n-octyl)-3-isothiazolone, which degrades further to 2-chloro-n-octylacetamide. At pH 7, about 86% of the parent compound was still present after 30 days.

B. Directions for Use

C-9211 M is an algaecide/barnicide developed for use in antifouling marine coatings (aquatic nonfood use). It is intended for distribution to the largest industrial formulator/painters involved in the painting of large military and commercial ships; it should not be available to private boat owners or small commercial establishments. In the old formulations, the active ingredients in C-9211M were RH-5287 (4,5-dichloro-2n-octyl-3(2H)-isothiazolone and RH-085 (4-chloro-2-n-octyl-3-(2H)-isothiazolone) in a 7:1 mixture as a 40% L to be formulated into paint by the purchaser. In the new formulation, the active ingredient is RH-5287(30-31%) in an organic solvent and will be formulated into paint by the purchaser.

10. DISCUSSION OF INDIVIDUAL TESTS OF STUDIES:

See attached reviews of individual studies.

11. COMPLETION OF ONE-LINER: Not complete.

12. CBI APPENDIX:

All data reviewed here are considered CBI by the registrant and must be treated as such.

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DYNAMAC
CORPORATION

C-9211 M (RH-5287)

Final Report

Task 1: Review and Evaluation of Individual Studies

Task 2: Environmental Fate Assessment

Contract No. 68-02-4250

NOVEMBER 24, 1987

Submitted to:
Environmental Protection Agency
Arlington, VA 22202

Submitted by:
Dynamac Corporation
The Dynamac Building
11140 Rockville Pike
Rockville, MD 20852

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RH-5287

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INTRODUCTION

C-9211 M is an algaecide/barnicide developed for use in antifouling marine coatings (aquatic nonfood use). It is intended for distribution to the largest industrial formulator/painters involved in the painting of large military and commercial ships; it should not be available to private boat owners or small commercial establishments. The active ingredient of the present C-9211 formulation is RH-5287, (4,5-dichloro-2-n-octyl-3(2H)-isothiazolone (30-31%) in an organic solvent. The end-product will be formulated into paint by the purchaser.

CASE GS -- RH-5287 STUDY 1 PM --

CHEM 128101 RH-5287

BRANCH EAB DISC --

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID No MRID CONTENT CAT 01

Carpenter, M. and J. Warren. 1986a. Determination of photodegradation of ^{14}C-RH-5287 in aqueous solution. Amended Final Report No. 32117; Technical Report No. 310-86-27. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc No. 265902.

FICHE/MASTER ID No MRID CONTENT CAT 01

Carpenter, M. and J. Warren. 1986b. Determination of photodegradation of ^{14}C-RH-5287 in seawater. Amended Final Report No. 34232; Technical Report No. 310-86-29. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265903.

SUBST. CLASS = S.

DIRECT RVW TIME = 60 (MH) START-DATE END DATE

REVIEWED BY: R. Tama, K. Patten
TITLE: Staff Scientists
ORG: Dynamac Corp., Rockville, MD
TEL: 468-2500

APPROVED BY: S.C. Termes
TITLE: Chemist
ORG: EAB/HED/OPP
TEL: 557-7336

SIGNATURE: DATE: Dec. 3/1987

CONCLUSIONS:

Degradation - Photodegradation in Water

This study is unacceptable because the material balance was incomplete (up to 36% of the [^{14}C]residues were not accounted for) and the analytical method (TLC) was inappropriate to characterize residues. In addition, this study would not fulfill EPA Data Requirements for Registering Pesticides because the degradates were inadequately characterized, and the artificial light source was incompletely characterized and was not compared to natural sunlight.

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MATERIALS AND METHODS:

Experiment 1

[^{14}C]RH-5287 (labeled on the carbonyl carbon of the isothiazolone ring, radiochemical purity 95.6%, specific activity 15.3 µCi/g, Rohm and Haas Company) dissolved in acetone was added at 3608 µg/flask to each of four sterilized glass flasks. The acetone was evaporated and the flasks were filled with 350 mL of either sterilized buffered deionized water (pH 7), sterilized buffered deionized water containing 1% acetone (pH 7), sterilized seawater (pH 8; Table 1), or sterilized seawater containing 1% acetone (pH 8). Aliquots (~10 mL) of the solutions were transferred to silanized glass screw-capped culture tubes. Half the samples were wrapped in aluminum foil and stored in the dark at 25°C. The remaining samples were placed in a "photolysis apparatus" and irradiated with a 275-W RS-M sunlamp (General Electric) filtered through a 0.12-inch-thick sheet of Pyrex glass (Table 2). The temperature of the irradiated solutions averaged 32°C (range not specified). Irradiated and dark control solutions were sampled at up to 30 days posttreatment. The samples were stored overnight at 4°C.

Aliquots of each sample were analyzed for total radioactivity using LSC. Additional aliquots were cochromatographed with unlabeled standards on silica gel TLC plates developed in toluene:ethyl acetate (90:10, v:v). The plates were visualized using shortwave UV light and autoradiography. Radioactive compounds were identified by comparison to standards, and radioactive areas were scraped and quantified using LSC.

Experiment 2

In order to quantify volatilization during photodegradation, 50-mL aliquots of each test solution described previously were placed in gas washing bottles and the bottles were attached to a positive pressure air flow system. Moistened CO_2-free air was passed through the head space of the bottle containing the treated solution, then through four tubes of trapping solutions: ethylene glycol; 1 N sulfuric acid; 1 N potassium hydroxide; and 1 N potassium hydroxide. The samples were irradiated using the filtered RS-M sunlamp described previously; duplicate test systems were incubated in the dark as controls. The trapping solutions were sampled at intervals up to 30 days posttreatment, stored at 4°C until analysis, and analyzed for total radioactivity using LSC.

REPORTED RESULTS:

Experiment 1

[^{14}C]RH-5287 degraded with half-lives of 1-3 days in irradiated deionized water (pH 7 buffer) and 3-7 days in seawater (pH 7.5) (Tables 3 and 4). In the dark controls, [^{14}C]RH-5287 degraded with half-lives of >30 and 21-30 days, respectively. [^{14}C]RH-5287 degraded primarily to a compound or compounds that were immobile (R_f 0.0) in the TLC solvent system used; this zone was identified by comparison to standards as the ring-cleavage product 3,3'-dithiobis-n-octyl-propionamide (RH-893-I) in the deionized water (~66% of applied on day 30 in irradiated samples) and as "ring

cleavage products" (unspecified) in the seawater (~73% of applied in irradiated on day 30). 2-N-Octyl-3(2H)-isothiazolone (RH-893), 4-chloro-2-n-octyl-3(H)-isothiazolone (RH-085), and an unidentified compound with an R_f of 0.54 were isolated in the deionized water (compounds were not quantified and intervals when present were not specified). RH-893 was 6-7% of the applied in both the dark control and irradiated seawater on days 21 and 30. The unidentified compound (R_f 0.54) was isolated in the dark control seawater.

[^{14}C]RH-5287 degraded with a half-life of <1 day in irradiated sensitized (1% acetone) deionized water and seawater (Tables 3 and 4). In the dark controls for both treatments, the half-life increased to 7-14 days. [^{14}C]RH-5287 degraded primarily to the compound or compounds that remained at the origin on the TLC plates (57-67% of the applied in irradiated day 30 samples). RH-085 comprised ≤5.7% of the applied in both the irradiated and dark control seawater during the first weeks of the study, but was not detected after day 14 in either solution.

Experiment 2

No [^{14}C]residues were volatilized from the nonsensitized irradiated and dark control deionized water solutions. A total of 17.065 µg of [^{14}C]-residues (0.34 µg/mL) were volatilized from the sensitized irradiated deionized water; no [^{14}C]residues were volatilized from the sensitized dark control deionized water.

A total of 1.684 µg of [^{14}C]residues (0.03 µg/mL) were volatilized from the nonsensitized irradiated seawater and 1.037 µg (0.02 µg/mL) were volatilized from the sensitized irradiated seawater. No [^{14}C]residues were volatilized from the nonsensitized seawater dark controls.

DISCUSSION:

General

1. The material balance for the solutions was incomplete. Up to 30% of the [^{14}C]residues in the deionized water solutions were not accounted for by day 30. Volatilization, as measured in the separate Experiment 2, failed to account for the missing [^{14}C]residues.

2. The registrant stated that 22 mL of a stock solution containing 164 µg of [^{14}C]RH-5287/mL of acetone were added to each of four flasks, the acetone was evaporated, and 350 mL of aqueous buffer solution were added to each flask. The final concentration should have been ~10 ppm, but was measured as ~4 ppm in the distilled water and 2 ppm in the seawater at time 0. A letter appended to the study mentioned that there was an "initial loss" of the compound during preparation, but this loss was neither mentioned nor explained in the study.

3. The majority of [^{14}C]residues in the solutions were not adequately identified. These residues (57-67% of applied radioactivity after 30 days in sensitized media) remained at the origin on the TLC plate and were identified as RH-893-I in the deionized water but only as "ring cleavage products" in the seawater. The identification as RH-893-I was by compari-

son to a standard. It is not an acceptable procedure to assume that two immobile compounds are identical. No other solvent system was tested to confirm that the origin contained a single compound or a mixture of various degradation products. No other method was used to confirm the identity of the compound.

4. In the deionized water samples, it was implied that RH-893 and RH-085 were isolated, but these compounds were not quantified.

5. A preliminary study indicated that RH-5287 strongly adsorbed to glass and that all glassware should be silanized. Silanized glass adsorbed 3% of the RH-5287 in solution during 4 days of incubation, in contrast to 13% adsorbed by unsilanized glassware during the same period. However, it could not be determined whether, in fact, silanized glassware was used.

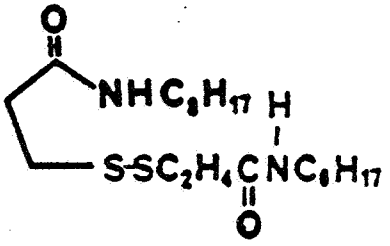
6. The registrant indicated that RH-5287 is relatively insoluble in water. The solubility was not reported; it could not be determined if the concentration of RH-5287 was within the solubility range of the pesticide.

7. The artificial light source was incompletely characterized. The actual irradiating light was not compared to natural sunlight and did not appear to simulate natural sunlight.

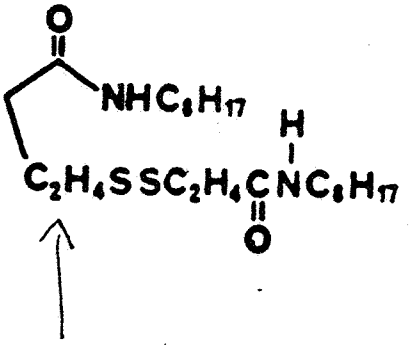
8. The temperature of the dark controls (25°C) was at least 7°C cooler than the temperature of the irradiated samples.

9. The data presented by the registrant were of such poor quality it was necessary for the reviewers to recalculate the data before the study could be interpreted. Arithmetic errors were discovered, and some calculations were based on questionable assumptions. Tabulated data were provided in such a variety of units it was difficult to compare treatments.

10. The structure for 3,3'-dithiobis-n-octylpropionamide (RH-893-I) was incorrectly represented in the report. The correct structure is:



instead of



extra "C_2H_4"

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Table 1. Seawater characteristics.[a,b]

Parameter	Concentration
Sodium ion	11,100 ppm
Chloride ion	20,000 ppm
Calcium ion	367 ppm
Magnesium ion	1,240 ppm
Nitrate ion	1 ppm
Sulfate ion	2,954 ppm
Dissolved solids	3.62%

[a] The seawater was obtained off the coast of New Jersey.

[b] pH 7.5.

Table 2. Spectral irradiation of the artificial light source, measured with a LiCor LI-1800 spectral radiometer using the same illumination source configuration as in the photodegradation study.

Wavelength (nm)	Relative intensity ($W/m^2/nm$)
290	0.4005E-01
300	0.1227E-00
310	0.2846I-00
320	0.2848E-01
330	0.4314E-01
340	0.3576E-01
350	0.2294E-01
360	0.4349E-01
370	0.1102E-00
380	0.2022E-01
390	0.3923E-01
400	0.3605E-01
410	0.6902E-01
420	0.1101E-01
430	0.3154E-01
440	0.9376E-01
450	0.1252E-01
460	0.1141E-01
470	0.1239E-01
480	0.1341E-01
490	0.3641E-01
500	0.1552E-01
510	0.1671E-01
520	0.1723E-01
530	0.2011E-01
540	0.2850E-01
550	0.2524E-01
560	0.2787E-01
570	0.3296E-01
580	0.1414E-01
590	0.3753E-01
600	0.3458E-01
610	0.3800E-01
620	0.4038E-01
630	0.4233E-01
640	0.4516E-01
650	0.4816E-01
660	0.5131E-01
670	0.5630E-01
680	0.5821E-01
690	0.8952E-01
700	0.6523E-01
710	0.7785E-01
720	0.7205E-01
730	0.7542E-01
740	0.7889E-01
750	0.8205E-01

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Table 3. Distribution of radioactivity (% of the applied) in nonsensitized sterile deionized water and seawater treated with [^{14}C]RH-5287.[a]

Sampling interval (days)	Deionized water[b]		Seawater			
	Ring cleavage products or RH-893-I[c] (R_f 0.0)	RH-5287 (R_f 0.42)	Ring cleavage products or RH-893-I[c] (R_f 0.0)	RH-5287 (R_f 0.37)	Unknown (R_f 0.54)	RH-893[d] (R_f 0.11)
			Irradiated			
0	4.12	89.20	7.30	85.51	ND[e]	ND
1	8.17	83.42	11.26	75.81	ND	ND
3	40.95	35.18	19.81	46.51	ND	ND
7	51.26	12.96	46.33	37.12	ND	ND
14	67.59	2.67	67.91	16.0	ND	ND
21	68.34	ND	60.93	14.19	ND	6.56
30	66.08	1.84	72.56	5.35	ND	6.28
			Dark control			
0	4.12	89.20	7.30	86.51	ND	ND
1	4.62	90.20	8.28	82.79	ND	ND
3	6.01	89.70	14.79	79.07	ND	ND
7	6.78	90.76	28.93	76.24	ND	ND
14	8.29	89.70	40.52	58.14	2.57	ND
21	11.76	74.62	41.30	52.09	ND	6.47
30	17.99	74.37	53.62	35.40	7.72	7.72

[a] The treatment rate was calculated as ~10 ppm; however, the initial concentration of [^{14}C]residues was measured as 2.15 ppm in the deionized water and 3.98 ppm in the seawater.

[b] 2-N-octyl-3-(2H)-isothiazolone (RH-893), 4-chloro-2-n-octyl-3(H)-isothiazolone (RH-085), and an unidentified compound with an R_f of 0.54 were isolated in the deionized water but were not quantified.

[c] R_f 0.0 was identified as 3,3'-dithiobis-n-octyl-propionamide (RH-893-I) in the deionized water and "ring cleavage products" in the seawater.

[d] 2-N-octyl-3-(2H)-isothiazolone.

[e] Not detected, the detection limit was not specified.

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Table 4. Distribution of radioactivity (% of the applied) in sensitized (1% acetone) sterile deionized water and seawater treated with [^{14}C]RH-5287.[a]

Sampling interval (days)	Deionized water[b]		Seawater				
	Ring cleavage products or RH-893-I[c] (R_f 0.0)	RH-5287 (R_f 0.42)	Ring cleavage products or RH-893-I[c] (R_f 0.0)	RH-5287 (R_f 0.37)	RH-085[d] (R_f 0.19)	Unknown (R_f 0.54)	RH-893[e] (R_f 0.11)
			Irradiated				
0	4.07	91.21	8.16	84.65	ND[f]	ND	ND
1	9.04	91.21	82.30	21.21	ND	ND	ND
3	79.65	6.86	86.51	ND	5.12	ND	ND
7	88.19	ND	66.98	ND	3.12	ND	ND
14	85.43	ND	47.91	ND	ND	ND	ND
21	87.93	ND	75.35	ND	ND	ND	ND
30	67.09	ND	57.21	ND	ND	ND	ND
			Dark control				
0	4.07	91.21	7.91	84.65	ND	ND	ND
1	4.10	84.92	12.37	82.33	ND	ND	ND
3	3.23	91.96	20.84	67.91	1.15	ND	ND
7	7.26	89.95	40.33	42.74	5.72	ND	ND
14	8.17	96.47	59.07	31.30	4.41	ND	ND
21	9.30	87.69	64.19	14.88	ND	ND	ND
30	13.96	86.43	70.70	11.91	ND	ND	ND

[a] The treatment rate was calculated as ~10 ppm; however, the initial concentration of [^{14}C]residues was measured as 2.15 ppm in the deionized water and 3.98 ppm in the seawater.

[b] 2-N-octyl-3-(2H)-isothiazolone (RH-893), 4-chloro-2-n-octyl-3(H)-isothiazolone (RH-085), and an unidentified compound with an R_f of 0.54 were isolated in the deionized water but were not quantified.

[c] R_f 0.0 was identified as 3,3'-dithiobis-n-octyl-propionamide (RH-893-I) in the deionized water and "ring cleavage products" in the seawater.

[d] 4-Chloro-2-n-octyl-3-(H)-isothiazolone.

[e] 2-N-octyl-3(2H)-isothiazolone.

[f] Not detected, the detection limit was not specified.

CASE GS -- RH-5287 STUDY 2 PM --

CHEM 128101 RH-5287

BRANCH EAB DISC --

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID No MRID CONTENT CAT 01

Warren, J. 1986. Determination of adsorption/desorption constants of C-9211/^{14}C-RH-5287. Report No. 32116. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265908.

SUBST. CLASS = S.

DIRECT RVW TIME = 16 (MH) START-DATE END DATE

REVIEWED BY: W. Higgins
TITLE: Staff Scientist
ORG: Dynamac Corp., Rockville, MD
TEL: 468-2500

APPROVED BY: S.C. Termes
TITLE: Chemist
ORG: EAB/HED/OPP
TEL: 557-7336

SIGNATURE: DATE: Dec. 3/1987

CONCLUSIONS:

Mobility - Leaching and Adsorption/Desorption (batch equilibrium, unaged soil/sediment)

This study may be acceptable if data clarifying the nature of the test material and radiochemical purity of the labeled compound can be provided for reevaluation of the study.

However, an aged soil/sediment study to determine the mobility of major degradates under anaerobic aquatic conditions is also necessary.

MATERIALS AND METHODS:

Preliminary studies were conducted to determine the optimum soil: solution ratio and solution equilibration time for the following batch equilibrium study.

Four soils, ranging in texture from loamy sand to clay, and an aquatic sediment (sandy clay) were air-dried, sieved, autoclaved (121°C, 15 psi), and oven-dried prior to use (Table 1). Duplicate 1.0-g samples of each soil were mixed in tubes with 10 mL of aqueous solution containing 0.0524, 0.128, 0.259, or 0.537 g/mL of 3C-labeled [14C]RH-5287 (specific

activity 1.78 mCi/g, Rohm and Haas Company, purity unspecified). Duplicate 1.0-g samples of the aquatic sediment were mixed in tubes with 20 mL of aqueous solution containing 0.0678, 0.170, 0.339, or 0.678 µg/mL of [^{14}C]RH-5287. Controls were prepared for each soil type and the aquatic sediment. All sample suspensions were shaken in darkness for a minimum of 48 hours at 25 ±1°C. The solutions were then centrifuged, filtered, and aliquots of the supernatant were analyzed for total radioactivity by LSC.

To measure [^{14}C]RH-5287 desorption, deionized water was added to samples to replace the supernatant removed for adsorption analysis. Samples were shaken in darkness for a minimum of 72 hours at 25 ±1°C. The solutions were then centrifuged, filtered, and aliquots of the supernatant were analyzed for total radioactivity by LSC. The desorption procedure was repeated once. The remaining soil was analyzed for total radioactivity by LSC following combustion. In order to characterize the [^{14}C]residues in the supernatant and soils, 1.0-g samples of the four soils and the aquatic sediment were mixed with 10 mL of aqueous solution containing 1.0 µg/mL [^{14}C]RH-5287. The suspensions were shaken in darkness for 192 hours (the total sum of time samples were shaken in the adsorption and desorption phases of the study) at 25°C. The samples were centrifuged and filtered, and aliquots of the supernatant were analyzed for total radioactivity by LSC. Additional aliquots were concentrated prior to TLC analysis. The remaining soils were extracted with methanol:water (9:1). Duplicate aliquots of extract were taken for LSC analysis. Additional aliquots were concentrated prior to TLC analysis.

Aliquots of the concentrated water and soil extracts and reference RH-5287 were applied as a thin band at the origin of silica gel TLC plates. The plates were developed with a toluene:ethyl acetate:methanol (90:10:2, v:v:v) solvent system. Plates were visualized using UV light and autoradiography. The silica gel was scraped from the plates in sections. The radioactivity was desorbed from the silica gel scrapings using deionized water and was quantified using LSC.

REPORTED RESULTS:

Freundlich K_{ads} values ranged from 13.7 for the loamy sand soil to 905 for the aquatic sediment (Table 2). K_{des} values for the first desorption phase ranged from 31.7 for the loamy sand soil to 289 for the clay loam soil. K_{des} values for the second desorption phase ranged from 31.6 for the loamy sand soil to 737 for the silt loam soil. The distribution of radioactivity in solution, as determined by LSC, for the four soils and the aquatic sediment after the adsorption and desorption phases is presented in Tables 3-7. The material balances ranged from 65.1 to 74.8% of the applied in loamy sand soil, 62.4 to 72.5% in clay soil, 56.6 to 70.7% in silt loam soil, 57.4 to 74.9% in clay loam soil, and 70.2 to 87.3% in aquatic sediment.

The characterization of residues in the soil and aqueous fractions of samples equilibrated for 192 hours is presented in Table 8. RH-5287 was not detected in the aqueous fractions but ranged from 20.9 to 68.5% of the applied in the soil fractions.

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DISCUSSION:

1. The rate of application of RH-5287 could not be confirmed. First, the purity of the test substance was not specified. A memorandum included in the raw data indicates that the regis trant requested Analytical Bio-Chemistry Laboratories, Inc., to delete the purity from the report. This suggests that the test substance was not analytical grade. However, the lot number and specific activity indicate that the test substance in the mobility studies was the same as in the aquatic metabolism studies, but different from the one used in the photodegradation studies.

2. In the TLC procedure, the parent material was not found in the water fraction, and from the soil fraction a maximum of only 68.5% of the radioactivity applied to the TLC plate was parent material. Thus, it cannot be determined what percentage of the applied test substance was actually RH-5287 or whether adsorption was a reflection of the behavior of some [^{14}C]residue other than RH-5287 that was present in the original solution.

3. It is mentioned that RH-5287 "appears to degrade rapidly in water" and that it is also "degraded when adsorbed onto the soil though not as rapidly as in water". No attempts to identify any degradate were made.

4. A majority of the [^{14}C]residues on the TLC plates were not identified. A zone labeled at Remainder is not properly defined; in the the aqueous phase, the percent of applied radioactivity to the TLC is as high as 70% in the "aquatic sediment sample".

5. An improper solvent system appears to have been used for the TLC procedure since up to 81.7% of the applied material remained at the origin.

6. It could not be determined how the registrant made correction calculations for " g radioactivity left in soil". In addition, mathematical errors were made in the determination of percent recovery. Consequently, the reviewer calculated the "percent recovery" values presented in Tables 3-7.

7. Portions of the raw data were illegible.

8. A preliminary study indicated that RH-5287 strongly adsorbed to glass and that all glassware should be silanized. Silanized glass adsorbed 3% of the RH-5287 in solution during 4 days of incubation, in contrast to 13% adsorbed by unsilanized glassware during the same period. However, it could not be determined whether, in fact, silanized glassware was used.

9. The registrant indicated that RH-5287 is relatively insoluble in water. The solubility is not shown in the report, but in a memorandum (Sept. 10, 1984) sent by the registrant to Analytical Bio-Chemistry Laboratories, Inc., it is given as 2.3-14 ppm.

Table 1. Soil characteristics.

Soil texture	Sand	Silt	Clay	Organic matter	pH	CEC (meq/100 g)	Kads	Kdes
		%						
Loamy sand	83.6	9.2	7.2	0.3	7.8	5.9	13.7	31.6
Clay	25.6	33.2	41.2	3.2	6.4	34.8	37.0	198
Silt loam	12.8	70.0	17.2	4.1	5.3	25.7	46.6	737
Clay loam	25.6	45.2	29.2	7.5	6.8	41.2	74.4	132
Aquatic sediment (sandy clay)	48.8	36.0	15.2	8.6	5.7	19.7	975	200

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Table 2. Freundlich K values for the adsorption and desorption of [^{14}C]RH-5287 on four soils and an aquatic sediment.

Soil texture	Adsorption phase		1st Desorption		2nd Desorption	
	K_{ads}	n	K_{des}	n	K_{des}	n
Loamy sand	13.7	1.03	31.7	1.07	31.6	1.16
Clay	37.0	0.98	120	1.01	198	0.92
Silt loam	40.6	0.98	255	0.92	737	0.73
Clay loam	74.4	0.93	289	0.97	132	1.05
Aquatic sediment (sandy clay)	905	0.74	49.1	1.44	200	1.02

Table 3. Distribution of radioactivity, as determined by LSC, from loamy sand soil treated with aqueous solution containing [^{14}C]RH-5287 at four concentrations.

Initial concentration in solution (µg/mL)	Replicate	Total at initiation	In solution after adsorption	In solution after 1st desorption phase	In solution after 2nd desorption phase	Left in soil	Percent recovery[a]
		µg					
0.0524	1	0.524	0.180	0.0661	0.0462	0.0587	67.0
0.0524	2	0.524	0.241	0.0556	0.0363	0.0367	70.5
0.128	1	1.28	0.550	0.136	0.0411	0.172	70.2
0.128	2	1.28	0.446	0.155	0.107	0.125	65.1
0.259	1	2.59	1.08	0.287	0.180	0.307	71.6
0.259	2	2.59	1.02	0.307	0.244	0.291	71.9
0.537	1	5.37	2.23	0.732	0.352	0.445	70.0
0.537	2	5.37	2.10	0.673	0.452	0.794	74.8

[a] Calculated by reviewer.

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Table 4. Distribution of radioactivity, as determined by LSC, from clay soil treated with aqueous solution containing [^{14}C]RH-5287 at four concentrations.

Initial concentration in solution (µg/mL)	Replicate	Total at initiation	In solution after adsorption	In solution after 1st desorption phase	In solution after 2nd desorption phase	Left in soil	Percent recovery[a]
		µg					
0.0524	1	0.524	0.0924	0.0262	0.0395	0.169	62.4
0.0524	2	0.524	0.158	0.0281	0.0233	0.142	67.1
0.128	1	1.28	0.331	0.0901	0.0554	0.452	72.5
0.128	2	1.28	0.278	0.0735	0.0835	0.427	67.3
0.259	1	2.59	0.557	0.138	0.112	1.01	70.2
0.259	2	2.59	0.496	0.141	0.122	1.09	71.4
0.537	1	5.37	1.26	0.296	0.261	2.07	72.4
0.537	2	5.37	1.08	0.314	0.260	2.24	72.5

[a] Calculated by reviewer.

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Table 5. Distribution of radioactivity, as determined by LSC, from silt loam soil treated with aqueous solution containing [^{14}C]RH-5287 at four concentrations.

Initial concentration in solution (µg/mL)	Replicate	Total at initiation	In solution after adsorption	In solution after 1st desorption phase	In solution after 2nd desorption phase	Left in soil	Percent recovery[a]
		µg					
0.0524	1	0.524	0.112	0.0281	0.0347	0.122	56.6
0.0524	2	0.524	0.0927	0.0211	0.0386	0.144	56.6
0.128	1	1.28	0.308	0.0824	0.0701	0.415	68.4
0.128	2	1.28	0.306	0.0550	0.0918	0.343	62.2
0.259	1	2.59	0.533	0.119	0.110	1.04	69.6
0.259	2	2.59	0.646	0.0965	0.123	0.772	63.2
0.537	1	5.37	0.986	0.205	0.213	2.39	70.7
0.537	2	5.37	0.898	0.203	0.210	2.47	70.4

[a] Calculated by reviewer.

Table 6. Distribution of radioactivity, as determined by LSC, from clay loam soil treated with aqueous solution containing [^{14}C]RH-5287 at four concentrations.

Initial concentration in solution (µg/mL)	Replicate	Total at initiation	In solution after adsorption	In solution after 1st desorption phase	In solution after 2nd desorption phase	Left in soil	Percent recovery[a]
		µg					
0.0524	1	0.524	0.0840	0.0141	0.0178	0.185	57.4
0.0524	2	0.524	0.0821	0.0310	0.0306	0.178	61.4
0.128	1	1.28	0.194	0.0428	0.0650	0.657	74.9
0.128	2	1.28	0.212	0.0358	0.0647	0.465	60.7
0.259	1	2.59	0.363	0.112	0.195	0.964	63.1
0.259	2	2.59	0.386	0.0757	0.134	0.991	61.3
0.537	1	5.37	0.674	0.188	0.237	2.39	65.0
0.537	2	5.37	0.818	0.117	0.134	2.52	66.8

[a] Calculated by reviewer.

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Table 7. Distribution of radioactivity, as determined by LSC, from aquatic sediment (sandy clay) treated with aqueous solution containing [^{14}C]RH-5287 at four concentrations.

Initial concentration in solution (µg/mL)	Replicate	Total at initiation	In solution after adsorption	In solution after 1st desorption phase	In solution after 2nd desorption phase	Left in soil	Percent recovery[a]
		µg					
0.0464	1	0.928	0.137	0.115	0.0886	0.470	87.3
0.0464	2	0.928	0.127	--	0.0556	0.469	70.2
0.122	1	2.44	0.182	0.113	0.132	1.37	73.6
0.122	2	2.44	0.242	0.208	0.132	1.33	78.4
0.256	1	5.12	0.430	0.444	0.426	2.42	72.7
0.256	2	5.12	0.362	0.384	0.398	2.92	79.4
0.528	1[b]	--	--	--	--	--	--
0.528	2	10.6	0.804	1.88	0.704	5.17	80.7

a Calculated by reviewer.

b Contaminated sample. Values omitted from table.

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Table 8. Characterization of residues (% of the applied to the TLC plate) in soil and water from four soils and one aquatic sediment (sandy clay) (1.0 g) treated with aqueous solution (10 mL) containing [^{14}C]RH-5287 at 1.0 µg/mL and equilibrated for 192 hours.

Soil texture	RH-5287	Unknown	Origin	Remainder	Percent recovery
			Soil		
Loamy sand	52.3	7.7	19.3	50.1	129.4
Clay	68.0	6.6	8.0	11.4	94.0
Silt loam	68.5	7.5	5.4	12.4	93.8
Clay loam	30.3	15.6	29.7	27.2	102.7
Aquatic sediment	20.9	10.6	15.3	24.1	70.9
			Water		
Loamy sand	--	12.1	71.6	26.7	110.4
Clay	--	20.7	57.0	58.1	135.8
Silt loam	--	19.7	34.8	60.6	115.2
Clay loam	--	--	81.7	20.2	101.9
Aquatic sediment	--	--	66.7	70.5	137.1

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CASE GS -- RH-5287 STUDY 3 PM --

CHEM 128101 RH-5287

BRANCH EAB DISC --

FORMULATION 90 - FORMULATION NOT IDENTIFIED

FICHE/MASTER ID No MRID CONTENT CAT 01

Forbis, A.D. and L. Georgie. 1985. Time-independent flow-through toxicity of RH-5287 to bluegill sunfish (Lepomis macrochirus). ABC Report No. 32113. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265911.

FICHE/MASTER ID No MRID CONTENT CAT 01

Forbis, A.D., L. Georgie, and B. Bunch. 1985. Uptake, depuration, and bio-concentration of ^{14}C-RH-5287 by bluegill sunfish (Lepomis macrochirus). ABC Report No. 32970. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohn and Haas Company, Philadelphia, PA. Acc. No. 265912.

FICHE/MASTER ID No MRID CONTENT CAT 01

Leak, T. 1986. Characterization of RH-5287 in bluegill sunfish (Lepomis macrochirus). ABC Report No. 32971. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265913.

SUBST. CLASS = S.

DIRECT RVW TIME = 16 (MH) START-DATE END DATE

REVIEWED BY: L. Binari
TITLE: Staff Scientist
ORG: Dynamac Corp., Rockville, MD
TEL: 468-2500

APPROVED BY: S.C. Termes
TITLE: Chemist
ORG: EAB/HED/OPP
TEL: 557-7336

SIGNATURE:

DATE: Dec. 3/1987

CONCLUSIONS:

Laboratory Accumulation - Fish

This study is unacceptable because the purity of the test substance was not reported and the treatment rate (concentration of parent RH-5287) was not confirmed; therefore, it could not be determined if the fish were exposed to parent RH-5287 only. In addition, this study would not

would not fulfill EPA Data Requirements for Registering Pesticides because residues in the water and fish tissues were not completely characterized.

MATERIALS AND METHODS:

Bluegill sunfish (Lepomis macrochirus; average length and weight of 72 mm and 6.2 g, respectively) were held in culture tanks on a 16-hour daylight photoperiod for >14 days prior to study initiation. Flow-through aquatic exposure systems were prepared using two 100-L aquaria. Aerated well water (Table 1) was provided to each aquarium at a rate of ~9 turnovers per day. The aquaria were immersed in a water bath and maintained at 22 ± 2°C.

Bluegill sunfish (120) were placed in each aquarium, and one aquarium was continuously treated with carbonyl carbon-labeled [^{14}C]RH-5287 (specific activity 15.3 mCi/g, Rohm and Haas Co., purity unspecified) at 1.2 ppb. The second aquarium served as an untreated control. Following a 28-day exposure period, the [^{14}C]RH-5287-treated water was replaced with untreated water for a 21-day depuration period. The treated water was sampled prior to introducing the fish, and then water samples and fish (6, 15, or 25) were taken from the treated and control aquaria after 4 hours and 1, 3, 7, 14, 21, and 28 days of exposure. During the depuration period, water samples and [^{14}C]RH-5287-treated and untreated fish were taken on days 1, 3, 7, 10, 14, and 21.

Radioactivity in the water samples was quantified using LSC. Water samples were extracted three times with methylene chloride. The extracts were dried over anhydrous sodium sulfate, combined, concentrated by evaporation, and the residue was dissolved in acetone. The residue was analyzed by TLC on silica gel plates developed in toluene:ethyl acetate (9:1). Unlabeled RH-5287 was cochromatographed with the samples. Following development, radioactive areas were located with a TLC radioscanner. Radioactivity was quantitated by scraping the silica gel from the plates, eluting with methanol, and analyzing by LSC.

Pooled samples (3 fish) of whole fish, edible tissues (body, muscle, skin, skeleton), and nonedible tissues (fins, head, internal organs) were homogenized with dry ice and analyzed for total radioactivity using combustion and LSC. Anhydrous sodium sulfate was added to the tissue samples, and the samples were extracted three times with methylene chloride. The extracts were filtered, combined, concentrated, and analyzed by TLC as described above. The reported recovery of parent [^{14}C]RH-5287 from nonedible tissues fortified (concentration not reported) with [^{14}C]RH-5287 was 112%.

REPORTED RESULTS:

Throughout the study, the temperature of the treated water ranged from 20 to 22°C, the pH ranged from 7.9 to 8.3, and the dissolved oxygen content ranged from 5.9 to 8.8 mg/L; values were comparable to the control aquarium. Total [^{14}C]residues in the treated water ranged from 0.76 to 1.5 ppb during the exposure period (Table 2). Analysis of the 21- and 28-day water samples from the exposure period found only 0.028 and 0.004 ppb, respectively, of parent RH-5287 (Table 3).

No mortality of the fish in either the treated or untreated aquaria was observed during the study. Maximum accumulation of [^{14}C]residues occurred on days 21-28 of the exposure period, with bioconcentration factors of 170-200x in edible tissues, 1100-1200x in nonedible tissues, and 660-680x in whole fish (Table 2). Maximum concentrations of [^{14}C]-residues during the exposure period were 0.23 ppm in edible tissues, 1.4 ppm in nonedible tissues, and 0.8 ppm in whole fish. Only 12-14% and 30-35% of the sample radioactivity was extractable from the 21- and 28-day samples of edible and nonedible tissues, respectively. TLC analysis of the extracts determined that parent RH-5287 concentrations were ~0.008 and ~0.06-0.10 ppm in edible and nonedible tissues, respectively (Table 4). After 21 days of depuration, [^{14}C]residues in edible and nonedible tissues and whole fish were 0.093, 0.28, and 0.18 ppm, respectively.

DISCUSSION:

1. The radiochemical purity of the test substance was not reported (lot number differs from the material used in photodegradation studies, although the reported specific activity is the same).

2. The treatment rate was not confirmed. Degradate characterization of the 21- and 28-day water samples (from the exposure period) found only 0.028 and 0.004 ppb, respectively, of parent RH-5287. Either the parent had degraded or the method did not satisfactorily analyze for RH-5287. The study authors stated that a method validation on the extraction and analysis of RH-5287 from water was performed; however, no data were reported.

3. Residues in the water and fish tissues were not completely characterized. Extracts were analyzed for parent RH-5287 only, and no attempt was made to further extract and analyze the unextracted [^{14}C]residues in the water (67-70% of the sample radioactivity) and edible (86-88%) and nonedible (65-70%) tissues. The unextracted residues in the fillet and viscera tissues were assumed to be present as polar metabolites.

4. It was not specified in the report how the unlabeled reference compound of RH-5287 was located on the TLC plates. Raw data indicate that it was visualized with "short-wave light".

5. Results from analyses of untreated water and fish were not provided.

6. A preliminary 7-day toxicity study was conducted to determine the LC_{50} value of RH-5287 for bluegill sunfish. The LC_{50} value was determined to be 18 ppb and the no-observed-effect level was 7.5 ppb. In view of these results, the registrant chose an exposure level of 1.2 ppb for the bioaccumulation study.

7. A preliminary study indicated that RH-5287 strongly adsorbed to glass and that all glassware should be silanized. Silanized glass adsorbed 3% of the RH-5287 in solution during 4 days of incubation, in contrast to 13% adsorbed by unsilanized glassware during the same period. However, it could not be determined whether, in fact, silanized glassware was used.

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8. The solubility in water is not stated in the report, but in an attached letter from the registrant to Analytical Bio-Chemistry Laboratories, Inc., it is given as 2.3-14 ppm.

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Table 1. Chemical characteristics of the aerated well water.

Parameter	Concentration
Temperature	15-20°C[b]
Dissolved oxygen[a]	9.2-10.2 ppm[b]
pH	7.8-8.3[b]
Hardness ($CaCO_3$)	255-275 ppm[b]
Alkalinity ($CaCO_3$)	325-375 ppm[b]
Conductivity	700 µmhos/cm
NO_3-N	0.60 ppm
NO_3-NO_2-N	0.20 ppm
Ortho-phosphate	0.10 ppm
Aluminum	<0.010 ppm
Arsenic	<0.0005 ppm
Cadmium	<0.002 ppm
Chromium	<0.006 ppm
Cobalt	<0.003 ppm
Copper	<0.002 ppm
Iron	<0.004 ppm
Lead	0.017 ppm
Mercury	0.0008 ppm
Nickel	<0.013 ppm
Silver	<0.0004 ppm
Zinc	0.001 ppm
Measured organophosphorus pesticides	-- [c]
Measured organochlorine pesticides plus PCB's	-- [c]

[a] After aeration.

[b] Represents seasonal variation, with the monthly range not exceeding 10%.

[c] Less than minimum detectable limits.

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Table 2. Total [^{14}C]residues in the water and tissues of bluegill sunfish treated with carbonyl carbon-labeled [^{14}C]RH-5287 (purity unspecified) during a 28-day exposure period and a 21-day depuration period.

Sampling interval (days)		Water ppb	Edible[a] ppm	Edible[a] BCF[c]	Nonedible[b] ppm	Nonedible[b] BCF[c]	Whole fish ppm	Whole fish BCF[c]
Exposure	0[d]	1.2	--	--	--	--	--	--
	4 hours	0.76	0.007	7	0.11	110	0.056	57
	1	1.0	0.031	31	0.37	380	0.24	240
	3	1.5	0.082	74	0.81	730	0.53	480
	7	1.1	0.11	99	0.91	818	0.48	430
	14	1.4	0.10	86	1.00	860	0.56	480
	21	1.3	0.20	170	1.40	1200	0.80	680
	28	1.0	0.23	200	1.30	1100	0.77	660
Depuration	1	0.13	0.20	--	0.88	--	0.55	--
	3	ND[e]	0.18	--	0.61	--	0.42	--
	7	ND	0.15	--	0.48	--	0.35	--
	10	ND	0.14	--	0.45	--	0.30	--
	14	ND	0.12	--	0.36	--	0.28	--
	21	ND	0.093	--	0.28	--	0.18	--

[a] Body, muscle, skin, skeleton.

[b] Fins, head, internal organs.

[c] Daily bioconcentration factor (BCF) obtained by dividing the tissue concentration by the mean measured water concentration up to and including the respective sampling day.

[d] Samples taken immediately prior to addition of fish.

[e] Not detected; detection limits were 0.078 ppb in water and 0.0035 ppm in fish tissues.

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Table 3. [^{14}C]Residues and parent RH-5287 (ppb) in water treated with carbonyl carbon-labeled [^{14}C]RH-5287 (purity unspecified) at 1.2 ppb.

Sampling interval (days)	Total [^{14}C]-residues (original analysis)	Total [^{14}C]-residues (reanalysis)[a]	[^{14}C]Residues in extracted water	[^{14}C]Residues in methylene chloride extract	RH-5287
21	1.3	0.63	0.42	0.10	0.028
28	1.0	0.72	0.52	0.08	0.004

[a] Study author attributed decrease in radioactivity to adsorption of the test substance and/or degradates to the polyethylene bottles that the samples were stored in. The samples were kept frozen prior to analysis.

Table 4. RH-5287 and its degradates (ppm) in extracts from tissues of bluegill sunfish exposed to carbonyl carbon-labeled [^{14}C]-RH-5287 (purity unspecified) at 1.2 ppb for 28 days.

Sampling interval (days)	RH-5287	R_f 0-0.35	R_f 0.45-1.0	Origin
		Edible tissue		
21	0.0014	0.0078	0.00057	0.016
28	0.00079	0.0084	0.00019	0.015
		Nonedible tissue		
21	0.0081	0.10	0.0019	0.28
28	0.0069	0.057	0.0014	0.26

CASE GS -- RH-5287 STUDY 4 PM --

CHEM 128101 RH-5287

BRANCH EAB DISC --

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID No MRID CONTENT CAT 01

Cranor, W. 1986a. Anaerobic aquatic metabolism of ^{14}C-RH-5287. Report No. 32115. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265904.

SUBST. CLASS = S.

DIRECT RVW TIME = 60 (MH) START-DATE END DATE

REVIEWED BY: W. Higgins, K. Patten
TITLE: Staff Scientist
ORG: Dynamac Corp., Rockville, MD
TEL: 468-2500

APPROVED BY: S.C. Termes
TITLE: Chemist
ORG: EAB/HED/OPP
TEL: 557-7336

SIGNATURE: DATE: Dec. 3/1987

CONCLUSIONS:

Metabolism - Anaerobic Aquatic

This study is unacceptable because the material balance was incomplete, the parent material accounted for only 31.4% of the total [^{14}C]residues at time 0, and data were variable. In addition, this study would not fulfill EPA Data Requirements for Registering Pesticides because characterization of degradates by TLC was not adequate and the purity of the [^{14}C]RH-5287 parent compound was not specified.

MATERIALS AND METHODS:

[^{14}C]RH-5287 (purity unspecified, specific activity 1.78 mCi/g, Rohm and Haas) in acetone stock solution was added to 200 mL of seawater (pH 7.9 and 2.9 mg/L dissolved oxygen) in the vessel of a metabolism apparatus (Figure 1). A stream of nitrogen was bubbled through the water for twenty minutes to remove the acetone from solution. Then an additional 1800 mL of seawater and 700 g (571.2 g dry weight basis) of sand (95.2% sand, 1.2% silt, 3.6% clay, 0.2% organic matter, pH 6.2, CEC 0.3 meq/100 g) were added to the solution, resulting in 10 ppm

[^{14}C]RH-5287. Dry powdered kelp (10 g) was added as an organic amendment to aid in the establishment of anaerobic conditions. The treated solution and a control solution were incubated at 25 ± 4°C. Samples of sand, water, and trapping solutions were taken at intervals from day 0 to 12 months posttreatment.

The volatile trapping solutions were analyzed at each sampling interval for radioactivity by LSC. Seawater samples were partitioned with methylene chloride. The resulting organic-soluble and aqueous-soluble phases were analyzed for radioactivity by LSC. Portions of each fraction were concentrated prior to one-dimensional TLC characterization; two-dimensional TLC analyses of these samples were performed months after the one-dimensional analysis.

Sand samples were extracted with methanol:water (90:10) and the radioactivity in the extracts analyzed by LSC. The extracts were partitioned with methylene chloride and the aqueous and organic phase analyzed by LSC and one-dimensional TLC. A supplementary sand extraction was performed with acetonitrile in an attempt to increase the amount of radioactivity recovered from the sand. After concentration, aliquots of the extracts were analyzed by one-dimensional TLC, and the remaining extracts were kept frozen until analyzed by two-dimensional TLC at a later time. The extracted sand samples were analyzed by LSC following combustion.

For the two-dimensional TLC, aliquots of the acetonitrile sand extracts and the methylene chloride seawater extracts were applied to the silica gel plates. The plates were developed in toluene:ethyl acetate (90:10, v:v) in the first direction and ethyl acetate:methanol (70:30, v:v) in the second direction. The plates were visualized by autoradiography. Radioactive spots were scraped from the plates, desorbed from the silica gel using deionized water, and quantified with LSC. Degradates were identified by comparison to standards (radiolabeled and nonlabeled parent compound and nonlabeled RH-893, RH-893-I, and RH-085, OCPA, and N-(n-octyl)-malonamic acid).

REPORTED RESULTS:

Over the course of the study, total [^{14}C]residues ranged between 53.8 to 100.0% of the total [^{14}C]residues recovered at time 0 (Table 1). At day 0, the majority of the [^{14}C]residues were in the seawater fraction; by 12 monts posttreatment, the majority of [^{14}C]residues were in the sand fraction (a total of 66.7% as extractable residues and 26.5% as bound residues; partitioning of the extracts showed that the percent of ^{14}C-components was 78.6% in the organic phase and 12.9% in the aqueous phase). Volatiles accounted for 8.1% of the [^{14}C]residues 12 months posttreatment. [^{14}C]RH-5287 decreased from 31.4% of the total [^{14}C]residues recovered at time 0 to undetectable (detection limit not specified) by 4 months posttreatment (Table 2). Detectable degradates included N-(n-octyl) malonamic acid (maximum of 2.1% at 1 month posttreatment), 2-N-octyl-3(2H)-isothiazolone (maximum of 6.0% at 2 months), 2-N-octyl-4-chloro-1-isothiazolin-3-one (maximum of 9.2% at 1 month), and 3,3'-disthiobis-n-octyl-propionamide (maximum of 15.6% at 6 months).

Assuming first-order kinetics, the authors calculated a half-life for the decay of [^{14}C]RH-5287 based on one-dimensional TLC data of 23.4 days (sample days 0 through 4 months) and 10.2 days (sample days 0 through 1 month). Based on two-dimensional TLC, the calculated half-life was 9.8 days (sample days 0 through 1 month).

DISCUSSION:

1. The purity of the test material was not specified, but the purity of possible degradates used as standards was given.

2. The rate of application could not be confirmed; only 31.4% of the total [^{14}C]residues were RH-5287 at time 0.

3. Data were very variable. Total radioactivity as determined by LSC ranged from 53.8 to 100% of the total [^{14}C]residues recovered at time 0 prior to extraction.

4. The material balance was incomplete. The sum of extractable and unextractable [^{14}C]residues and [^{14}C]volatiles was significantly less than the total [^{14}C]residues as determined by LSC (Table 1).

5. A methanol:water extraction was performed on sand and the resulting extract was analyzed by one-dimensional TLC, which indicated that 82.7% of day 0 residues were attributable to the parent compound. Some degradates were not mobile in that TLC procedure. Then, the sand was extracted with acetonitrile, and a portion of the resulting extract which was kept frozen for an unspecified period of time was analyzed by two-dimensional TLC; data showed that 31.4% of day 0 residues was present as the parent compound.

6. A preliminary study indicated that RH-5287 strongly adsorbed to glass and that all glassware should be silanized. Silanized glass adsorbed 3% of the RH-5287 in solution during 4 days of incubation, in contrast to 13% adsorbed by unsilanized glassware during the same period. However, it could not be determined whether, in fact, silanized glassware was used. In fact, unaccounted radioactivity was attributed to adsorption onto glass and/or lost as volatile material during evaporation of carrier solvent (dosing step).

7. The registrant indicated that RH-5287 is relatively insoluble in water. The solubility was not reported; it could not be determined if the concentration of RH-5287 was within the solubility range of the pesticide.

8. Degradates were not adequately identified. A compound identified as 3,3'-disthiobis-n-octyl-propionamide, the structure of which was not correctly represented, consisted of five distinct areas on the 2-dimensional TLC plates. No explanation was provided; therefore, the identity of that compound is in question. In addition, in the TLC procedures, the [^{14}C]residues at the origin and those labeled as unknown were of sufficient concentration

(for example, as high as 2-4% of total TLC-recovered radioactivity left at the origin in acetonitrile extracts of sand) at some sampling intervals to mandate characterization.

9. The data presented by the registrant were of such poor quality it was necessary for the reviewers to recalculate the data before the study could be interpreted. Arithmetic errors were discovered in the report, and some calculations were based on questionable assumptions. Some data were normalized several times before the values reported by the registrant were obtained, while other data were never normalized. When several routes could be used to obtain a final value, the method which provided the most favorable data was used by the registrant even if the method was not the most logical. In some cases, it was impossible for the reviewers to trace how values were arrived at by the registrant. Tabulated data were provided in such a variety of units, it was difficult to compare treatments. Unfortunately, it also appeared that data were treated selectively rather than consistently, with the result that the study was provided with the most favorable results possible for the registrant.

10. Only pH and dissolved oxygen content of seawater were reported; no other information on composition was provided.

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Pages _____ through _____ are not included in this copy.

The material not included contains the following type of information:

_____ Identity of product inert ingredients.

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_____ Sales or other commercial/financial information.

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The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

Table 1. Distribution of radioactivity (% of total [^{14}C]residues recovered at time 0) in a seawater:sand system (initially 2000 mL:700 g) treated with [^{14}C]RH-5287 (purity unspecified) and incubated anaerobically in the dark at 25°C.

Sampling interval	Total by LSC[a]	Extractable			Unextractable		Cumulative volatiles	Total by addition[c]
		Before TLC	After TLC					
		Seawater	Sand	Total[b]	Seawater	Sand		
0 day	100.0	48.7	21.2	32.4	2.2	2.7	--	37.3
1 day	53.8	24.5	26.8	30.7	2.7	3.2	<0.01	36.6
3 days	74.6	29.8	24.9	33.4	4.5	7.2	<0.01	45.1
7 days	72.4	29.4	28.5	22.7	8.9	14.4	<0.01	46.0
14 days	76.4	26.1	25.3	22.3	12.4	15.2	0.01	50.0
1 month	89.6	10.0	32.6	27.7	19.7	21.6	0.01	69.0
2 months	90.6	5.4	29.0	31.6	13.4	17.3	0.01	62.3
3 months	87.0	4.4	31.7	18.4	21.5	20.1	0.01	60.0
4 months	82.7	78.2	36.6	25.1	29.7	22.5	0.03	77.3
6 months	88.6	1.6	32.8	25.5	15.7	22.5	4.2	67.9
9 months	88.6	3.6	24.6	20.8	20.9	28.6	7.4	77.7
12 months	90.9	5.0	22.9	16.7	14.9	32.8	8.1	75.7[d]

[a] Total radioactivity in the seawater and sand prior to extraction; volatiles are not included.

[b] Based on [^{14}C]residues in the seawater and sand extracts after TLC analysis, rather than on total radioactivity in the extracts prior to TLC. In most cases, the TLC recovery was poor and the majority of residues applied to the plates were not accounted for.

[c] Sum of [^{14}C]residues in the seawater and sand extractables after TLC analysis, in the unextractable fraction, and volatiles.

[d] Includes 3.2% recovered from the sides of the glass incubation flask at 12 months post-treatment.

Table 2. Distribution of radioactivity (% of total [^{14}C]residues recovered at time 0) in the methylene chloride extracts of seawater plus the acetonitrile extracts of sand from a seawater:sand system (initially 2000 mL:700 g) treated with [^{14}C]RH-5287 (purity unspecified) and incubated anaerobically in the dark at 25°C.

Sampling interval	Origin	RH-5287	N-(n-octyl) malonamic acid	RH-893[a]	RH-085[b]	RH-893-I[c]	Unknowns[d]	Total
0 day	ND[e]	31.4	ND	ND	0.96	ND	ND	32.4
1 day	ND	29.3	ND	ND	1.4	ND	ND	30.7
3 days	0.13	30.2	ND	ND	2.5	0.61	ND	33.4
7 days	ND	11.8	ND	2.0	6.0	2.9	ND	22.7
14 days	0.64	10.6	1.1	1.6	4.2	4.2	1.9	22.3
1 month	1.1	1.2	2.1	3.5	9.2	8.7	3.6	27.7
2 months	1.3	0.91	1.7	6.0	8.9	9.2	ND	31.6
3 months	0.56	5.2	0.64	2.4	4.5	5.1	ND	18.4
4 months	1.0	ND	1.5	3.2	8.2	11.2	ND	25.1
6 months	2.2	ND	ND	5.8	1.9	15.6	ND	25.5
9 months	0.98	ND	ND	3.6	4.4	11.8	ND	20.8
12 months	1.6	ND	ND	4.8	3.2	7.1	ND	16.7

[a] 2-N-Octyl-3(2H)-isothiazolone.

[b] 2-N-Octyl-4-chloro-1-isothiazolin-3-one.

[c] This was identified by the registrant as 3,3'-disthiobis-n-octyl-propionamide; it consisted of five distinct areas on the 2-dimensional TLC plates (Rf 0.16/0.67, 0.075/0.60, 0.044/0.65, 0.044/0.71, 0.22/0.64, and 0.22/0.70).

[d] Five or six unidentified compounds, each <1.4% of the recovered (<0.18 ppm).

[e] Not detected; the detection limit was not reported.

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CASE GS -- RH-5287 STUDY 5 PM --

CHEM 128101 RH-5287

BRANCH EAB DISC --

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID No MRID CONTENT CAT 01

Cranor, W. 1986b. Aerobic aquatic metabolism of C-9211/RH-5287 in seawater. Report No. 32880. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265906.

SUBST. CLASS = S.

DIRECT RVW TIME = 60 (MH) START-DATE END DATE

REVIEWED BY: W. Higgins, K. Patten
TITLE: Staff Scientist
ORG: Dynamac Corp., Rockville, MD
TEL: 468-2500

APPROVED BY: S.C. Termes
TITLE: Chemist
ORG: EAB/HED/OPP
TEL: 557-7336

SIGNATURE: DATE: Dec. 3/1987

CONCLUSIONS:

Metabolism - Aerobic Aquatic

This study is unacceptable because data were variable and the parent material accounted for only 33.4% of the total radioactivity at time 0. In addition, this study would not fulfill EPA Data Requirements for Registering Pesticides because the purity of the test substance was not specified and degradates were not characterized.

MATERIALS AND METHODS:

[^{14}C]RH-5287 (purity unspecified, specific activity 1.78 mCi/g, Rohm and Haas) in acetone stock solution was added to 500 mL of seawater in the vessel of a metabolism apparatus (Figure 1). A stream of nitrogen was bubbled through the water for twenty minutes to remove the acetone from the solution. Then an additional 1000 mL of seawater (pH 7.9 and 2.9 ppm dissolved oxygen content) and 300 g of dry sea sand (92.4% sand, 1.6% silt, 6.0% clay, 0.01% organic matter, pH 6.7, CEC 0.6 meq/100 g) were added to solution, resulting in 10 ppm [^{14}C]RH-5287. All metabolism vessels were incubated in darkness at 25 ± 1°C. Samples of sand and water were taken at intervals from 0 to 28 days posttreatment.

The volatile trapping solutions were analyzed at each sampling interval for radioactivity by LSC. Sand samples were extracted three times by blending with methanol: water (90:10). The extracts were analyzed for radioactivity by LSC. Additional sand samples were extracted twice by shaking with acetonitrile. The extract was analyzed for radioactivity by LSC. Seawater samples were partitioned using methylene chloride. The resulting aqueous and organic phases were analyzed for radioactivity by LSC.

Acetonitrile extracts of sand and the organic phase of the seawater extraction were concentrated prior to characterization by one-dimensional TLC using silica gel plates and a toluene:ethyl acetate:methanol (90:10:2) solvent system. Plates were visualized by autoradiography. Radioactive spots were scraped from plates, redissolved in methanol, and quantified by LSC. RH-5287 was identified by comparison to a standard. Radioactivity in extracted sand was quantified by LSC following combustion.

REPORTED RESULTS:

Over the course of the study, total [^{14}C]residues ranged between 83.9 to 155.3% of total [^{14}C]residues recovered at time 0 (Table 1). At the beginning of the study, the majority of the [^{14}C]residues were in the seawater fraction; by the end of the study, the [^{14}C]residues were more evenly distributed between the seawater and the sand. Volatiles accounted for 0.4% of [^{14}C]residues by day 28. The registrant calculated that 33.4% of the recovered radioactivity was [^{14}C]RH-5287 at time 0. [^{14}C]RH-5287 decreased from 86% of the recovered from the TLC plate at time 0 to 55% at 28 days in seawater, and ranged from 47.8% to 81.8% in sand (Table 2). Degradates were separated by TLC but were not characterized.

Assuming first-order kinetics, the authors calculated a half-life of 17.1 days.

DISCUSSION:

1. Data were very variable. Total radioactivity as determined by LSC ranged from 83.9 to 155.3%. Total [^{14}C]residues as determined by adding extractable [^{14}C]residues, unextractable [^{14}C]residues, and [^{14}C]volatiles do not equal total [^{14}C]residues as determined by LSC (Table 1).

2. The rate of application could not be confirmed. The registrant calculated that only 33.4% of the radioactivity at time 0 was RH-5287.

3. The purity of the test material was not specified.

4. The stock solution was prepared 10/15/84; the study was not initiated until 2/19/85 (see Comment 6).

5. Degradates were not characterized (only R_f values were reported). No other standards of possible degradates were even cochromatographed. A region labeled as "Remainder" was not defined. After 28 days, 40% of recovered radioactivity by TLC was left at the origin and 21.6% at "Remainder".

6. A preliminary study indicated that RH-5287 strongly adsorbed to glass and that all glassware should be silanized. Silanized glass adsorbed 3% of the RH-5287 in solution during 4 days of incubation, in contrast to 13% adsorbed by unsilanized glassware during the same period. However, it could not be determined whether, in fact, silanized glassware was used.

7. The registrant indicated that RH-5287 is relatively insoluble in water. The solubility was not reported; it could not be determined if the concentration of RH-5287 was within the solubility range of the pesticide.

8. The data presented by the registrant were of such poor quality it was necessary for the reviewers to recalculate the data before the study could be interpreted. Arithmetic errors were discovered in the report, and some calculations were based on questionable assumptions. Some data were normalized several times before the values reported by the registrant were obtained, while other data were never normalized. When several routes could be used to obtain a final value, the method which provided the most favorable data was used by the registrant even if the method was not the most logical. In some cases, it was impossible for the reviewers to trace how values were arrived at by the registrant. Tabulated data were provided in such a variety of units, it was difficult to compare treatments. Unfortunately, it also appeared that data were treated selectively rather than consistently, with the result that the study was provided with the most favorable results possible for the registrant.

KATHON 287 T

Page 51 is not included in this copy.

Pages _____ through _____ are not included in this copy.

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_____ Identity of product inert ingredients.

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_____ The product confidential statement of formula.

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X FIFRA registration data.

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The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

Table 1. Distribution of radioactivity (% of total [^{14}C]residues recovered at time 0) in a seawater:sand system (initially 1500 mL:300 g) treated with [^{14}C]RH-5287 (purity unspecified) and incubated aerobically in the dark at 25°C.

Sampling interval (days)	Total by LSC[a]	Extractable			Unextractable		Cumulative volatiles	Total by addition[c]
		Before TLC		After TLC				
		Seawater	Sand	Total[b]	Seawater	Sand		
0	100.0	81.2	11.5	66.6	13.2	11.5	--	91.3
1	83.9	53.1	24.3	49.2	13.2	11.6	<0.1	74.0
2	111.8	64.3	40.1	86.3	20.0	10.4	0.2	117.1
7	155.3	41.9	37.7	44.1	27.5	15.4	0.2	87.4
14	128.3	35.9	42.8	63.3	36.8	19.6	0.3	120.3
21	129.7	33.8	67.8	90.7	45.8	22.1	0.4	159.4
28	139.6	27.8	28.6	46.8	30.0	44.4	0.4	122.0

[a] Total radioactivity in the seawater and sand prior to extraction; volatiles are not included.

[b] Based on [^{14}C]residues in the seawater and sand extracts after TLC analysis, rather than on total radioactivity in the extracts prior to TLC. In most cases, the TLC recovery was poor and the majority of residues applied to the plates were not accounted for.

[c] Sum of [^{14}C]residues in the seawater and sand extractables after TLC analysis, in the unextractable fraction, and volatiles.

Table 2. Distribution of radioactivity in the methylene chloride extracts of seawater and the acetonitrile extracts of sand from a seawater:sand system (initially 1500 mL:300 g) treated with [^{14}C]RH-5287 (purity unspecified) and incubated aerobically in the dark at 25°C.[a]

Sampling interval (days)	Total recovery (% of applied) to TLC plate	RH-5287 (R_f 0.37)	Origin	R_f 0.10	0.16	0.02	0.28	0.30	0.33	0.46	0.56	Remainder[b]
				% of recovered								
Seawater												
0	70.1	86	0.97	0.86	ND[a]	8.2	ND	ND	ND	1.6	D[d]	2.1
1	51.2	81	0.62	ND	ND	11.0	ND	ND	ND	ND	D	7.0
2	77.8	83	0.12	ND	ND	8.7	ND	ND	ND	ND	0.25	8.0
7	28.5	68	2.7	3.1	ND	16.0	ND	7.6	ND	ND	D	2.7
14	63.3	56	3.4	6.6	ND	18.0	ND	7.6	ND	ND	2.1	7.2
21	64.0	60	1.7	7.2	ND	16.0	ND	8.3	ND	ND	D	6.0
28	74.1	55	2.9	3.0	ND	19.0	ND	7.1	ND	ND	D	3.0
RH-5287 Std[e]	120.0	84	1.9	ND	ND	5.5	ND	ND	ND	ND	ND	8.6
Sand												
0	84.4	47.8	27.6	ND	3.7	D	ND	ND	ND	4.8	ND	16.0
1	90.4	81.8	6.9	ND	2.4	0.1	ND	ND	ND	1.8	ND	7.0
2	90.5	81.7	6.5	ND	2.7	1.5	ND	ND	ND	2.8	ND	4.7
7	85.3	74.6	7.2	ND	4.4	3.0	ND	ND	ND	1.7	ND	9.1
14	95.0	74.4	11.0	ND	3.7	2.79	ND	ND	ND	1.8	1.4	4.8
21	102.0	79.7	7.0	ND	3.9	1.9	1.4	ND	ND	1.4	1.6	3.1
28	91.8	8.1	40.0	ND	13.0	9.5	4.2	ND	ND	3.6	ND	21.6

[a] At day 0, 81.2% of the residues recovered at time 0 were in the seawater extract and 11.5% were in the sand extract (Table 1).

[b] "Remainder" was not defined.

[c] Not detected; the detection limit was not reported.

[d] Detected by autoradiography, but below the LSC detection limit.

[e] RH-5287 standard; apparently no other standards were analyzed with the seawater and no standards were analyzed with the sand.

EXECUTIVE SUMMARY

A. The following findings are derived from those reviewed studies which have met the requirements of 40 CFR 158.130 and the Subdivision N Guidelines, and were also deemed acceptable.

Hydrolysis

This study was reviewed by EAB (Manning, 8/11/83) and considered adequate to fulfill data requirements for hydrolysis. Carbon-14 RH-5287 (purity unspecified), at 10 ppm, degraded rapidly in pH 5 and pH 9 buffered water: methanol (84:16, v:v), with half-lives of 9 days at pH 5 and 2.5 days at pH 9, but very little degradation was observed at pH 7. The major degradate was 4-chloro-5-hydroxy-2-(n-octyl)-3-isothiazolone, which degrades further to 2-chloro-n-octylacetamide. At pH 7, about 86% of the parent compound was still present after 30 days.

B. The following studies may be made acceptable if additional data is submitted for reevaluation.

Mobility-adsorption/desorption (unaged soil/sediment). Freundlich K_{ads} values of 13.7, 37.0, 40.6, 74.4, and 905 were calculated for the following soils and aquatic sediment: loamy sand, clay, silt loam, clay loam, and sandy clay aquatic sediment, respectively, with corresponding first and second (in parentheses) K_{des} values of 31.7 (31.6), 120 (198), 255 (737), 289 (132), and 49.1 (200).

C. The following studies were unacceptable:

Photodegradation (in aqueous solution and in seawater)
Anaerobic and aerobic aquatic metabolism
Fish accumulation studies

RECOMMENDATIONS

A. The following data requirements are fulfilled:

Hydrolysis. No data were reviewed for this addendum. Based on a previous EAB review (Manning, 8/11/83), no additional data are required.

B. The following data is partially required:
Leaching and adsorption/desorption studies(batch equilibrium, unaged soil/sediment).

One study(Warren, EPA Accession No.265908) was reviewed and may be accepted if data on the test material used can be provided for reevaluation.

C. The following data are wholly required:

Photodegradation studies in water: One study (Carpenter and Warren, Acc. Nos. 265902 and 265903) was reviewed and is unacceptable because the material balance was incomplete (up to 36% of the [^{14}C]residues were not accounted for) and the analytical method (TLC) was inappropriate to characterize residues. In addition, this study would not fulfill data requirements because the degradates were inadequately characterized, and the artificial light source was incompletely characterized and was not compared to natural sunlight.

Anaerobic aquatic metabolism studies: One study (Cranor, Acc. No. 265904) was reviewed and is unacceptable because the material balance was incomplete, the parent material accounted for only 31.4% of the total [^{14}C]residues at time 0, and data were variable. In addition, this study would not fulfill data requirements because the purity of the test substance was not specified and degradates were not adequately characterized.

Aerobic aquatic metabolism studies: One study (Cranor, Acc. No. 265906) was reviewed and is unacceptable because data was variable and the parent material accounted for only 33.4% of the total radioactivity at time 0. In addition, this study would not fulfill data requirements because the purity of the test substance was not specified and degradates were not characterized.

Laboratory studies of pesticide accumulation in fish: One study (Forbis and Georgie, Acc. No. 265911; Forbis et al., Acc. No. 265912; Leak, Acc. No. 265913) was reviewed and is unacceptable because the purity of test substance was not reported and the treatment rate (concentration of parent RH-5287) was not confirmed; therefore, it could not be determined if the fish were exposed to parent RH-5287 only. In addition, this study would not fulfill data requirements because residues in the water and fish tissues were not completely characterized.

Leaching or adsorption/desorption(aged soil/sediment): Although one study (Warren, EPA Accession No. 255908) may be acceptable as an unaged study, an aged study showing the mobility of major degradates (under anaerobic aquatic metabolism conditions) is required. Individual major degradates should be used if adsorption/desorption studies are conducted. Alternatively, an aged column leaching study may be conducted.

Aquatic field dissipation study: This study is required because at environmentally significant pH's(5 and 7) the half-life of the active ingredient in water is greater than four days. Please refer to GUIDELINES, Subdivision N, 164-2, p.82.

C. The following data requirements are deferred or are not required for presently registered uses:

Photodegradation studies on soil: No data were reviewed; however, no data are required because RH-5287 has no terrestrial food crop or forestry uses.

Photodegradation studies in air: No data were reviewed. The data requirement is deferred pending the assessment of RH-5287 by the toxicology branch.

Aerobic soil metabolism studies: No data were reviewed; however, no data are required because RH-5287 has no terrestrial food crop or forestry uses.

Anaerobic soil metabolism studies: No data were reviewed; however, no data are required because RH-5287 has no terrestrial food crop use.

Laboratory volatility studies: No data were reviewed. The data requirement is deferred pending the assessment of RH-5287 by the toxicology branch.

Field volatility studies: No data were reviewed. The data requirement is deferred pending the assessment of RH-5787 by the toxicology branch.

Terrestrial field dissipation studies: No data were reviewed; however, no data are required because RH-5287 has no terrestrial use.

Forestry dissipation studies: No data were reviewed; however, no data are required because RH-5287 has no forestry use.

Dissipation studies for combination products and tank mix uses: No data were reviewed; however, no data are required because data requirements for combination products and tank mix uses are currently not being imposed.

Long term field dissipation studies: No data were reviewed; however, no data are required because RH-5287 has no terrestrial food crop or aquatic food crop uses.

Confined accumulation studies on rotational crops: No data were reviewed, however, no data are required because RH-5287 has no terrestrial food crop or aquatic food crop uses.

Field accumulation studies on rotational crops: No data were reviewed; however, no data are required because RH-5287 has no terrestrial food crop or aquatic food crop uses.

Accumulation studies on irrigated crops: No data were reviewed. However, no data are required for the proposed use.

Field accumulation studies on aquatic nontarget organisms: No data were reviewed. The data requirement is deferred pending evaluation of an acceptable fish accumulation study.

REFERENCES

The following studies were reviewed as new submittals:

Carpenter, M. and J. Warren. 1986a. Determination of photodegradation of ^{14}C-RH-5287 in aqueous solution. Amended final Report No. 32117; Technical Report No. 310-86-27. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265902.

Carpenter, M. and J. Warren. 1986b. Determination of photoedegradation of ^{14}C-RH-5287 in seawater. Amended Final Report No. 34232; Technical Report No. 310-86-29. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA Acc. No. 265903.

Cranor, W. 1986a. Anaerobic aquatic metabolism of ^{14}C-RH-5287. Report No. 32115. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265904.

Cranor, W. 1986b. Aerobic aquatic metabolism of C-9211/RH-5287 in seawater. Report No. 32880. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265906.

Forbis, A.D. and L. Georgie. 1985. Time-independent flow-through toxicity of RH-5287 to bluegill sunfish (Lepomis macrochirus). ABC Report No. 32113. Prepared by Analytical Bio Chemistry Laboratories, Inc., Columbia MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265911.

Forbis, A.D., L. Georgie, and B. Bunch. 1985. Uptake, depuration, and bioconcentration of ^{14}C-RH-5287 by bluegill sunfish (Lepomis macrochirus). ABC Report No. 32970. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265912.

Leak, T. 1986. Metabolite characterization of RH-5287 in bluegill sunfish (Lepomis macrochirus). ABC Report No. 32971. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc No. 265913.

Warren, J. 1986. Determination of adsorption/desorption constants of C-9211/^{14}C-RH-5287. Report No. 32116. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265908.

The following study was not reviewed because it contains summary and transmittal data only:

Rohm and Haas Company. 1986. Transmittal document (summary and discussion). Submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265900.

The following studies were not reviewed because they were previously reviewed by EAB (8/11/83):

Fahley, J.W. 1981. ^{14}C-RH-5287 hydrolysis study. BRL Project No. 22-201-202-S. Technical Report No. 36F-81-19. Prepared by Borriston Laboratories, Inc., Temple Hills, MD, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265901.

Brackett, C.K. 1981. The migration of antifoulant C-9211 from paint into simulated sea water. Technical Report No. 36F-81-26. Prepared and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265910.

The following study was not reviewed because it is not pertinent to current data requirements; rather, it is concerned with the biotic degradation of RH-5287 in pond water (no soil or sediment in system) under aerobic conditions for 30 days. This study is similar to the aerobic and anaerobic metabolism studies using seawater that were reviewed in that data were variable, recoveries were poor (up to 96% of [^{14}C]residues in some samples were lost during analysis), and the presentation was confusing:

Cranor, W., N, McGowan, and J. Warren. 1986. Aerobic aquatic metabolism of RH-5287 in pond water. ABC Revised Final Report No. 32118. Technical Report No. 310-86-30. Prepared by Analytical Bio-Chemistry Laboratories, Inc., Columbia MO, and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No 265907.

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The following study was not reviewed because it contains data generated by computer modeling only:

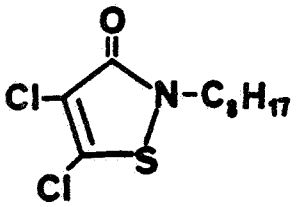
Weeks, J.A. and G.H. Drendel. 1986. Environmental dissipation modeling of the marine antifoulant RH-5287. Technical Report No. 30-86-35. Prepared by Labat-Anderson, Inc., Arlington, VA. and submitted by Rohm and Haas Company, Philadelphia, PA. Acc. No. 265909.

APPENDIX

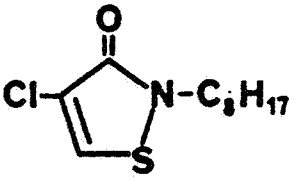
Structures of RH-5287

and

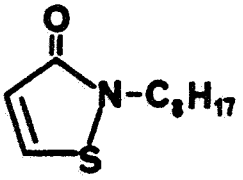
Major Degradates



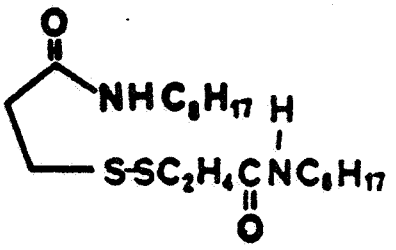
2-N-(n-octyl)-4,5-dichloro-1-isothiazolin-3-one
(RH-5287)



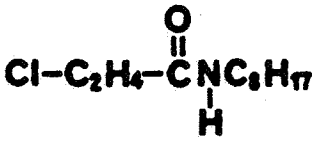
2-N-(n-octyl)-4-chloro-1-isothiazolin-3-one
(RH-085)



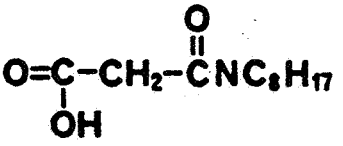
2-N-(n-octyl)-3(2H)-isothiazolone
(RH-893)



3,3'-Dithiobis-n-octyl propionamide
(RH-893-I)



3-Chloro-(n-octyl) propionamide
(OCPA)



N-(n-Octyl)-malonamic acid