3-6-90

Shaughnessy No: 080803

Date Out of EFGWB: MAR 6 1990

MAR 6 1990

TO: Lois Rossi
Special Review and Reregistration Division (H7508C)

FROM: Emil Regelman, Supervisory Chemist
Environmental Chemistry Review Section #2
Environmental Fate and Ground Water Branch, EFED (H7507C)

THRU: Henry M. Jacoby, Chief
Environmental Fate and Ground Water Branch/EFED (H7507C)

Attached, please find the EFGWB review of:

Reg./File #: 100-529

Common Name: Atrazine

Chemical Name: 2-Chloro-4-ethylamino-6-isopropylamino-1,3,5-triazine

Type product: Herbicide

Product Name: AAtrex

Company Name: Ciba-Geigy Corporation

Purpose: Review of new batch-equilibrium adsorption/desorption studies submitted to replace previously reviewed studies, which were invalidated as a result of a laboratory audit conducted by OCM.

Date Received: 10/6/89 EFGWB #: 90-0238

Action Code: 660 Total Reviewing Time (decimal days): 1.5

Deferrals to: _____ _____ Ecological Effects Branch, EFED

_____ Science Integration & Policy Staff, EFED

_____ _____ Non-Dietary Exposure Branch, HED

_____ Dietary Exposure Branch, HED

_____ _____ Toxicology Branch I , HED

_____ Toxicology Branch II, HED

1. CHEMICAL:

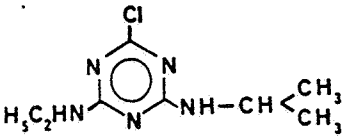
Chemical name: 2-Chloro-4-ethylamino-6-isopropylamino-s-triazine

Common name: Atrazine

Chemical Abstracts #: 1912-24-9

Trade name(s): AAtrex

Structure:



Physical/Chemical properties:

Physical state:	powder
Color:	white
Odor:	odorless
Melting point:	175-177°C
Vapor pressure:	3.0×10^{-7} mmHg at 20°C
Density:	1.19 gcm^{-7} at 20°C
Solubility at 20°C:	
	Water.....33 ppm
	Chloroform.....5.2%
	Diethyl ether.....1.3%
	Ethyl acetate.....1.8%
	n-pentane.....0.04%

Formulations: EC (2 lb/gal, 24% EC); WP (50, 80%)

2. STUDY/ACTION TYPE: Review of batch-equilibrium adsorption/desorption studies that were submitted to replace previously reviewed studies, which were invalidated as a result of a laboratory audit.

3. STUDY IDENTIFICATION:

MRID #41257901

- Spare, W.C. 1989a. Adsorption/desorption of ^{14}C-atrazine. Conducted by Agrisearch, Inc., Frederick, MD; Agrisearch Project No.12174; Completed on May 30, 1989. Submitted by Ciba-Geigy Corporation, Greensboro, NC.

2

MRID #41257902
-Spare, W.C. 1989b. Adsorption/desorption of ^{14}C-G-34048. Conducted by Agrisearch, Inc., Frederick, MD; Agrisearch Project No. 12171; Completed on August 23, 1989. Submitted by Ciba-Geigy Corporation, Greensboro, NC.

MRID #41257904
-Spare, W.C. 1989c. Adsorption/desorption of ^{14}C-G-28273. Conducted by Agrisearch, Inc., Frederick, MD; Agrisearch Project No. 12173; Completed on July 6, 1989. Submitted by Ciba-Geigy Corporation, Greensboro, NC.

MRID #41257905
-Spare, W.C. 1989d. Adsorption/desorption of ^{14}C-G-28279. Conducted by Agrisearch, Inc., Frederick, MD; Agrisearch Project No. 12170; Completed on July 27, 1989. Submitted by Ciba-Geigy Corporation, Greensboro, NC.

MRID #41257906
-Spare, W.C. 1989e. Adsorption/desorption of ^{14}C-G-30033. Conducted by Agrisearch, Inc., Frederick, MD; Agrisearch Project No. 12169; Completed on August 23, 1989. Submitted by Ciba-Geigy Corporation, Greensboro, NC.

4. REVIEWED BY:

Silvia C. Termes, Chemist
Review Section #2
EFGWB/EFED/OPP

Signature: [signature]
Date: March 1st 1990

5. APPROVED BY:

Emil Regelman
Supervisory Chemist
Review Section #2
EFGWb/EFED/OPP

Signature: [signature]
Date: MAR 6 1990

6. CONCLUSIONS:

All of the reviewed batch-equilibrium adsorption/desorption studies were considered acceptable. The studies can be used to fulfill data requirements for mobility in soil studies since they provide information on the adsorption/desorption behavior of parent atrazine, the "hydroxyatrazine" degradate (G-30048), and the dealkylated degradates G-30033, G-28279, and G-28273. The latter two degradates are also degradates of simazine.

However, EFGWB is requesting the following additional information about the soils used in the study:

a. For each soil provide a soil classification to the series level, with the name expessed according to the U.S.D.A. Soil Classification.

b. For the clay soil (42% clay), indicate which types of clays are present in the soil. This also applies to the sandy loam soil (16.8% clay).

The purpose of requesting the additional information on soils is to identify geographical regions where these soils prevail and relate these regions with those where atrazine is used (or has been used).

Summary of Results:

Table I summarizes the results of the studies. These results show that the dealkylated degradates (G-28273, G-28279, and G-30033) are more mobile than parent atrazine, but that "hydroxyatrazine" (G-34048) is the least mobile of the degradates. Of the dealkylated degradates, G-30033 appears to be the most mobile. The structures of atrazine and its degradates are shown in Figure 1.

Atrazine, its dealkylated degradates, and "hydroxyatrazine" are very mobile in the sand soil, as shown by their low (<2) adsorption coefficients (K_{ads}) and the low adsorption K_{OC} values (<500). In clay soil the adsorption coefficients and K_{OC} values were higher for parent atrazine and the dealkylated degradates, but still fall below 5 and 500. However, adsorption of "hydroxyatrazine" was the strongest.

Therefore, the results of the batch-equilibrium adsorption/desorption studies indicate that the dealkylated degradates are as likely (or even more likely) to leach to ground water as parent atrazine. However soil characteristics must be taken into account when assessing the leaching potential in an specific region.

7. RECOMMENDATIONS:

The registrant should be informed that the batch-equilibrium adsorption/desorption studies conducted with atrazine and its degradates "hydroxyatrazine" (G-34048) and G-28273, G-28279, and G-30033 are acceptable and fulfill data requirements for Mobility in Soil studies (163-1).

The registrant should also be informed that additional information on soil characterization at the series level and clay mineralogy (see CONCLUSIONS section) must be submitted.

9. BACKGROUND:

a. Introduction

As a result of a laboratory audit conducted by the Office of Compliance Monitoring on 2/14/89, the previously reviewed studies (Atrazine, 40431324; G-28273, 40431327; G-28279, 40431325; G-30033, 40431328; and G-34048, 40431326) were invalidated. The registrant agreed to submit new studies. These new studies have been reviewed here.

b. Directions for Use

Atrazine is a herbicide belonging to the triazine family of herbicides. It is used to control broadleaf and grassy leaves in a variety of crop and noncrop uses. Corn, sorghum, and sugarcane constitute the major crops in which atrazine is used and accounts for a sizeable amount of atrazine usage. Atrazine is available in a variety of formulations.

9. DISCUSSION OF INDIVIDUAL STUDIES:

Please refer to the enclosed Data Evaluation Records.

10. COMPLETION OF ONE-LINER:

The information obtained from these studies has been added to the one-liner.

11. CBI APPENDIX:

No CBI.

TABLE I

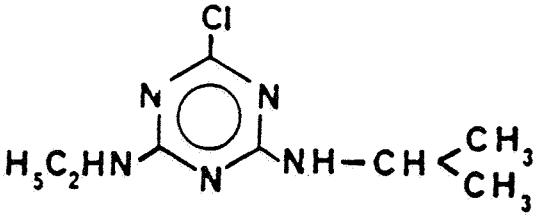
Sorption Coefficients of Atrazine and its Main Degradates in Four Soils

SOILS	Atrazine	G-28273	G-28279	G-30033	G-34048
			ADSORPTION COEFFICIENTS		
Clay	2.455 (86.947)	1.558 (55.177)	2.7341 (96.833)	1.10182 (36.062)	389.57 (13797)
Sand	0.2038 (38.503)	0.1623 (30.653)	0.1607 (30.362)	0.0643 (12.153)	1.9808 (374.16)
Sandy Loam	0.7863 (70.356)	0.6472 (57.908)	0.5056 (45.238)	0.3551 (31.774)	6.5195 (583.32)
Loam	0.731 (155.34)	0.3574 (75.956)	0.2732 (58.052)	0.2113 (44.909)	12.108 (2572.9)
			DESORPTION COEFFICIENTS		
Clay	9.1178 (322.9)	7.7985 (276.2)	12.364 (467.88)	8.1392 (288.26)	515.89 (18271)
Sand	1.5115 (285.5)	value indeterminable due to limited adsorption			9.0224 (1704.2)
Sandy Loam	7.2717 (650.50)	8.0587 (721.04)	15.278 (1366.9)	11.189 (1001.1)	14.869 (1330.4)
Loam	4.7599 (1011.5)	6.8702 (1459.9)	6.9846 (1484.2)	3.9215 (833.31)	11.283 (22397.6)

Numbers in parentheses refer to K_{OC} values; $K_{OC} = K_{a/d}/\%OC$, where $\%OC = \%OM/1.7$

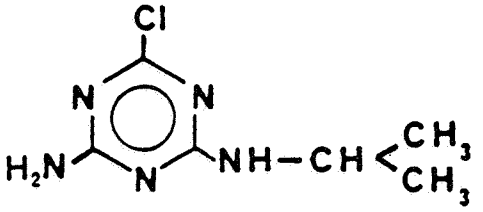
	% Sand	% Silt	% Clay	% OM	pH	CEC, meq/100g	BD, g/mL	% FC
Clay	25.2	32.8	42.0	4.8	5.9	24.3	1.22	35.9
Sand	95.5	2.2	2.2	0.9	6.5	1.8	1.65	3.8
Sandy loam	63.2	20.0	16.8	1.9	7.5	6.1	1.28	15.8
Loam	44.0	47.0	9.0	0.8	6.7	4.3	1.57	11.7

FIGURE 1



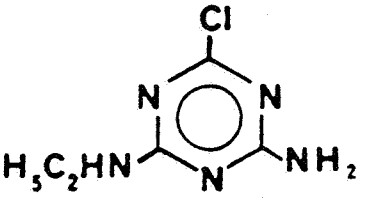
2-Chloro-4-ethylamino-6-isopropyl-amino-s-triazine

Atrazine
G-30027



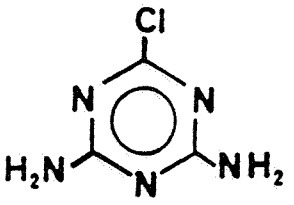
2-Amino-4-chloro-6-isopropylamino-s-triazine

G-30033



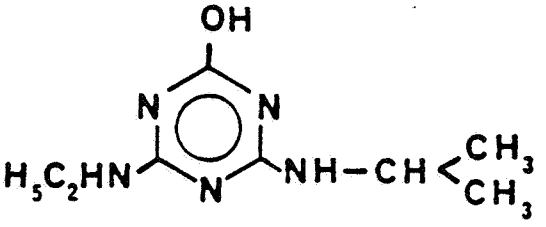
2-Amino-4-chloro-6-ethylamino-s-triazine

G-28279



2,4-diamino-6-chloro-triazine

G-28273



2-Hydroxy-4-ethylamino-6-isopropylamino-
s-triazine ("Hydroxy atrazine")

G-34048

ATRAZINE

DISCUSSION OF INDIVIDUAL STUDIES

Batch-equilibrium adsorption/desorption studies of:

Parent atrazine
"Hydroxyatrazine"
Dealkylated degradates (G-28273, G-28279, and G-30033)

Reviewed by:
S.C. Termes
EFGWB/EFED/OPP

Completed: March 1, 1990

ATRAZINE

Table of Contents

DATA EVALUATION RECORD

STUDY 1

CHEM 080803 Atrazine §163-1

FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 41257901
Spare, W.C. 1989a. Adsorption/desorption of ^{14}C-Atrazine. Agrisearch Project Number 12174. Unpublished study performed by Agrisearch Inc., Frederick, MD, and submitted by Ciba-Geigy Corporation, Greensboro, NC.

DIRECT REVIEW TIME = 8

REVIEWED BY: E. Hirsh TITLE: Staff Scientist

EDITED BY: K. Patten TITLE: Task Leader

APPROVED BY: W. Spangler TITLE: Project Manager

ORG: Dynamac Corporation
Rockville, MD
TEL: 468-2500

APPROVED BY: S. Termes
TITLE: Chemist
ORG: EFGWB/EFED/OPP
TEL: 557-2243

SIGNATURE: March 1, 1990

CONCLUSIONS:

Mobility - Leaching and Adsorption/Desorption

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

2. Atrazine is very mobile in sand, sandy loam, loam, and clay soils. Freundlich K_{ads} values were 0.20 for sand soil, 0.79 for sandy loam soil, 0.73 for loam soil, and 2.46 for clay soil. Adsorption increased with increasing CEC, clay content, and soil organic matter content.

3. This study is acceptable and partially fulfills EPA Data Requirements for Registering Pesticides by providing information on the mobility (batch equilibrium) of phenyl ring-labeled [^{14}C]atrazine in sand, sandy loam, loam, and clay soils.

4. No additional data are needed on the mobility of atrazine at this time. In place of an aged study, the registrant has provided data on the mobility (batch equilibrium) of individual degradates of atrazine. These data are reviewed in other studies in this report.

METHODOLOGY:

Sand, sandy loam, loam, and clay soils (Table I) were air-dried and sieved (2 mm) before use. Based on preliminary batch equilibrium experiments using an atrazine concentration of 10 ug/mL, an equilibration time of 4 hours and a soil:solution ratio of 1:5 were selected for the definitive study.

For the adsorption portion of the experiment, 4 g of soil and 20 mL of a filter-sterilized 0.01 N calcium acetate solution containing 0, 0.2, 0.5, 1, 5, or 10 ug/mL of phenyl ring-labeled [^{14}C]atrazine (radiochemical purity 99.2%, specific activity 19.5 uCi/mg, Ciba-Geigy) were transferred to borosilicate glass centrifuge tubes. The tubes were capped, and the soil:solution slurries were agitated (200 rpm) on an Eberbach shaker for 4 hours at 24 C. The slurries were centrifuged for 15 minutes, and the supernatant was removed by decanting. Duplicate aliquots of the supernatants were analyzed for total radioactivity by LSC. The concentration of [^{14}C]atrazine adsorbed to the soil was determined by calculating the difference between the concentration of [^{14}C]atrazine in solution before and after equilibration.

The wet soil samples from the adsorption portion of the experiment were reweighed, and the desorption of atrazine was determined by replacing the decanted supernatant with an equal volume of pesticide-free calcium ion solution. The soil:solution slurries were agitated for 4 hours as previously described, then centrifuged and the supernatant decanted. Aliquots of the supernatants were analyzed using LSC. The concentration of [^{14}C]atrazine remaining adsorbed to the soil was determined by calculating the difference between the concentration of [^{14}C]atrazine in solution before and after equilibration.

Aliquots of the supernatants from the 10 ug/mL treatment were analyzed by one-dimensional TLC on silica gel plates developed in chloroform:methanol:formic acid:water (80:15:4:2) or toluene:acetone (75:25). The plates were visualized using UV at 254 nm. (No additional methodology was provided for this procedure.)

DATA SUMMARY:

Based on batch equilibrium studies, phenyl ring-labeled [^{14}C]atrazine (radiochemical purity 99.2%) at nominal concentrations of 0.2, 0.5, 1, 5, and 10 ug/mL was determined to be very mobile in sand, sandy loam, loam, and clay soil:calcium ion solutions slurries (1:5) that were equilibrated for 4 hours at 24 C. Freundlich K_{ads} values were 0.20 for sand soil, 0.79 for sandy loam soil, 0.73 for loam soil, and 2.46 for clay soil; respective K_{oc} values were 38.50, 70.36, 155.34, and 86.95 (Table IX). Adsorption increased with increasing CEC, clay content, and soil organic matter content.

Following the equilibration of the soil from the adsorption portion of the study in pesticide-free calcium ion solution, 0-10% of the [^{14}C]residues that had originally adsorbed to the sand soil, 32-35% that had adsorbed to the clay soil, 38-42% that had adsorbed to the sandy loam soil, and 44-50% that had adsorbed to the loam soil were desorbed (calculated from Tables VI and VIII by the reviewer). K_{des} values were 1.51 for sand soil, 7.27 for sandy loam soil, 4.76 for loam soil, and 9.12 for clay soil; respective K_{oc} values were 285.5, 650.6, 1011.5, and 322.9 (Table X). At the completion of the study, 77.2-90% of the [^{14}C]residues in the supernatant were identified as atrazine.

COMMENTS:

1. The concentration of [^{14}C]atrazine adsorbed to the soil was determined by calculating the difference between the concentration of [^{14}C]atrazine in solution before and after equilibration. The study author did not analyze the soils at the completion of the definitive experiment to provide a complete materials balance and to prove that the residues not in solution had in fact been adsorbed to the soil. However, when the soil was analyzed at the completion of the preliminary experiment by LSC following combustion, material balances were >90% (Table II).

2. It was not stated whether the soil:solution slurries were equilibrated in darkness.

3. Details of the TLC analysis were not provided to review. However, this portion of the experiment can be regarded as ancillary because Subdivision N guidelines do not specify that identification of residues following batch equilibrium studies is necessary.

Atrazine

Page_____ is not included in this copy.

Pages 14 through 22 are not included.

The material not included contains the following type of information:

____ Identity of product inert ingredients.

____ Identity of product impurities.

____ Description of the product manufacturing process.

____ Description of quality control procedures.

____ Identity of the source of product ingredients.

____ Sales or other commercial/financial information.

____ A draft product label.

____ The product confidential statement of formula.

____ Information about a pending registration action.

✓ FIFRA registration data.

____ The document is a duplicate of page(s) _____.

____ The document is not responsive to the request.

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.

DATA EVALUATION RECORD

STUDY 2

CHEM 080803 Atrazine §163-1

FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 41257902
Spare, W.C. 1989b. Adsorption/desorption of ^{14}C-G-34048. Agrisearch Project Number 12171. Unpublished study performed by Agrisearch Inc., Frederick, MD, and submitted by Ciba-Geigy Corporation, Greensboro, NC.

DIRECT REVIEW TIME = 5

REVIEWED BY: E. Hirsh TITLE: Staff Scientist

EDITED BY: K. Patten TITLE: Task Leader

APPROVED BY: W. Spangler TITLE: Project Manager

ORG: Dynamac Corporation
Rockville, MD
TEL: 468-2500

APPROVED BY: S. Termes
TITLE: Chemist
ORG: EFGWB/EFED/OPP
TEL: 557-2243

SIGNATURE: March 1, 1990

CONCLUSIONS:

Mobility - Leaching and Adsorption/Desorption

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

2. Hydroxyatrazine (G-34048) is very mobile in sand soil, mobile in sandy loam and loam soils, and slightly mobile in clay soil. Freundlich K_{ads} values were 1.98 for sand soil, 6.52 for sandy loam soil, 12.1 for loam soil, and 389.6 for clay soil. This degradate is less mobile than parent atrazine or its dealkylated degradates G-30033, G-28273, and G-28279.

3. This study is acceptable and partially fulfills EPA Data Requirements for Registering Pesticides by providing information on the mobility (batch equilibrium) of the

atrazine degradate hydroxyatrazine (G-34048) in sand, sandy loam, loam, and clay soils.

4. No additional data are needed on the mobility of the atrazine degradate hydroxyatrazine (G-34048) at this time. In place of an aged study, the registrant has provided data on the mobility (batch equilibrium) of individual degradates of atrazine. These data are reviewed in other studies in this report.

METHODOLOGY:

Sand, sandy loam, loam, and clay soils (Table I) were air-dried and sieved (2 mm) before use. Based on preliminary batch equilibrium experiments using a hydroxyatrazine (G-34048) concentration of 10 ug/mL, an equilibration time of 8 hours and a soil:test solution ratio of 1:5 were selected for use in the definitive study.

For the adsorption portion of the experiment, 4 g of soil and 20 mL of a filter-sterilized 0.01 N calcium acetate solution containing 0, 0.2, 0.5, 1, 5, or 10 ug/mL of phenyl ring-labeled [^{14}C]hydroxyatrazine (radiochemical purity 97.4%, specific activity 21.3 uCi/mg, Ciba-Geigy) were transferred to glass centrifuge tubes. The tubes were capped, and the soil:-solution slurries were agitated (200 rpm) on an Eberbach shaker for 8 hours at 24 C. The slurries were centrifuged for 15 minutes, then the supernatant was removed by decanting. Duplicate aliquots of the supernatant were analyzed for total radioactivity by LSC. The concentration of [^{14}C]hydroxyatrazine absorbed to the soil was determined by calculating the difference between the concentration of [^{14}C]hydroxyatrazine in solution before and after equilibration.

The wet soil samples from the adsorption portion of the experiment were reweighed, and the desorption of hydroxyatrazine was determined by replacing the decanted supernatant with an equal volume of pesticide-free calcium ion solution. The soil:solution slurries were agitated for 8 hours as previously described, then centrifuged and the supernatant decanted. Aliquots of the supernatant were analyzed for total radioactivity using LSC. The concentration of [^{14}C]-hydroxyatrazine remaining adsorbed to the soil was determined by calculating the difference between the concentration of [^{14}C]hydroxyatrazine in solution before and after equilibration.

Aliquots of the supernatants containing the highest amounts of radioactivity were analyzed by one-dimensional TLC on silica gel plates developed in chloroform:methanol:formic acid:water (80:15:4:2) or toluene:acetic acid:water (50:50:4.5). The

plates were visualized using UV at 254 nm. (No additional methodology was provided for this procedure.)

DATA SUMMARY:

Based on batch equilibrium studies, phenyl ring-labeled [^{14}C]hydroxyatrazine (G-34048) (radiochemical purity 97.4%) at 0.23, 0.57, 1.13, 5.61, and 11.21 ug/mL was determined to be very mobile in sand, mobile in sandy loam and loam, and slightly mobile in clay soil:calcium ion solution slurries (1:5) that were equilibrated for 8 hours at 24 C. Freundlich K_{ads} values were 1.98 for sand soil, 6.52 for sandy loam soil, 12.1 for loam soil, and 389.6 for clay soil; respective K_{oc} values were 374.2, 583.3, 2573, and 13797 (Table IX). Adsorption increased with increasing CEC, clay content, and soil organic matter content.

Following the equilibration of the soil from the adsorption portion of the study in pesticide-free calcium ion solution, <1% of the [^{14}C]residues that had originally adsorbed to the clay soil, 32-37% that had adsorbed to the sand soil, 21.2-26.9% that had adsorbed to the sandy loam soil, and 26.3-31.0% that had adsorbed to the loam soil were desorbed (calculated from Tables VI and VIII by the reviewer). K_{des} values were 9.0 for sand soil, 14.9 for sandy loam soil, 11.3 for loam soil, and 515.9 for clay soil; respective K_{oc} values were 1704, 1,330, 22,398, and 18,271 (Table X). At the completion of the study, 91.1-99.9% of the [^{14}C]residues in the supernatant were identified as hydroxyatrazine.

COMMENTS:

1. The concentration of [^{14}C]hydroxyatrazine adsorbed to the soil was determined by calculating the difference between the concentration of the [^{14}C]hydroxyatrazine in solution before and after equilibration. The study author did not analyze the soil at the completion of the definitive experiment to provide a complete materials balance, and to test to confirm adsorption. However, when the soil was analyzed at the completion of the preliminary experiment by LSC following combustion, material balances were ≥95% (Table IV).

2. It could not be determined if the studies were conducted in the dark or light.

3. Details of the TLC analysis were not provided to review. However, this portion of the experiment can be regarded as ancillary because Subdivision N guidelines do not specify that identification of residues following batch equilibrium studies is necessary.

Atrazine

Page_____ is not included in this copy.

Pages 26 through 34 are not included.

The material not included contains the following type of information:

_____ Identity of product inert ingredients.

_____ Identity of product impurities.

_____ Description of the product manufacturing process.

_____ Description of quality control procedures.

_____ Identity of the source of product ingredients.

_____ Sales or other commercial/financial information.

_____ A draft product label.

_____ The product confidential statement of formula.

_____ Information about a pending registration action.

✓ FIFRA registration data.

_____ The document is a duplicate of page(s) _____.

_____ The document is not responsive to the request.

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.

DATA EVALUATION RECORD

STUDY 3

CHEM 080803 Atrazine §163-1

FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 41257904
Spare, W.C. 1989d. Adsorption/desorption of ^{14}C-G-28273. Agrisearch Project Number 12173. Unpublished study performed by Agrisearch Inc., Frederick, MD, and submitted by Ciba-Geigy Corporation, Greensboro, NC.

DIRECT REVIEW TIME = 5

REVIEWED BY: E. Hirsh TITLE: Staff Scientist

EDITED BY: K. Patten TITLE: Task Leader

APPROVED BY: W. Spangler TITLE: Project Manager

ORG: Dynamac Corporation
Rockville, MD
TEL: 468-2500

APPROVED BY: S. Termes
TITLE: Chemist
ORG: EFGWB/EFED/OPP
TEL: 557-2243

SIGNATURE:

March 1, 1990

CONCLUSIONS:

Mobility - Leaching and Adsorption/Desorption

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

2. 2-Chloro-4,6-bis-(amino)-s-triazine (G-28273) is very mobile in sand, sandy loam, loam, and clay soils. Freundlich K_{ads} values were 0.16 for sand soil, 0.36 for loam soil, 0.65 for sandy loam soil, and 1.56 for clay soil. Adsorption increased with increasing CEC and clay content.

3. This study is acceptable and partially fulfills EPA Data Requirements for Registering Pesticides by providing information on the mobility (batch equilibrium) of the atrazine degradate G-28273 in sand, sandy loam, loam, and clay soils.

4. No additional data are needed on the mobility of the atrazine degradate G-28273 at this time. In place of an aged study, the registrant has provided data on the mobility (batch equilibrium) of individual degradates of atrazine. These data are reviewed in other studies in this report.

METHODOLOGY:

Sand, sandy loam, loam and clay soils (Table I) were air-dried and sieved (2 mm) before use. Based on preliminary batch equilibrium experiments using a G-28273 (2-chloro-4,6-bis-(amino)-s-triazine) concentration of 5 ug/mL, an equilibration time of 4 hours and a soil:solution ratio of 1:5 were selected for use in the definitive test.

For the adsorption portion of the experiment, 4 g of soil and 20 mL of a filter-sterilized 0.01 N calcium acetate solution containing 0, 0.3, 0.6, 1.2, 2.5, or 5 ug/mL of phenyl ring-labeled [^{14}C]G-28273 (radiochemical purity 98.6%, specific activity 40.7 uCi/mg, Ciba-Geigy) were transferred to borosilicate glass centrifuge tubes. The tubes were capped, and the soil:solution slurries were agitated (200 rpm) on an Eberbach shaker for 4 hours at 24 C. The slurries were centrifuged for 15 minutes, then the supernatant was removed by decanting. Duplicate aliquots of the supernatant were analyzed for total radioactivity by LSC. The concentration of [^{14}C]G-28273 absorbed to the soil was determined by calculating the difference between the concentration of [^{14}C]G-28273 in solution before and after equilibration.

The wet soil samples from the adsorption portion of the experiment were reweighed, and the desorption of G-28273 was determined by replacing the decanted supernatant with an equal volume of pesticide-free calcium ion solution. The soil:solution slurries were agitated for 4 hours as previously described, then centrifuged and the supernatant decanted. Aliquots of the supernatant were analyzed for total radioactivity using LSC. The concentration of [^{14}C]G-28273 remaining adsorbed to the soil was determined by calculating the difference between the concentration of [^{14}C]G-28273 in solution before and after equilibration.

Aliquots of the supernatants containing the highest amounts of radioactivity were analyzed by one-dimensional TLC on silica gel plates developed in chloroform:methanol:formic acid:water (80:15:4:2) or toluene:acetic acid:water (50:50:4.5). The plates were visualized using UV at 254 nm. (No additional methodology was provided for this procedure.)

DATA SUMMARY:

Based on batch equilibrium studies, phenyl ring-labeled [^{14}C]G-28273 (2-chloro-4,6-bis-(amino)-s-triazine, radiochemical purity 98.6%) at concentrations of 0.3, 0.6, 1.2, 2.5, and 5 ug/mL was determined to be very mobile in sand, sandy loam, loam, and clay soil:calcium ion solutions slurries (1:5) that were equilibrated for 4 hours at 24 C. Freundlich K_{ads} values were 0.16 for sand soil, 0.36 for loam soil, 0.65 for sandy loam soil, and 1.56 for clay soil; respective K_{oc} values were 30.65, 75.96, 57.91, and 55.18 (Table IX).

Following the equilibration of the soil from the adsorption portion of the study in pesticide-free calcium ion solution, 30.9-39% of the radioactivity that had originally adsorbed to the clay, 0-1% that had adsorbed to the sand soil, 30.6-45.9% that had adsorbed to the sandy loam, and 45-55.8% that had adsorbed to the loam soil was desorbed (calculated from Tables VI and VIII by the reviewer). K_{des} values were 8.1 for sandy loam soil, 6.9 for loam soil, and 7.8 for clay soil; respective K_{oc} values were 721, 1.460, and 276 (Table X). Values for the desorption of G-28273 in sand soil were not determined because of the low adsorption. At the completion of the study, 89-99% of the [^{14}C]residues in the supernatant were identified as G-28273.

COMMENTS:

1. The concentration of [^{14}C]G-28273 adsorbed to the soil was determined by calculating the difference between the concentration of the [14C]G-28273 in solution before and after equilibration. The study author did not analyze the soil at the completion of the definitive experiment to provide a complete materials balance, and to test to confirm adsorption. However, when the soil was analyzed at the completion of the preliminary experiment by LSC following combustion, the material balances were 102.8-105.8% (Table IV).

2. It could not be determined if the studies were conducted in the dark or light.

3. Details of the TLC analysis were not provided to review. However, this portion of the experiment can be regarded as ancillary because Subdivision N guidelines do not specify that identification of residues following batch equilibrium studies is necessary.

Atrazine

Page_____ is not included in this copy.

Pages 38 through 46 are not included.

The material not included contains the following type of information:

____ Identity of product inert ingredients.

____ Identity of product impurities.

____ Description of the product manufacturing process.

____ Description of quality control procedures.

____ Identity of the source of product ingredients.

____ Sales or other commercial/financial information.

____ A draft product label.

____ The product confidential statement of formula.

____ Information about a pending registration action.

✓ 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.

DATA EVALUATION RECORD

STUDY 4

CHEM 080803 Atrazine §163-1

FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 41257904
Spare, W.C. 1989e. Adsorption/desorption of ^{14}C-G-28279. Agrisearch Project Number 12170. Unpublished study performed by Agrisearch Inc., Frederick, MD, and submitted by Ciba-Geigy Corporation, Greensboro, NC.

DIRECT REVIEW TIME = 5

REVIEWED BY: E. Hirsh TITLE: Staff Scientist

EDITED BY: K. Patten TITLE: Task Leader

APPROVED BY: W. Spangler TITLE: Project Manager

ORG: Dynamac Corporation
Rockville, MD
TEL: 468-2500

APPROVED BY: S. Termes
TITLE: Chemist
ORG: EFGWB/EFED/OPP
TEL: 557-2243

SIGNATURE: March 1, 1990

CONCLUSIONS:

Mobility - Leaching and Adsorption/Desorption

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

2. 2-Chloro-4-ethylamino-6-amino-s-triazine (G-28279) is very mobile in sand, sandy loam, loam, and clay soils. Freundlich K_{ads} values were 0.16 for sand soil, 0.27 for loam soil, 0.51 for sandy loam soil, and 2.7 for clay soil. Adsorption increased with increasing CEC, clay, and organic matter content.

3. This study is acceptable and partially fulfills EPA Data Requirements for Registering Pesticides by providing information on the mobility (batch equilibrium) of the atrazine degradate G-28279 in sand, sandy loam, loam, and clay soils.

4. No additional data are needed on the mobility of the atrazine degradate G-28279 at this time. In place of an aged study, the registrant has provided data on the mobility (batch equilibrium) of individual degradates of atrazine. These data are reviewed in other studies in this report.

METHODOLOGY:

Sand, sandy loam, loam and clay soils (Table I) were air-dried and sieved (2 mm) before use. Based on preliminary batch equilibrium experiments using a G-28279 (2-chloro-4-ethylamino-6-amino-s-triazine) concentration of 10 ug/mL, an equilibration time of 2 hours and a soil:solution ratio of 1:5 were selected for use in the definitive test.

For the adsorption portion of the experiment, 4 g of soil and 20 mL of a filter-sterilized 0.01 N calcium acetate solution containing 0, 0.22, 0.56, 1.07, 5.44, or 10.9 ug/mL of phenyl ring-labeled [^{14}C]G-28279 (radiochemical purity 98.5%, specific activity 20.2 uCi/mg, Ciba-Geigy) were transferred to borosilicate glass centrifuge tubes. The tubes were capped, and the soil:solution slurries were agitated (200 rpm) on an Eberbach shaker for 2 hours at 24 C. The slurries were centrifuged for 15 minutes, then the supernatant was removed by decanting. Duplicate aliquots of the supernatant were analyzed for total radioactivity by LSC. The concentration of [^{14}C]G-28279 absorbed to the soil was determined by calculating the difference between the concentration of [^{14}C]G-28279 in solution before and after equilibration.

The wet soil samples from the adsorption portion of the experiment were reweighed, and the desorption of G-28279 was determined by replacing the decanted supernatant with an equal volume of pesticide-free calcium ion solution. The soil:solution slurries were agitated for 4 hours as previously described, then centrifuged and the supernatant decanted. Aliquots of the supernatant were analyzed for total radioactivity using LSC. The concentration of [^{14}C]G-28279 remaining adsorbed to the soil was determined by calculating the difference between the concentration of [^{14}C]G-28279 in solution before and after equilibration.

Aliquots of the supernatants containing the highest amounts of radioactivity were analyzed by one-dimensional TLC on silica gel plates developed in chloroform:methanol:formic acid:water (80:15:4:2) or toluene:acetic acid:water (50:50:4.5). The plates were

visualized using UV at 254 nm. (No additional methodology was provided for this procedure.)

DATA SUMMARY:

Based on batch equilibrium studies, phenyl ring-labeled [^{14}C]G-28279 (2-chloro-4-ethylamino-6-amino-s-triazine, radiochemical purity 98.5%) at concentrations of 0.22, 0.56, 1.07, 5.44, and 10.9 ug/mL was determined to be very mobile in sand, sandy loam, loam, and clay soil:-calcium ion solutions slurries (1:5) that were equilibrated for 4 hours at 24 C. Freundlich K_{ads} values were 0.16 for sand soil, 0.27 for loam soil, 0.51 for sandy loam soil, and 2.7 for clay soil; respective K_{oc} values were 30.4, 58.1, 45.2, and 96.8 (Table IX).

Following the equilibration of the soil from the adsorption portion of the study in pesticide-free calcium ion solution, 27.2-28.5% of the radioactivity that had originally adsorbed to the clay, 0-15.7% that had adsorbed to the sand soil, 27.4-34.5% that had adsorbed to the sandy loam, and 32.6-51.9% that had adsorbed to the loam soil was desorbed (calculated from Tables VI and VIII by the reviewer). K_{des} values were 15.3 for sandy loam soil, 7 for loam soil, and 12.4 for clay soil; respective K_{oc} values were 1366, 1484, and 437. Values for the desorption of G-28279 in sand soil were not determined because of the low adsorption. At the completion of the study, 88.2-97.7% of the [^{14}C]residues in the supernatant were identified as G-28279.

COMMENTS:

1. The concentration of [^{14}C]G-28279 adsorbed to the soil was determined by calculating the difference between the concentration of the [14C]G-28279 in solution before and after equilibration. The study author did not analyze the soil at the completion of the definitive experiment to provide a complete materials balance, and to test to confirm adsorption. However, when the soil was analyzed at the completion of the preliminary experiment by LSC following combustion, the material balances were 96-100.9% (Table IV).

2. It could not be determined if the studies were conducted in the dark or light.

3. Details of the TLC analysis were not provided to review. However, this portion of the experiment can be regarded as ancillary because Subdivision N guidelines do not specify that identification of residues following batch equilibrium studies is necessary.

4. Mean calculated concentrations in the soil were used to determine the percentage of G-28279 desorbed from each soil, except that the value of 0.005 ppm for the 0.22 ug/mL concentration in the sand soil (Table VIII) appeared to the reviewer to be an aberrant value. Therefore, it was not included in the calculation of percent desorption.

Atrazine

Page_____ is not included in this copy.

Pages 51 through 59 are not included.

The material not included contains the following type of information:

____ Identity of product inert ingredients.

____ Identity of product impurities.

____ Description of the product manufacturing process.

____ Description of quality control procedures.

____ Identity of the source of product ingredients.

____ Sales or other commercial/financial information.

____ A draft product label.

____ The product confidential statement of formula.

____ Information about a pending registration action.

✓ FIFRA registration data.

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DATA EVALUATION RECORD

STUDY 5

CHEM 080803 Atrazine §163-1

FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 41257906
Spare, W.C. 1989f. Adsorption/desorption of ^{14}C-G-30033. Agrisearch Project Number 12169. Unpublished study performed by Agrisearch Inc., Frederick, MD, and submitted by Ciba-Geigy Corporation, Greensboro, NC.

DIRECT REVIEW TIME = 5

REVIEWED BY: E. Hirsh TITLE: Staff Scientist

EDITED BY: K. Patten TITLE: Task Leader

APPROVED BY: W. Spangler TITLE: Project Manager

ORG: Dynamac Corporation
Rockville, MD
TEL: 468-2500

APPROVED BY: S. Termes
TITLE: Chemist
ORG: EFGWB/EFED/OPP
TEL: 557-2243

SIGNATURE: March 1, 1990

CONCLUSIONS:

Mobility - Leaching and Adsorption/Desorption

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

2. 2-Chloro-4-amino-6-isopropylamino-s-triazine (G-30033) is very mobile in sand, sandy loam, loam, and clay soils. Freundlich K_{ads} values were 0.06 for sand soil, 0.21 for loam soil, 0.36 for sandy loam soil, and 1.02 for clay soil. Adsorption increased with increasing CEC and clay content.

3. This study is acceptable and partially fulfills EPA Data Requirements for Registering Pesticides by providing information on the mobility (batch equilibrium) of the atrazine degradate G-30033 in sand, sandy loam, loam, and clay soils.

4. No additional data are needed on the mobility of the atrazine degradate G-30033 at this time. In place of an aged study, the registrant has provided data on the mobility (batch equilibrium) of individual degradates of atrazine. These data are reviewed in other studies in this report.

METHODOLOGY:

Sand, sandy loam, loam and clay soils (Table I) were air-dried and sieved (2 mm) before use. Based on preliminary batch equilibrium experiments using a G-30033 (2-chloro-4-amino-6-isopropylamino-s-triazine) concentration of 2 ug/mL, an equilibration time of 8 hours and a soil:solution ratio of 1:5 were selected for use in the definitive test.

For the adsorption portion of the experiment, 4 g of soil and 20 mL of a filter-sterilized 0.01 N calcium acetate solution containing 0, 0.14, 0.28, 0.55, 1.08, or 2.05-2.15 ug/mL of phenyl ring-labeled [^{14}C]G-30033 (radiochemical purity 99.0%, specific activity 28.0 uCi/mg, Ciba-Geigy) were transferred to borosilicate glass centrifuge tubes. The tubes were capped, and the soil:solution slurries were agitated (200 rpm) on an Eberbach shaker for 4 hours at 24 C. The slurries were centrifuged for 15 minutes, then the supernatant was removed by decanting. Duplicate aliquots of the supernatant were analyzed for total radioactivity by LSC. The concentration of [^{14}C]G-30033 absorbed to the soil was determined by calculating the difference between the concentration of [^{14}C]G-30033 in solution before and after equilibration.

The wet soil samples from the adsorption portion of the experiment were reweighed, and the desorption of G-30033 was determined by replacing the decanted supernatant with an equal volume of pesticide-free calcium ion solution. The soil:solution slurries were agitated for 8 hours as previously described, then centrifuged and the supernatant decanted. Aliquots of the supernatant were analyzed for total radioactivity using LSC. The concentration of [^{14}C]G-30033 remaining adsorbed to the soil was determined by calculating the difference between the concentration of [^{14}C]G-30033 in solution before and after equilibration.

Aliquots of the supernatants containing the highest amounts of radioactivity were analyzed by one-dimensional TLC on silica gel plates developed in chloroform:methanol:formic acid:water (80:15:4:2) or toluene:acetone (75:25). The plates were visualized

using UV at 254 nm. (No additional methodology was provided for this procedure.)

DATA SUMMARY:

Based on batch equilibrium studies, phenyl ring-labeled [^{14}C]G-30033 (2-chloro-4-amino-6-isopropylamino-s-triazine, radiochemical purity 98.6%) at concentrations of 0.14, 0.28, 0.55, 1.08, and 2.05-2.15 ug/mL was determined to be very mobile in sand, sandy loam, loam, and clay soil:calcium ion solutions slurries (1:5) that were equilibrated for 4 hours at 24 C. Freundlich K_{ads} values were 0.06 for sand soil, 0.21 for loam soil, 0.36 for sandy loam soil, and 1.02 for clay soil; respective K_{oc} values were 12.2, 44.9, 31.8, and 36.1 (Table IX).

Following the equilibration of the soil from the adsorption portion of the study in pesticide-free calcium ion solution, 26.4-33.5% of the radioactivity that had originally adsorbed to the clay, 0% that had adsorbed to the sand soil, 25.7-35.1% that had adsorbed to the sandy loam, and 16.7-31.1% that had adsorbed to the loam soil was desorbed (calculated from Tables VI and VIII by the reviewer). K_{des} values were 11.2 for sandy loam soil, 3.9 for loam soil, and 8.1 for clay soil; respective K_{oc} values were 1001.1, 833.3, and 288.3 (Table X). Values for the desorption of G-30033 in sand soil were not determined because of the low adsorption. At the completion of the study, 95.2-100% of the [^{14}C]residues in the supernatant were identified as G-30033.

COMMENTS:

1. The concentration of [^{14}C]G-30033 adsorbed to the soil was determined by calculating the difference between the concentration of the [14C]G-30033 in solution before and after equilibration. The study author did not analyze the soil at the completion of the definitive experiment to provide a complete materials balance, and to test to confirm adsorption. However, when the soil was analyzed at the completion of the preliminary experiment by LSC following combustion, the material balances were 96.9-100% (Table IV).

2. It could not be determined if the studies were conducted in the dark or light.

3. Details of the TLC analysis were not provided to review. However, this portion of the experiment can be regarded as ancillary because Subdivision N guidelines do not specify that identification of residues following batch equilibrium studies is necessary.

Atrazine

Page_____ is not included in this copy.

Pages 63 through 71 are not included.

The material not included contains the following type of information:

____ Identity of product inert ingredients.

____ Identity of product impurities.

____ Description of the product manufacturing process.

____ Description of quality control procedures.

____ Identity of the source of product ingredients.

____ Sales or other commercial/financial information.

____ A draft product label.

____ The product confidential statement of formula.

____ Information about a pending registration action.

✓ FIFRA registration data.

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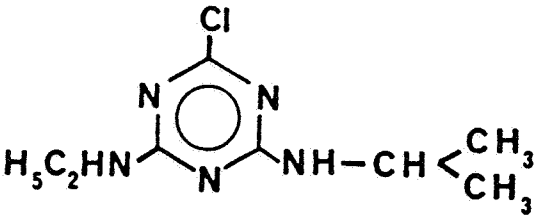
The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

APPENDIX

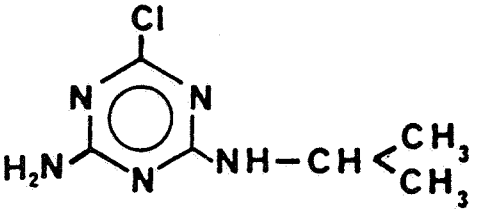
ATRAZINE AND ITS DEGRADATES

FIGURE 1



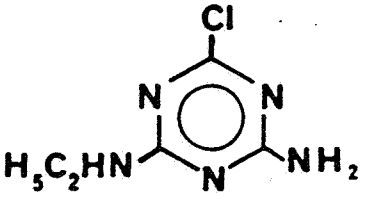
2-Chloro-4-ethylamino-6-isopropyl-amino-s-triazine

Atrazine
G-30027



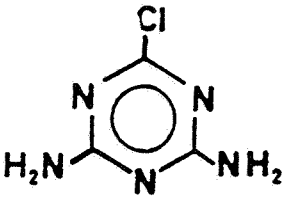
2-Amino-4-chloro-6-isopropylamino-s-triazine

G-30033



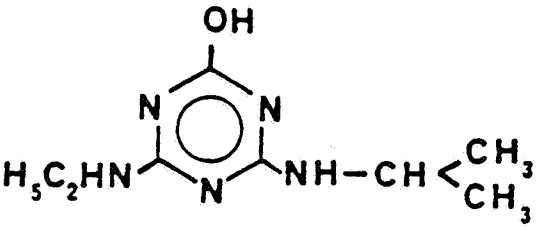
2-Amino-4-chloro-6-ethylamino-s-triazine

G-28279



2,4-diamino-6-chloro-triazine

G-28273



2-Hydroxy-4-ethylamino-6-isopropylamino-s-triazine ("Hydroxy atrazine")

G-34048