ISOFENPHOS (Groundwater Call-in Data)

Initial Draft Report

Task 1: Review and Evaluation of Individual Studies

Task 2: Environmental Fate Groundwater Assessment

Contract No. 68-02-4250

OCTOBER 8, 1987

Submitted to:
Environmental Protection Agency
Arlington, VA 22202

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

ISOFENPHOS

Table of Contents

CASE GS -- ISOFENPHOS STUDY 1 PM --

CHEM 109401 Isofenphos

BRANCH EAB DISC --

FORMULATION 90 - FORMULATION NOT IDENTIFIED

FICHE/MASTER ID No MRID CONTENT CAT 01

McNamara, F. T. 1977. Dissipation of [^{14}C]oftanol in buffered aqueous solution. Report No. 53617. Prepared and submitted by Mobay Chemical Corporation, Kansas City, MO Acc. No. 257815.

SUBST. CLASS = S.

DIRECT RVW TIME = 8 (MH) START-DATE END DATE

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

APPROVED BY: C. Eiden
TITLE: Groundwater Program Chemist
ORG: EAB/HED/OPP
TEL: 557-1450

SIGNATURE: DATE:

CONCLUSIONS:

Degradation - Hydrolysis

This study is unacceptable because discrepancies exsist in the data (for example, one table indicated that 90% of the applied was recovered from day 98 samples of the pH 9 aqueous buffered solution at 10 ppm. Another table indicated that 4% of the applied was in the organic fraction, 4% in the aqueous fraction and 92% was lost. In the figure, volatiles recovered from gas traps were reported as ~14% of the applied, but in the text the registrant stated that 92% of the applied had volatilized). In addition, this study does not fulfill EPA Data Requirements for Registering Pesticides because the study was not conducted at pH 5 and 7, the test substance was incompletely characterized, all degradates >10% of the applied were not characterized, and the incubation temperature was not 25 ± 1°C.

This study does not provide information that may be used in evaluating the potential risk of groundwater contamination by isofenphos because discrepancies exist in the data.

MATERIALS AND METHODS:

Ring-labeled [^{14}C]isofenphos (purity unspecified, specific activity 9.96 mCi/mMol, source unspecified) was added at 1 and 10 ppm to sterile phosphate buffered solutions adjusted to pH 3 and 9. The solutions were incubated in black-painted flasks in a water bath at 37°C. The flasks were fitted with two gas traps consisting of borosilicate glass wool plugs coated with 5% corn oil in hexane. The solutions were sampled immediately posttreatment and at various intervals up to 98 days posttreatment. Gas traps were sampled weekly and at the sampling intervals.

Aliquots of each sample were analyzed for total radioactivity by LSC. The samples were then extracted three times with ethyl acetate. The extracts were combined, and aliquots of both the ethyl acetate extracts and the aqueous fraction were analyzed by LSC. Then the ethyl acetate extracts were concentrated and analyzed by LSC and TLC. Into 2 mL of aqueous fraction, 0.6-g sodium chloride and 0.1-mL hydrochloric acid were added and mixed. The solution was extracted three times with ethyl acetate. The ethyl acetate extracts were dried with sodium sulfate, combined, concentrated, and analyzed by LSC and TLC. The remaining aqueous fraction was analyzed by LSC.

TLC was performed on silica gel plates developed in benzene:acetic acid (60:1), isopropyl ether:acetic acid (60:1), carbon tetrachloride:chloroform (2:1), hexane:benzene:acetonitrile:acetic acid (40:40:20:1) and (40:40:60:1), chloroform:ethyl acetate:acetone:acetic acid (7:10:3:3), benzene:methanol:acetic acid (18:1:1) or ethyl acetate:acetone:acetic acid (14:5:1). Reference compounds were cochromatographed with the samples. Following development isofenphos and its degradates were visualized under short wavelength UV light and by autoradiography. Radioactive zones were scraped and analyzed by LSC. The glass wool gas traps were sonicated for 20 minutes with hexane. The extract was concentrated and analyzed by LSC and TLC.

REPORTED RESULTS:

[^{14}C]Isofenphos, at 1 and 10 ppm, degraded with a half-life of 28-98 days in pH 3 buffered solutions (Table 1). The registrant calculated half-lives were 79 days at 1 ppm and 30 days at 10 ppm. [^{14}C]Isofenphos degraded with half-lives of 28-98 days at 1 ppm and 28-49 days at 10 ppm in pH 9 buffered solutions (Table 2). Calculated half-lives were 88 days at 1 ppm and 32 days at 10 ppm. In the pH 3 buffered solutions, the major degradate was deaminated isofenphos (maximum concentration 22% of the applied after 98 days at 1 ppm; Table 1). Other degradates included isofenphos oxygen analog, deaminated isofenphos oxygen analog, isopropyl salicylate, and salicylic acid (each <4.2% of the applied). At 1 and 10 ppm, 98 days posttreatment, volatiles totaled <5 and <15% of the applied respectively (Figure 1). The material balance (radioactivity in the organosoluble and aqueous fractions and volatiles) ranged from ~91 to 100% of the applied at 1 ppm and from ~42 to 100% at 10 ppm. Radioactivity in the aqueous fraction accounted for up to 4% of the applied.

[^{14}C]Isofenphos degraded with half-lives of 28-98 days at 1 ppm and 28-49 days at 10 ppm in pH 9 buffered solutions (Table 2). The registrant

calculated half-lives were 88 days at 1 ppm and 32 days at 10 ppm. Degradates included cyclic isofenphos, isofenphos oxygen analog, N-isopropyl salicylamide, isopropyl salicylate, salicylic acid, and deethylated isofenphos oxygen analog (each <6.8% of the applied). At 1 and 10 ppm, 98 days posttreatment, volatiles totaled <4 and <15% of the applied, respectively (Figure 1). The material balance ranged from ~42 to 100% of the applied at 1 ppm and from ~23 to 100% at 10 ppm. Radioactivity in the aqueous fraction accounted for up to 26% of the applied, and 11.7% of the applied was unidentified.

DISCUSSION:

1. This study contained discrepancies in the data. For example, one table indicated that 90% of the applied was recovered from day 98 samples of the pH 9 aqueous buffered solution at 10 ppm. Another table indicated that 4% of the applied was in the organic fraction, 4% was in the aqueous fraction, and 92% was "lost". In the figure, volatiles recovered from gas traps were reported as ~14% of the applied, but in the text the registrant stated that 92% of the applied had volatilized.

2. The purity and source of the test substance were not reported.

3. The material balance was incomplete; up to 92% of the applied was not accounted for.

4. All degradates >10% of the applied were not characterized.

5. The incubation temperature was 37°C and not 25 ±1°C. Data concerning the hydrolysis of isofenphos at 48 and 50°C were not reviewed because the temperatures were atypical of environmental conditions.

6. The registrant stated that hydrolysis studies were conducted at 5 and 20°C in pH 5, 7, and 9 buffered solutions and that isofenphos was stable under these conditions for 28 days. However, no data were provided.

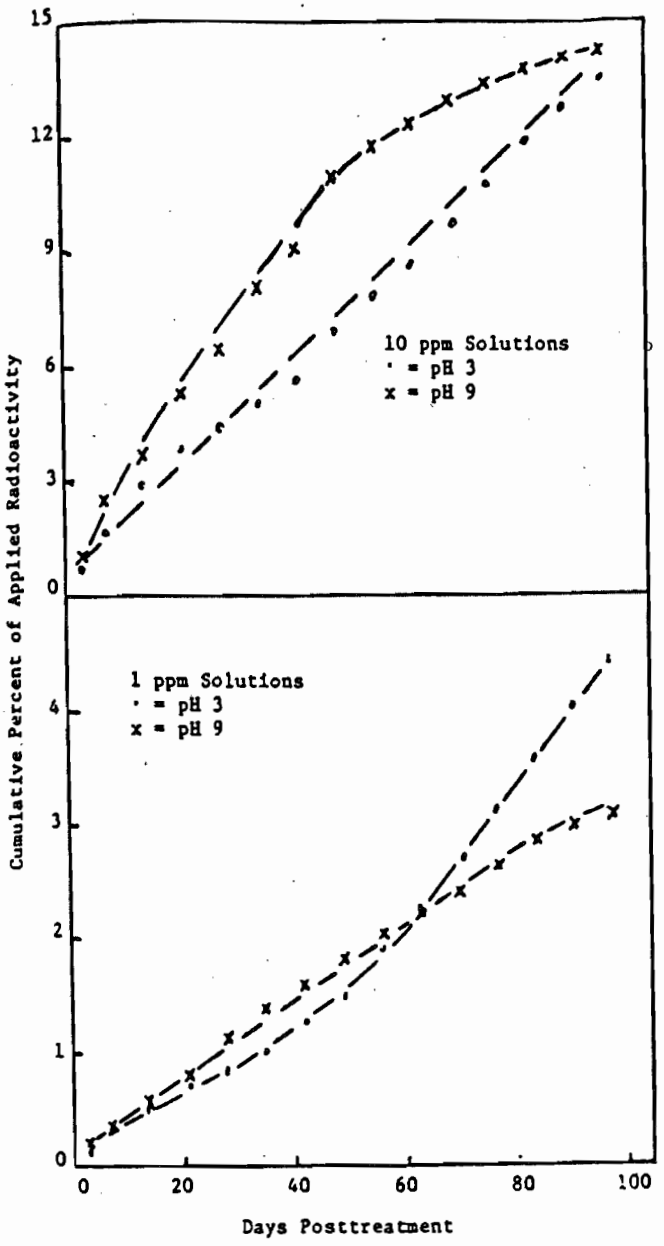


Figure 1. Percent of applied radioactivity in corn oil-coated glass wool plug gas traps attached to flasks containing pH 3 and 9 phosphate buffered solutions treated with [^{14}C]isofenphos at 1 and 10 ppm and incubated at 37°C.

Table 1. Distribution of radioactivity in the organosoluble fraction of pH 3 aqueous buffered solutions treated with [^{14}C]isofenphos at 1 and 10 ppm and incubated at 37°C.

Sampling interval (days)	Percent of applied radioactivy in organosoluble fraction	Relative percent composition						
		Isofenphos	DeAmOf[a]	OxAn[b]	DeAm OxAn[c]	IPS[d]	SA[e]	Unknown
			1 ppm					
0	100	98	ND[f]	1	ND	<1	<1	ND
3	102	96	<1	1	<1	<1	2	ND
7	98	94	1	1	1	1	2	ND
14	97	90	3	1	1	1	1	3
28	94	82	7	2	2	3	2	2
98	83	52	27	2	5	1	2	11
			10 ppm					
0	100	98	ND	1	ND	<1	<1	ND
3	98	97	ND	1	ND	<1	2	ND
7	86	94	3	1	1	<1	1	ND
14	81	90	7	<1	1	<1	1	ND
28	65	80	16	1	1	2	2	ND
98	24	40	32	3	10	1	2	12

[a] Deaminated isofenphos.

[b] Isofenphos oxygen analog, isopropyl 2-[[(ethoxy)(isopropylamino)phosphinyl]oxy]benzoate.

[c] Deaminated isofenphos oxygen analog, isopropyl 2-[[(ethoxy)(hydroxy)phosphinyl]oxy]benzoate.

[d] Isopropyl salicylate.

[e] Salicylic acid.

[f] Not detected; the detection limit was 0.03-0.06 ppm.

Table 2. Distribution of radioactivity in the organosoluble fraction of pH 9 aqueous buffered solutions treated with [^{14}C]isofenphos at 1 and 10 ppm and incubated at 37°C.

Sampling interval (days)	Percent of applied radioactivity in organosoluble fraction	Relative percent composition							
		Isofenphos	CyOf[a]	OxAn[b]	NIP SAM[c]	IPS[d]	SA[e]	DeEt OxAn[f]	Unknown
			1 ppm						
0	100	93	ND[g]	6	ND	1	ND	ND	ND
3	97	90	2	7	ND	1	ND	ND	ND
7	96	93	3	3	ND	<1	ND	ND	ND
14	88	95	4	<1	<1	<1	ND	ND	ND
28	82	94	4	<1	1	<1	<1	ND	1
49	72	94	3	1	2	<1	<1	ND	<1
98	52	86	3	2	3	<1	<1	3	3
			10 ppm						
0	100	98	ND	1	ND	<1	ND	ND	ND
3	93	96	1	2	ND	1	ND	ND	ND
7	90	96	2	1	ND	<1	ND	ND	ND
14	77	96	2	<1	<1	<1	ND	ND	<1
28	61	95	2	1	1	<1	<1	ND	1
49	35	95	1	2	1	<1	<1	ND	1
98	4	61	<1	19	3	<1	3	2	12

[a] Cyclic isofenphos, 2-ethoxy-3-isopropyl-4-oxo-2-thioxo-1,3,2-benzoxazaphosphorine.

[b] Isofenphos oxygen analog, isopropyl 2-[[(ethoxy)(isopropylamino)phosphinyl]oxy]benzoate.

[c] N-Isopropyl salicylamide.

[d] Isopropyl salicylate.

[e] Salicylic acid.

[f] Deethylated isofenphos oxygen analog, isopropyl 2-[[(hydroxy)(isopropylamino)phosphinyl]oxy]benzoate.

[g] Not detected; the detection limit was 0.03-0.06 ppm.

CASE GS -- ISOFENPHOS STUDY 2 PM --

CHEM 109401 Isofenphos

BRANCH EAB DISC --

FORMULATION 90 - FORMULATION NOT IDENTIFIED

FICHE/MASTER ID No MRID CONTENT CAT 01
Poje, A.J. 1979. Amaze photoproduct identification. Mobay Report No. 68146 Prepared and submitted by Mobay Chemical Corporation, Kansas City, MO. Acc. No. 257815.

FICHE/MASTER ID No MRID CONTENT CAT 01
Strankowski, K.J. and J.J. Murphy. 1979. Photodegradation of [^{14}C]oftanol in aqueous solution. Mobay Report No. 53939. Prepared and submitted by Mobay Chemical Corporation, Kansas City, MO. Acc. No. 257815.

SUBST. CLASS = S.

DIRECT RVW TIME = 8 (MH) START-DATE END DATE

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

APPROVED BY: C. Eiden
TITLE: Groundwater Program Chemist
ORG: EAB/HED/OPP
TEL: 557-1450

SIGNATURE: DATE:

CONCLUSIONS:

Degradation - Photodegradation in Water

This study is unacceptable because the material balances were incomplete, (up to 97% of the applied was unaccounted for from the sensitized irradiated buffered solutions and up to 25% from the nonsensitized dark control and irradiated samples). In addition, this study does not fulfill EPA Data Requirements for Registering Pesticides, because degradates were not adequately characterized, the intensity and wavelengh distribution of the artificial light source was not compared to natural sunlight, the incubation temperature was not 25 ±1°C, and the test substance was incompletely characterized.

Although the photodegradation in water study is unacceptable it provides information that may be used in evaluating the potential risk of groundwater contamination by isofenphos. Isofenphos in nonsensitized and

sensitized (2% acetone) buffered solution irradiated with artificial light and incubated at ~20°C, degraded with half-lives of >30 days (calculated 51 days) and 12-24 hours (calculated 13.6 hours), respectively. In the dark controls of nonsensitized buffered solutions, [^{14}C]isofenphos decreased by 24% of the applied after 30 days of incubation. The major degradate (3,3-dimethyl isoindolin-1-one) in the sensitized irradiated buffered solutions accounted for a maximum of ~21% of the applied. The study results show that isofenphos is stable to photolysis in the non-sensitized systems.

MATERIALS AND METHODS:

Ring-labeled [^{14}C]isofenphos (purity unspecified, specific activity 9.96 mCi/mMol, source unspecified) in methanol was added at ~5 ppm to nonsensitized 0.2 M phosphate buffered solutions (pH 7) and 2% acetone sensitized buffered solutions (pH 7). The nonsensitized and sensitized solutions were each placed in a photochemical reactor equipped with a borosilicate glass reaction vessel and a high pressure quartz mercury vapor lamp (200 W, Hanovia No. 6515-32), and stirred continuously. The samples were incubated at 20°C. The light intensity on the sample, as measured by chemical actinometry using potassium ferrioxalate, was 0.0461 W. The spectral energy distribution of the mercury lamp is given in Table 1. The photochemical reactor containing the test solutions was attached to a gas collection system consisting of two glass wool plugs coated with 5% corn oil in hexane. As controls, samples of both the nonsensitized and sensitized test solutions were incubated in black painted flasks at ~20°C in the dark. Samples of the nonsensitized and sensitized irradiated solutions were taken at intervals up to 30 and 72 hours posttreatment, respectively. Gas traps and dark control solutions were sampled at the last sampling interval only.

Aliquots of all samples were analyzed for total radioactivity by LSC. The remaining portions of the samples were then diluted with distilled water and extracted three times with ethyl acetate. Aliquots of the ethyl acetate and aqueous fractions were analyzed by LSC. The ethyl acetate fraction was then concentrated and analyzed by TLC. One-dimensional TLC analyses were performed on silica gel plates developed in benzene:acetic acid (60:1), isopropyl ether:acetic acid (60:1), hexane:benzene:acetonitrile:acetic acid (40:40:60:1) or chloroform: ethyl acetate:acetone:acetic acid (7:10:3:3). The two-dimensional TLC plates were developed in benzene:acetic acid (60:1), benzene:methanol:acetic acid (18:1:1), isopropyl ether:acetic acid (60:1) or chloroform:ethyl acetate:acetic acid (60:30:1). Radioactive areas were detected by autoradiography and quantified by LSC. Nonradioactive standards (cochromatographed with the two-dimensional TLC solutions) were detected under ultraviolet light.

Samples from each test solution were acidified with 1 N hydrochloric acid and extracted three times with ethyl acetate. The combined organic fractions and the aqueous fractions were analyzed by LSC. The organic fractions were also analyzed by TLC as described previously. Volatiles were extracted (sonicated for 5 minutes) from the glass wool plugs with hexane. Radioactivity in the hexane extracts was analyzed by LSC.

REPORTED RESULTS:

[^{14}C]Isofenphos degraded with half-lives of >30 days (calculated 51 days) in nonsensitized irradiated buffered solution and 12-24 hours (calculated 13.6 hours) in sensitized irradiated buffered solution (Figures 1 and 2). At 30 days posttreatment, isofenphos accounted for 75% of the applied radioactivity in the nonsensitized irradiated buffered solution. At 72 hours posttreatment, isofenphos accounted for 3% of the applied in the sensitized irradiated buffered solution. In the dark controls, [^{14}C]isofenphos decreased by 24% of the applied after 30 days in the nonsensitized buffered solutions. No degradation occurred during the 72 hours of incubation in the dark control sensitized buffered solution. The major degradate in the sensitized irradiated buffered solutions was 3,3-dimethyl isoindolin-1-one, which accounted for ~21% of the applied (sampling interval not specified). Other tentatively identified degradates were isofenphos oxygen analog, deaminated isofenphos, salicylic acid and catechol (each <5% of the applied). Approximately 13-26 degradates were detected in both the nonsensitized and sensitized solutions but were not positively identified. Volatiles totaled 0.04-0.08% of the applied.

DISCUSSION:

1. The material balances were incomplete. In the text, the registrant reported "total radioactivity recovered" and referred to it as the "material balance." However, up to ~25 and 97% of the applied radioactivity was not accounted for in the irradiated nonsensitized and sensitized solutions, respectively. Up to 24% of the applied radioactivity was unaccounted for in the nonsensitized dark control.

2. Degradates were not adequately characterized. Only one degradate was positively identified; however, quantitative data for this degradate were provided at only one sampling interval (unspecified) for the sensitized solution. Degradates should have been characterized in the nonsensitized solution. The registrant stated that the degradates in the nonsensitized and sensitized solutions seemed to be the same but provided no evidence of this.

3. The purity and source of the test substance were not reported.

4. The incubation temperature was not 25 ±1°C but ~ 20°C.

5. The intensity and wavelength distribution of the artificial light source was not compared to natural sunlight.

6. The registrant provided methodology for an extraction procedure performed on sensitized solution samples from the last sampling interval but it is unclear whether results were reported using that procedure.

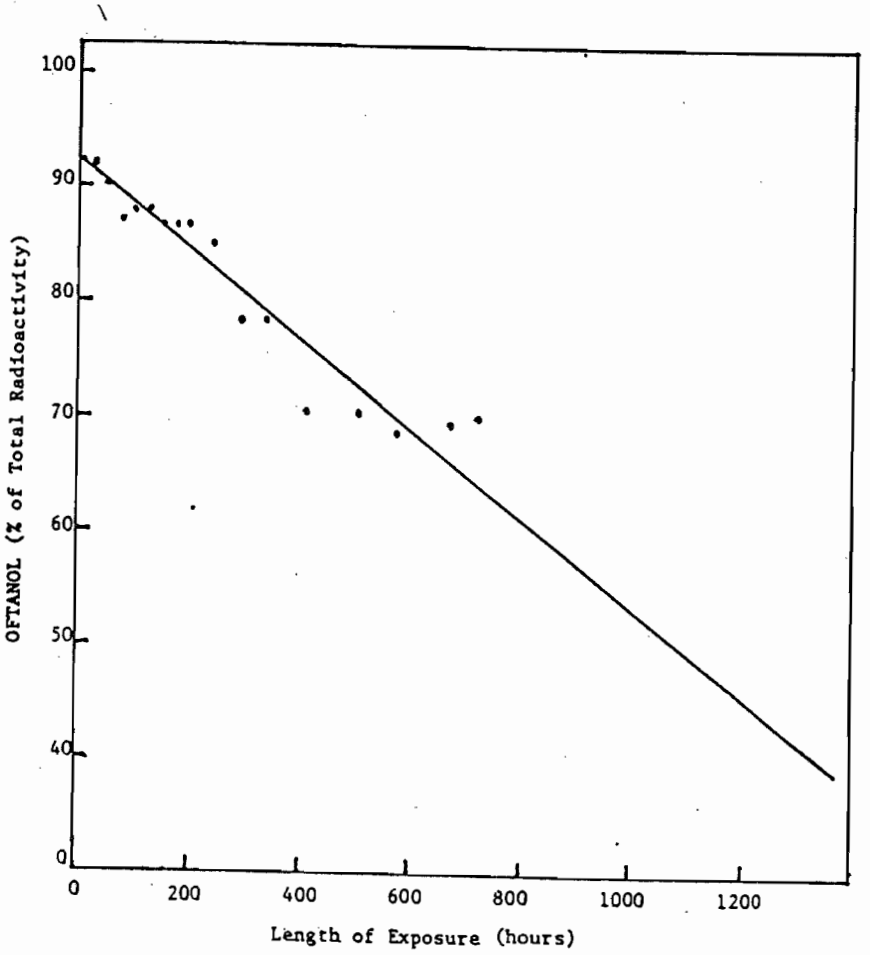


Figure 1. Isofenphos (% of applied) in an irradiated nonsensitized pH 7 buffered solutions treated with [^{14}C]isofenphos at ~ 20°C.

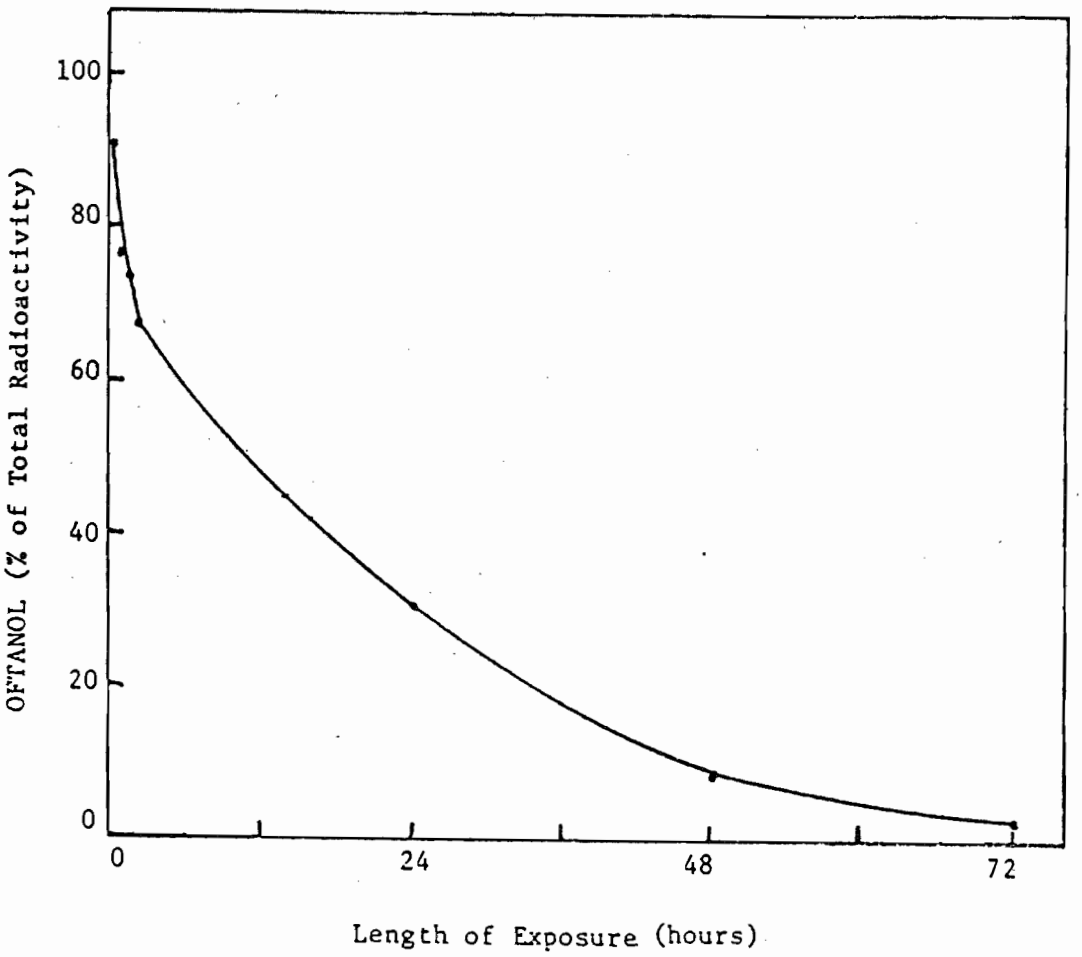


Figure 2. Isofenphos (% of applied) in an irradiated sensitized pH 7 buffered solution treated with [^{14}C]isofenphos at ~5 ppm and incubated at ~20°C.

Table 1. Spectral energy distribution of a mercury-vapor 200-W Hanovia immersion lamp.

Wavelengths (nm)	Radiated energy (Watts)
220-280	2.9
280-320	4.1
320-400	3.5
400-600	10.6
1000-1400	4.1
Total radiated energy	25.2

CASE GS -- ISOFENPHOS STUDY 3 PM --

CHEM 109401 Isofenphos

BRANCH EAB DISC --

FORMULATION 90 - FORMULATION NOT IDENTIFIED

FICHE/MASTER ID No MRID CONTENT CAT 01

Weissenburger, B. and R.J. Pollock. 1979. Photodegradation of [^{14}C]amaze on a soil surface. Mobay Report No. 68245. Prepared by Analytical Development Corporation, Monument, CO, and submitted by Mobay Chemical Corporation, Agricultural Chemicals Division, Kansas City, MO. Acc. No. 257815.

SUBST. CLASS = S.

DIRECT RVW TIME = 9 (MH) START-DATE END DATE

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

APPROVED BY: C. Eiden
TITLE: Groundwater Program Chemist
ORG: EAB/HED/OPP
TEL: 557-1450

SIGNATURE: DATE:

CONCLUSIONS:

Degradation - Photodegradaton on Soil

1. This study is scientifically sound and provides supplemental information towards the registration of isofenphos.

2. Ring-labeled [^{14}C]isofenphos (purity unspecified), at ~302 µg/plate, degraded with a half-life of 1-3 days (calculated 2-6 days) on silt loam soil TLC plates irradiated with artificial light (0.34 W intensity). After 26 days of irradiation, isofenphos comprised 7% of the applied radioactivity, and the major degradates, isofenphos oxygen analog and des-N-isopropyl oxygen analog, comprised a combined (not separated on TLC plates) total of 31% of the applied. The degradates des-N-isopropyl-isofenphos isopropyl salicylate and phenol accounted for a maximum of 1-6% of the applied at 5-7 days posttreatment and were either not detected, or 1% of the applied at 26 days posttreatment. Unextractable residues totaled 25% of the applied at 26 days posttreatment. In the dark control, isofenphos comprised 95% of the applied radioactivity at 26 days posttreatment.

3. This study does not fulfill EPA Data Requirements for Registering Pesticides because the material balance was incomplete, up to 36% of the applied radioactivity not accounted for, volatiles were neither measured nor controlled, the artificial light source was not compared to natural sunlight and the purity of the test substance was unspecified.

4. The study on photodegradation on soil provides information that may be used in evaluating the potential risk of groundwater contamination by isofenphos. Ring-labeled [^{14}C]isofenphos (purity unspecified), at ~302 µg/plate, degraded with a half-life of 1-3 days (calculated 2-6 days) on silt loam soil TLC plates irradiated with artificial light (0.34 W intensity). After 26 days of irradiation, isofenphos comprised 7% of the applied radioactivity, and the major degradates, isofenphos oxygen analog and des-N-isopropyl oxygen analog, comprised a combined total of 31% of the applied. The degradates des-N-isopropyl-isofenphos, isopropyl salicylate and phenol accounted for a maximum of 1-6% of the applied at 5-7 days posttreatment and were either not detected or 1% at 26 days posttreatment. Unextractable residues totaled 25% of the applied at 26 days posttreatment. In the dark control, isofenphos comprised 95% of the applied at 26 days posttreatment. In the dark control, isofenphos comprised 95% of the applied radioactivity at 26 days posttreatment. The study results indicate that isofenphos is stable to photodegradation on soil.

MATERIALS AND METHODS:

A silt loam soil (3% sand, 75% silt, 22% clay, 2.3% organic matter, pH 6.4, CEC 32 meq/100 g):water slurry was spread on glass plates (5 x 20 cm), and the plates were dried (method of drying unspecified). Uniformly ring-labeled [^{14}C]isofenphos (purity unspecified, specific activity 9.96 mCi/mMol, Mobay Chemical Corporation) was applied at ~302 µg/plate over the entire surface of the soil. Each sample plate was mounted vertically at the center of a hardware cloth cylinder attached to a plywood base in a rotating (16 rpm) photoreactor (Figure 1). The samples were irradiated with a 200 W high pressure mercury vapor lamp (Hanovia lamp No. 6515-32) emitting light of 0.34 W intensity (based on uranyl oxalate actinometer). The spectral energy distribution of the mercury vapor lamp is given in Table 1. As a control, a similarly prepared soil sample was wrapped in aluminum foil and incubated in darkness. The irradiated soil was sampled prior to exposure and at various intervals up to 26 days posttreatment, and the dark control was sampled only at 26 days posttreatment.

A portion of the soil from each irradiated and dark control plate was analyzed for total radioactivity by LSC following combustion. The remaining soil from each sample was Soxhlet-extracted with methylene chloride:methanol (7:3) for 16-20 hours. The extracted soil was filtered and analyzed for remaining radioactivity by LSC following combustion. The extracts were concentrated and diluted with distilled water. The aqueous solution was extracted three times with methylene chloride. The extracts were combined, and aliquots of solutions were analyzed by LSC. The remaining combined extract was evaporated to dryness and the residue was dissolved in ethyl acetate. Radioactivity in the organic extract was analyzed by LSC and by TLC on silica gel plates developed in benzene:acetic acid (120:2). Aliquots of the day 3 sample were also

analyzed by two-dimensional TLC on silica gel plates developed in isopropyl ether:acetic acid (120:2) and benzene:acetic acid (120:2). Nonlabeled reference standards were cochromatographed with the samples. Following development, isofenphos and its degradates were visualized under UV light and by autoradiography. Radioactive zones were scraped, extracted from the silica with methanol by sonication, and quantified using LSC.

In an attempt to measure volatilization, an additional study was done. In this study, soil TLC plates treated with isofenphos (application rate unspecified) were placed in a pyrex flask and irradiated with a mercury vapor lamp (previously described), placed at a distance of 10 to 15 cm from the plates. Air was passed through the flask and into a ground glass elbow adapter containing two borosilicate glass wool plugs coated with 5% corn oil in hexane. The elbow was connnected to a second adapter containing Chromosorb 102. The trapping solutions were sampled at 14 days posttreatment.

The corn oil coated glass wool plugs, and the Chromosorb 102, were extracted by sonication with hexane and methanol, respectively. Aliquots of the extracts were analyzed for total radioactivity by LSC and for isofenphos and its degradates by one dimensional TLC, as described previously. The amount of radioactivity remaining in the soil was determined by LSC following combustion.

REPORTED RESULTS:

The half-life of [^{14}C]isofenphos was 1-3 days (calculated 2.6 days) on silt loam soil irradiated with artificial light (Table 2). After 26 days of irradiation, isofenphos comprised 7% of the applied, and the major degradates, isofenphos oxygen analog and des N-isopropyl oxygen analog, comprised a combined total of 31% of the applied. The degradates des-N-isopropyl isofenphos, des-isopropyl cyclic isofenphos, isopropyl salicylate, and phenol each accounted for <6% of the applied. Unextractable residues totaled 25% of the applied at 26 days posttreatment. The material balance in the irradiated samples ranged from 64 to 101%. In the dark control, isofenphos comprised 95% of the applied radioactivity at 26 days posttreatment.

In the additional 14-day study done to measure volatility, ~0.1% of the applied was recovered in the corn oil, all of which was identified as isofenphos oxygen analog, and 3.1% of the applied was recovered in the Chromosorb 102, the majority of which (91.4%) was identified as isofenphos. Small amounts of des-N-isopropyl isofenphos, isopropyl salicylate, and phenol were also trapped in the Chromosorb 102. Total [^{14}C]residues remaining in the soil after 14 days accounted for 97% of the applied.

DISCUSSION:

1. The material balance was incomplete; up to 36% of the applied [^{14}C]isofenphos was not accounted for.

2. The purity of the test substance was unspecified.

3. The artificial light source was not compared to natural sunlight.

4. Volatilization was neither measured nor controlled in the 26-day soil photolysis study. The additional 14-day study, which was done to measure volatility, cannot be compared to the original 26-day study because the two studies were conducted under different experimental conditions. Although the 14-day soil photolysis study does provide data on the volatilization of [^{14}C]isofenphos, the study is unacceptable because neither the application rate nor the purity of the test substance were specified, no immediate pretreatment samples were analyzed, no dark control samples were maintained, samples were taken only once at 14 days posttreatment, the artificial light source was not compared to natural sunlight, and total [^{14}C]residues remaining in the soil were not characterized.

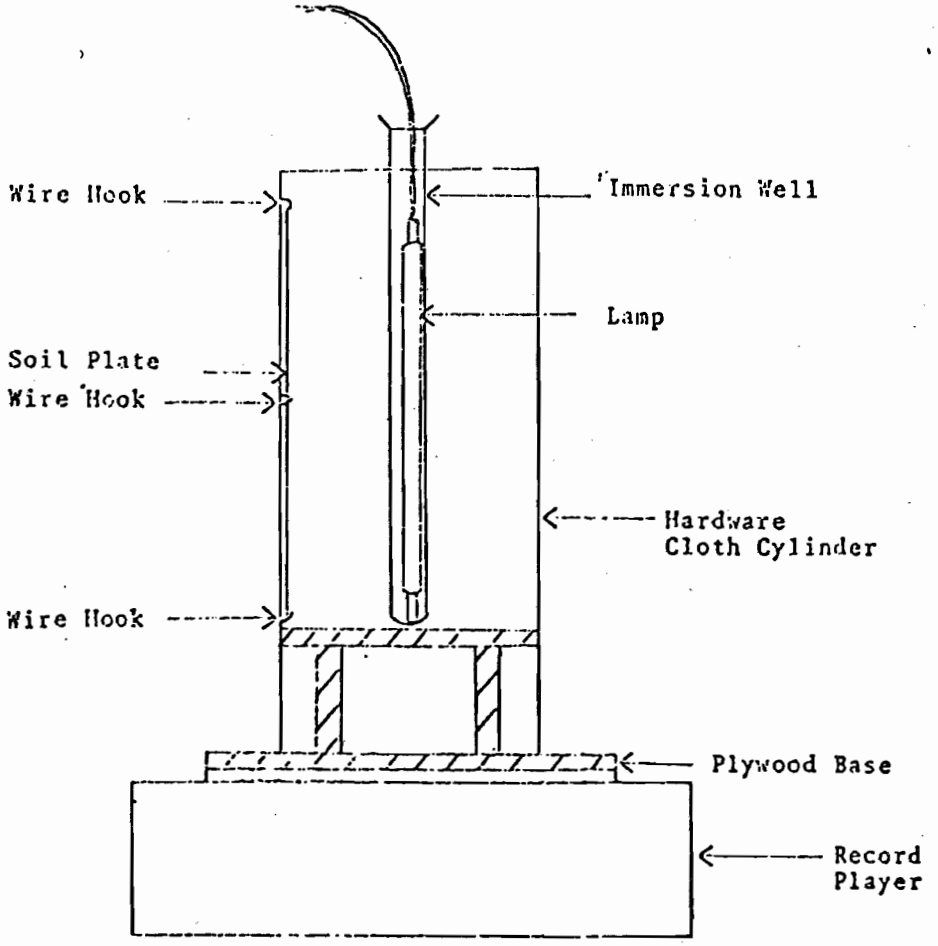
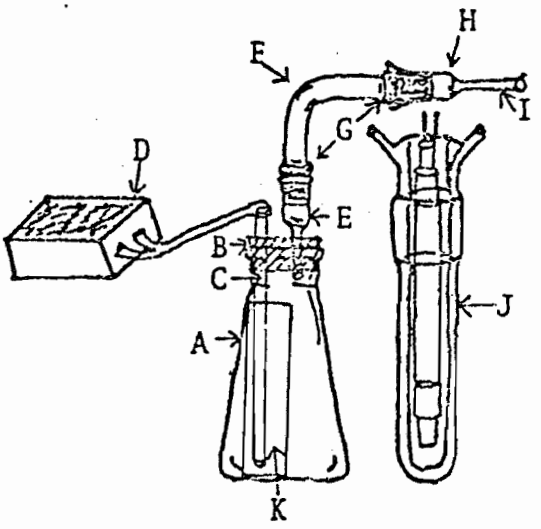


Figure 1. Schematic drawing of rotating photoreactor with a high pressure mercury vapor lamp in an immersion well composed of borosilicate glass to remove wavelengths <290 nm.



A. 2800 ml flask
B. # 13 stopper
C. 6 mm O.D. glass tube
D. Air pump with Teflon tubing to flask
E. 24/40 ground glass adapter with an 8 mm O.D. extension tube
F. 24/40 ground glass elbow adapter
G. 0.5 g plugs of glass wool coated with 1 ml 5% corn oil in hexane
H. 24/40 ground glass adapter with 8 mm O.D. x 50 mm extension tube
I. 30 mm Chromosorb 102 with a small glass wool plug at each end
J. Photochemical immersion well and lamp
K. Soil coated 5x20 cm glass plates

Figure 2. Schematic drawing of photoreactor connected to two trapping systems.

Table 1. Spectral energy distribution of high pressure mercury vapor lamp (Hanovia #6515-32).

Lamps watts	200
Lamp volts	125
Amps	1.9

Wavelength (nm)		Radiated energy (watts)
1367	(infrared)	1.0
1128		1.3
1014		1.8
578	(yellow)	3.4
546	(green)	3.0
435	(blue)	2.6
404	(violet)	1.6
366	(UV)	3.1
334		0.36
313		2.3
302		0.86
296		0.48
289		0.20
280		0.30
275		0.14
270		0.14
265		0.64
257		0.20
253	(reversed)[a]	1.10
248		0.20
240		0.20
238		0.12
236		0.08
232		0.03
222		0.03
Total watts		25.18

[a] 253 line is reversed in high pressure lamps.

Table 2. Distribution of radioactivty (% of applied)[a] in silt loam soil treated with ring-labeled [^{14}C]isofenphos (purity unspecified) at 320 µg/plate.

Sampling interval (days)	Isofenphos	Des-N-isopropyl isofenphos[b]	Des-isopropyl cyclic isofenphos[c]	Isofenphos oxygen analog[d] + Des-N-isopropyl isofenphos oxygen analog[e]	Isopropyl salicylate	Phenol	Unextractable	Total [^{14}C]
				Irradiated				
0	93	ND[f]	ND	4	1	ND	--	98
1	76	ND	ND	17	2	1	5	101
39	43	ND	ND	36	4	2	15	100
5	34	1	ND	37	4	4	15	95
7	27	1	ND	34	3	6	18	89
12	28	ND	ND	29	2	1	21	81
14	21	ND	ND	32	4	ND	23	80
16	17	ND	ND	38	4	ND	22	81
20	14	ND	ND	36	2	1	25	78
23	9	ND	ND	33	1	1	26	70
26	7	ND	ND	31	1	ND	25	64
				Dark control				
26	95	ND	1	6	1	1	ND	104

[a] Data from the aqueous fraction were not reported.

[b] Isopropyl 2-[[(amino)(ethoxy)phosphinothioyl]oxy]benzoate.

[c] 2-Ethoxy-3-hydro-4-oxo-2-thioxo-1,3,2-benzoxazaphoshorine.

[d] Isopropyl 2-[[(ethoxy)(isopropylamino)phosphinyl]oxy]benzoate.

[e] Isopropyl 2-[[(amino)(ethoxy)phosphinyl]oxy]benzoate.

[f] Not detected detection limits was <1% of the applied.

[g] Two-dimensional TLC analysis accounted for 46% isofenphos, 1% des-isopropyl cyclic isofenphos, 33% isofenphos oxygen analog, 2% des-N-isopropyl oxygen analog and 2% isopropyl salicylate.

CASE GS -- ISOFENPHOS STUDY 4 PM --

CHEM 109401 Isofenphos

BRANCH EAB DISC --

FORMULATION 90 - FORMULATION NOT IDENTIFIED AND 12 - EMUSIFIABLE CONCENTRATE

FICHE/MASTER ID No MRID CONTENT CAT 01

Minor, R.G. and J.J. Murphy. 1977. Metabolism of [^{14}C]oftanol in soil. Mobay Report No. 53643. Prepared by Mobay Chemical Corporation, Kansas City, MO. Acc. No. 257815.

SUBST. CLASS = S.

DIRECT RVW TIME = 10 (MH) START-DATE END DATE

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

APPROVED BY: C. Eiden
TITLE: Groundwater Program Chemist
ORG: EAB/HED/OPP
TEL: 557-1450

SIGNATURE: DATE:

CONCLUSIONS:

Metabolism - Aerobic Soil

1. This portion of the study is unacceptable because the material balance was incomplete (up to 61-69% of the applied radioactivity was unaccounted for). In addition, this portion of the study does not fulfill EPA Data Requirements for Registering Pesticides because volatiles were neither measured nor controlled, the incubation temperature was not reported, the test substance was incompletely characterized, the soil moisture content was not 75% of 0.33 bar and dark controls were not maintained for the sandy loam soil.

2. Ring-labeled isofenphos at 8,7 ppm degraded with a half-life of >90 days of anaerobic incubation, isofenphos comprised 72% of isofenphos and the only degradate isofenphos oxygen analog (2-[[(ethoxy)(isopropylamino)-phosphinyl]oxy]benzoate) comprised 3% of the applied. Unextractable residues totaled 13% of the applied at 90 days posttreatment.

3. This portion of the study does not fulfill EPA Data Requriements for Registering Pesticides because volatiles were neither measured nor controlled, the incubation temperature was not reported, the test substance

was incompletely characterized, the soil moisture content was not 75% of 0.33 bar and the test water was not characterized.

Although the aerobic soil metabolism portion of the study is unacceptable, it provides information that may used in evaluating the potential risk of groundwater contamination by isofenphos. Isofenphos in nonsterile silt loam and sandy loam soils incubated in the greenhouse, degraded with half-lives of 60 days (calculated 59 days) and 120-240 days (calculated 127 days), respectively. The major degradate, isofenphos oxygen analog, at 60 days posttreatment, accounted for 18% in nonsterilized silt loam soil, 11% in nonsterilized sandy loam soil, and was not detected in in sterilized sandy loam soil. Unextractable residues totaled 16-21% and volatiles totaled <26.2% at 340 and 165 days posttreatment, respectively.

Metabolism - Anaerobic soil

This portion of the study provides information that may be used in evaluating the potential risk of groundwater contamination by isofenphos. Ring-labeled isofenphos at 8.7 ppm degraded with a half-life of >90 days in sandy loam soil. After 90 days of anaerobic incubation, isofenphos comprised 72% of the applied radioactivity and the only degradate isofenphos oxygen analog, comprised 3% of the applied. Unextractable residues totaled 13% of the applied.

Metabolism - Aerobic Soil

Ring-labeled [^{14}C]isofenphos (purity and source unspecified, specific activity 1.01 mCi/mMol) in ethanol was applied at 8.7 ppm to samples of silt loam soil (3% sand, 75% silt, 22% clay, 2.3% organic matter, pH 6.4, CEC 32 meq/100 g) and sandy loam soil (59% sand, 21% silt, 20% clay, 0.5% organic matter, pH 6.4, CEC 26 meq/100 g) in glass jars and vigorously shaken. The treated soils were adjusted to 10% soil moisture and incubated in the greenhouse (incubation temperatures unspecified). Soil moisture content was maintained by periodic watering. As dark controls, similarly prepared silt loam soil was incubated in open glass jars in the dark at 25°C. In a related study sterilized sandy loam soil was treated with [^{14}C]isofenphos at 8.7 ppm and incubated in sealed Mason jars as described above. Samples of nonsterile soil were taken immediately after treatment and at various intervals up to 240 (silt loam soil) or 360 (sandy loam soil) days posttreatment. Sterile soil samples were taken at various intervals up to 360 days posttreatment. The soil samples were Soxhlet-extracted for 16 hours with chloroform: methanol (7:3). Aliquots of the extracts were analyzed for total radioactivity by LSC. The remaining extracts were concentrated and transferred to a separatory funnel with water. The mixture was partitioned twice with chloroform. Aliquots of the aqueous and organic fractions were analyzed by LSC. The organic fractions were concentrated, and analyzed by LSC and by cochromatography with nonlabeled reference standards on silica gel TLC plates. TLC plates were developed in either benzene:acetic acid (60:1) or isopropyl ether:acetic acid (60:1) or carbon tetrachloride:chloroform (2:1) or hexane:benzene:acetonitrile:acetic acid (60:1) or carbon tetrachloride:chloroform (2:1) or benzene:methylene chloride:acetic acid (30:30:1). Compounds were

identified by comparison to nonlabeled standards located by short wavelength UV light. Radioactive areas were visualized by autoradiography, scraped from the TLC plates, extracted (ultrasonication) from the silica with water and quantified using LSC.

The extracted soil was divided into two portions. One portion was analyzed for total radioactivity using LSC following combustion. The second portion was extracted (shaken for 24 hours at 25°C) with 0.5 N sodium hydroxide solution. The soil solution was centrifuged and decanted. The soil was rinsed twice with 0.5 N sodium hydroxide and recentrifuged. The NaOH supernatants were combined. The soil was then rinsed three times with water, centrifuged, and decanted. All the supernatants (water and sodium hydroxide solutions) were combined and aliquots were analyzed by LSC. The remaining aliquots were acidified to pH 1 and centrifuged to separate the soluble (fulvic acid) and insoluble (humic acid) fraction. The humic and fulvic acid fractions were analyzed by LSC; the sodium hydroxide- and water-extracted soil (humin) was air-dried and analyzed by LSC following combustion. In an attempt to measure volatilization, an additional study was done. In this study [^{14}C]isofenphos was applied at 8.7 ppm to nonsterilized silt loam soil. The treated soil was incubated in flasks attached to a continuous air flow system (150 ml/min) and maintained in the greenhouse. Air was passed over the samples, then through an empty gas trap, mineral oil, a second empty gas trap and two ethanolamine trapping solutions (Figure 1). Trapping solutions were analyzed at about two week intervals up to 134 days posttreatment, and soil was analyzed only at 134 days posttreatment.

Aliquots of the trapping solutions were analyzed for total radioactivity by LSC. The mineral oil trapping solutions were extracted three times with acetonitrile. The extracts were combined and aliquots were analyzed by LSC. The remaining extract was partitioned with hexane saturated with acetonitrile. Aliquots of the hexane and acetonitrile fractions were analyzed by LSC. Acetonitrile fractions were concentrated and analyzed by TLC as previously described. The ethanolamine traps were partitioned three times with benzene. The benzene fractions were combined, concentrated and analyzed by LSC. The $^{14}CO_2$ content in the ethanolamine was determined by slowly acidifying the extracted ethanolamine with concentrated hydrochloric acid to pH 1, collecting any liberated CO_2 in 1 M sodium hydroxide, then precipitating the CO_2 as barium carbonate by adding 1 M barium chloride to the sodium hydroxide and radioassaying. Both the precipitate and the supernatant were analyzed by LSC. The soil samples were extracted with chloroform:methanol as previously described.

An outdoor study was done in Vero Beach, FL where sand soil (99% sand, 1% silt, 0% clay, 2.3% organic matter, pH 6.2, CEC 19 meq/100 g) was placed in a container (soil surface of 9.2 sq ft) and treated (incorporated, depth unspecified) with ring-labeled [^{14}C]isofenphos (purity and source unspecified, specific activity 2.60 mCi/mMol) at 5 lb ai/A. The test substance was formulated as an EC prior to use. The soil was planted with corn and the containers were kept outdoors. Soil samples were taken immediately after treatment, and at 30, 90, 180 and 270 days after treatment. Soil samples were extracted with chloroform:methanol (7:3) and analyzed as described previously.

Metabolism - Anaerobic soil

After 30 days of aerobic incubation, portions of the treated nonsterilized sandy loam soil samples from the aerobic soil metabolism study were converted to anaerobic conditions by flooding the soil with a 1-cm water layer and transferring the flasks to a sealed chamber containing carbon dioxide and hydrogen gas. The soil was sampled immediately before establishing anaerobic conditions (30 days posttreatment) and at 60 and 90 days posttreatment, (30 and 60 days after anaerobic conditions were established). The soil samples were analyzed as described previously.

REPORTED RESULTS:

Metabolism - Aerobic Soil

Isofenphos degraded with a half-life of 60 days (calculated 59 days) in nonsterile silt loam soil and 120-240 days (calculated 127 days) in nonsterile sandy loam soil (Tables 1 and 2). The major nonvolatile degradate, isofenphos oxygen analog, accounted for <18% of the applied (1.6 ppm) in silt loam soil and <12% (1 ppm) in sandy loam soil. The degradate isopropyl salicylate was <3% (0.3 ppm) in silt loam soil and was not detected in sandy loam soil. Unextractable residues comprised up to 22% of the applied (1.9 ppm) in silt loam soil and 19% (1.7 ppm) in sandy loam soil. The material balance ranged from 31 to 99% of the applied in silt loam soil and 39 to 100% in sandy loam soil. In the dark controls of silt loam soil, isofenphos and isofenphos oxygen analog accounted for 88 and 11% of the applied, respectively, after 30 days of incubation. In the sterile sandy loam soil, isofenphos accounted to 99% of the applied and its degradate isofenphos oxygen analog was <1% of the applied.

In the volatilization study, volatiles totaled 26.2% of the aplied at 134 days posttreament from sandy loam soil (Table 3). The degradates isopropyl salicylate and $^{14}CO_2$ were identified from the trapping solutions. At study termination, the only sampling interval at which the soil was analyzed, 24% was extractable and 20% was unextractable.

In the outdoor metabolism study conducted at Vero Beach, FL, extractable [^{14}C]residues declined from 99 to 91% of the recovered (4.3 to 4.0 ppm) during 270 days after treatment (Table 4). Unextractable residues were <9% (0.39 ppm) of the recovered.

Metabolism - Anaerobic Soil

[^{14}C]Isofenphos declined from 91 to 72% of the recovered (7.4 ppm to 6.5 ppm) during 60 days of anaerobic incubation (Table 2). The only degradate, isofenphos oxygen analog, comprised up to 4% of the recovered (0.3 ppm). Unextractable residues totaled 13% (1.1 ppm) at study termination.

DISCUSSION:

General

1. The purity and source of the test substance were not reported.

2. The incubation temperature was not reported.

3. Volatiles were neither controlled nor measured.

4. Dark controls were maintained only for the aerobic silt loam soil study.

5. The soil moisture content was 10% and not 75% of 0.33 bar.

Metabolism - Aerobic Soil

1. The material balances for both the silt loam and sandy loam soils were incomplete; up to 61 and 69% of the applied was unaccounted for from sandy loam and silt loam soils, respectively. When an attempt was made by the reviewer to combine volatile and soil residue data provided for the sandy loam soil study (which appeared to be the intent of the registrant in spite of having different sampling intervals) complete material balances could not be achieved.

2. In the volatilization study, 25% of the applied radioactivity was recovered from the Tygon tubing. However, radioactivity was not characterized.

3. The experimental design for the study done outdoors in Vero Beach, FL, was inadequate to assess the metabolism of [^{14}C]isofenphos in soil because the treated soils were placed in open containers (soil surface of 9.2 sq ft) and incubated outdoors (site not further characterized), the soil moisture content was 10% and not 75% of 0.33 bar, and the sampling procedures were not reported. This portion of the study does not meet the requirements or provide useful information on either terrestrial field dissipation or aerobic soil metabolism.

Metabolism - Anaerobic Soil

1. Characteristics of the water used to flood the soil (including pH, dissolved oxygen content, hardness, and alkalinity) were not reported.

2. The water samples were not analyzed. However, >88% of the applied was recovered as extractable and unextractable fractions from the soil.

Table 1. Distribution of radioactivity (% of the applied) in nonsterilized silt loam soil following the application of ring-labeled [^{14}C]isofenphos at 8.7 ppm and incubated under aerobic conditions in the greenhouse.

Sampling interval (days)	Isofenphos	Isofenphos oxygen analog[a]	Isopropyl salicylate	Unextractable	Total ^{14}C
0	99	ND[b]	ND	ND	99
7	85	4	1	ND	90
14	--	--	--	--	--
30	74	8	3	13	98
60	50	18	ND	14	72
90	--	--	--	--	--
120	15	17	ND	22[c]	54
240	4	6	ND	21	31

[a] Isopropyl 2-[[(ethoxy)(isopropylamino)phosphinyl]oxy]benzoate.

[b] Not detected; detection limit was 0.2 ppm of the applied.

[c] Radioactivity in unextractable was distributed as follows: 8% in fulvic acid, 5% in humic acid and 9% in humin.

Table 2. Distribution of radioactivity (% of applied) in sandy loam soil following the application of ring-labeled [^{14}C]isofenphos at 8.7 ppm and incubated under aerobic and anaerobic conditions in the greenhouse.

Sampling interval (days)	Isofenphos	Isofenphos oxygen analog[a]	Unextractable	Total ^{14}C
		Aerobic nonsterilized soil		
0	98	1	ND[b]	99
7	96	2	2	100
14	93	4	2	99
30	91	5	4	100
60	79	11	8	98
90	65	12	11	88
120	54	12	13	79
240	20	5	19	44
360	18	5	16[c]	39
		Aerobic sterilized soil		
7	99	1	ND	100
14	99	1	--	100
30	99	1	--	100
60	99	ND	--	99
360	99	ND	ND	99
		Anaerobic nonsterilized soil		
0	91	5	4	100
60	85	4	6	95
90	72	3	13	88

[a] Isopropyl 2-[[(ethoxy)(isopropylamino)phosphinyl]oxy]benzoate.

[b] Not detected; detection limit was 0.2 ppm of the applied.

[c] Radioactivity in unextractable was distributed as follows: 4% in fulvic acid, 3% humic acid and 9% in humin.

Table 3. Distribution of radioactivity (% of applied) in trapping solutions, following the application of ring-labeled [^{14}C]isofenphos at 8.7 ppm to silt loam soil and incubated under aerobic conditions in the greenhouse.

Sampling interval (days)	Mineral oil[a]	Ethanolamine[b]	Cumulative [^{14}C]
9	0.1	0.6	0.7
23	0.4	1.7	2.8
36	0.3	0.8	3.9
52	0.3	0.7	4.9
69	1.2	2.0	8.1
84	1.4	3.6	13.1
94	1.4	4.0	18.5
104	1.1	1.5	21.1
118	1.3	1.5	23.9
129	0.4	1.6	25.9
134	0.1	0.2	26.2

[a] [^{14}C]Residues from three sampling intervals were distributed as follows: 0.076% isofenphos and 0.324% isopropyl salicylate from the 23 day sampling interval; 0.009% isofenphos and 0.291% isopropyl salicaylate from the 52 day sampling interval; and 1.4% isopropyl salicylate from the 84-day sampling interval.

[b] Radioactivity detected in ethanolamine trapping solution, was identified as $^{14}CO_2$.

Table 4. Distribution of radioactivity (% of recovered) in sand soil in Vero Beach, FL, following the application of ring-labeled [^{14}C]isofenphos (6 EC formulation) at 5 lb ai/A.

Sampling interval (days)	Extractable	Unextractable
0	99	ND[a]
30	98	2
90	96	4
180	91	9
270	93	7

[a] Not detected; detection limit was 0.2 ppm of the applied.

CASE GS -- ISOFENPHOS STUDY 5 PM --

CHEM 109401 Isofenphos

BRANCH EAB DISC --

FORMULATION 90 - FORMULATION NOT IDENTIFIED

FICHE/MASTER ID no MRID CONTENT CAT 01

Thornton, J.S., J.B. Hurley, and J.J. Obrist. 1976. Soil thin-layer mobilty of twenty four pesticides chemicals. Mobay Report No. 5106 Prepared and submitted by Mobay Chemical Corporation, Kanasas City, MO. Acc. No. 257815.

SUBST. CLASS = S.

DIRECT RVW TIME = 2 (MH) START-DATE END DATE

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

APPROVED BY: C. Eiden
TITLE: Groundwater Program Chemist
ORG: EAB/HED/OPP
TEL: 557-1450

SIGNATURE: DATE:

CONCLUSIONS:

Mobility - Leaching and Adsorption/Desorption

This study is unacceptable, because the soils were sieved through 250-420 (μm) mesh screens. In addition, this study does not fulfill EPA Data Requriements for Registering Pesticides because K_d values were not provided, the test substance was not characterized and CEC of the soil was not reported.

The soil TLC leaching and adsorption/desorption study does not provide information that may be used in evaluating the potential risk of groundwater contamination by isofenphos because soils were sieved through 250-420 μm mesh screens, which could have reduced the mobility of the test substance. The sieved (250-420 μm) soils showed R_f values for isofenphos ranging from 0.14 to 0.23.

MATERIALS AND METHODS:

Sand, sandy loam, sandy clay loam, silt loam and two silty clay soils (Table 1) were air-dried, sieved through either 420 μm (sand, sandy loam, and sandy clay loam soils) or 250 μm (silt loam and both silty clay soils) and mixed with sufficient water to produce slurries. The

slurries were spread on glass TLC plates (20 x 20 cm) to a thickness between 0.75 and 1.5 mm, then air-dried for at least 24 hours. The plates were spotted with [^{14}C]isofenphos (test substance uncharacterized) at ~0.014 µCi/ spot at a distance 2.5 cm from the bottom edge of each plate. The plates were then developed in water to a distance 10 cm from the origin, allowed to dry, and autoradiographed.

REPORTED RESULTS:

R_f values for [^{14}C]isofenphos in the six soils ranged from 0.14 to 0.23 (Table 1).

DISCUSSION:

1. Sieving the soils through 250 and 420 µm mesh screens would remove the coarse sand fraction, tending to make the pesticide less mobile than in an unsieved or "normally" sieved soil (a 2000 µm mesh screen is primarily used in soil texture analyses).

2. The test substance was not characterized.

3. Soil/water relationship (K_d) values were not provided.

4. Soil CEC was not reported.

Table 1. Soil characteristics.

Soil type	Origin	Sand	Silt	Clay	Organic matter	pH	R_f values
		%					
Sand	Florida	92	1	7	0.8	5.9	0.20
Sandy loam	Oregon	74	14	13	2.8	6.6	0.23
Sandy clay loam	Indiana	56	21	23	0.6	5.5	0.14
Silt loam	Nebraska	18	57	25	5.1	7.9	0.19
Silty clay	Maryland	4	53	43	2.1	6.7	0.15
Silty clay	Kansas	0	41	59	0.5	6.0	0.22

CASE GS -- ISOFENPHOS STUDY 6 PM --

CHEM 109401 Isofenphos

BRANCH EAB DISC --

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID No MRID CONTENT CAT 01

Obrist, J.J. and J.S. Thorton. 1977. Leaching characteristics of aged oftanol soil residues. Mobay Report No. 53944. Prepared and submitted by Mobay Chemical Corporation, Kansas City, MO. Acc. No. 257815.

SUBST. CLASS = S.

DIRECT RVW TIME = 10 (MH) START-DATE END DATE

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

APPROVED BY: C. Eiden
TITLE: Groundwater Program Chemist
ORG: EAB/HED/OPP
TEL: 557-1450

SIGNATURE: DATE:

CONCLUSIONS:

Mobility - Leaching and Adsorption/Desorption

1. The column leaching portion of the study is scientifically sound and provides supplemental information towards the registration of isofenphos. The soil TLC portion of the study of the study is unacceptable because the soils were sieved through 250-420 µm mesh screens which could have reduced the mobility of the test substance.

2. Aged (30 days) [^{14}C]isofenphos residues (66.6% [^{14}C]isofenphos, 7.4% isofenphos oxygen analog, 26% unextractable) were somewhat mobile in a column of sandy loam soil leached with ~22.5 inches of water over a 45-day period; [^{14}C]residues were distributed throughout the soil column. Approximately 9.4% of the [^{14}C]residues were recovered in the leachate. Isofenphos oxygen analog and isopropyl salicylate were identified in the leachate.

3. This study does not fulfill EPA Data Requirements for Registering Pesticides because [^{14}C]residues in the soil after leaching were not characterized, K_d values were not reported, and the test substance was inadequately characterized.

4. Ohe column leaching portion of the study provides information that may used in evaluating the potential risk of groundwater contamination by isofenphos. Aged (30 days) [^{14}C]isofenphos residues (66.6% [^{14}C]isofenphos, 7.4% isofenphos oxygen analog, 26% unextractable) were somewhat mobile in a column of sandy clay loam soil leached with ~22.5 inches of water over a 45-day period. [^{14}C]Residues were distributed throughout the soil column. Approximately 9.4% of the [^{14}C]residues were recovered in the leachate. Isofenphos oxygen analog and isopropyl salicylate were identified in the leachate. This study indicates that isofenphos is somewhat mobile in sandy clay loam soil. However, information on [^{14}C]residues in the soil fraction after leaching is required.

MATERIALS AND METHODS:

Sieved (2.0 mm) sandy clay loam soil (56% sand, 23% silt, 21% clay, 0.7% organic matter, pH 6.0, CEC 6.9 meq/100 g) was treated with uniformly ring-labeled [^{14}C]isofenphos (radiochemically pure by TLC, specific activity 9.96 mCi/mMol, Mobay Chemical Corporation) in 500 µL acetone:water (4:1) at 10 ppm and kept moist at room temperature for 30 days. A glass column (4.8 cm diameter) was packed to a depth of 30 cm with untreated sandy clay loam soil, saturated with distilled water, and capped with 10 g of the treated, aged soil. The column was topped with 1 cm of untreated soil, covered with a piece of filter paper, and leached with water at <0.5 inch/day for a total of 22.5 inches over at 45-day period. Leachate was collected in 23 mL fractions.

Following leaching, the column was divided into nine segments 1.25-5 cm in thickness. Soil samples were air-dried and then analyzed by LSC following combustion. Leachate fractions were analyzed for total radioactivity using LSC. Aliquots of combined 1- to 10-, 11- to 15-, 16- to 20-, 21- to 25-, 26- to 30-, 31- to 35-, 36- to 40-, and 41- to 45-day leachate fractions were extracted three times with water-saturated ethyl acetate. The aqueous fractions were extracted three times with chloroform:acetone (2:1) and once with water-saturated ethyl acetate. The extracts were combined and evaporated to near dryness. The residues were applied along with unlabeled reference standards to silica gel TLC plates, which were then developed in chloroform:ethyl acetate:acetone: acetic acid (7:10:3:3) or benzene:acetic acid (60:1). Unlabeled reference standards were visualized by UV fluorescence quenching. Radioactive area were located using a radiochromatogram scanner or autoradiography, and identified by comparison to standards.

Soil TLC

Sand, sandy clay loam, silt loam, and silty clay soils were air-dried, sieved through either 250 µm (sand and sandy clay loam soils) or 420 µm (silt loam and silty clay soils) and mixed with sufficient water to produce slurries (Table 1). The slurries were spread on glass TLC plates (20 x 20 cm) to a thickness of 0.75 - 1.5 mm, then air-dired for at least 24 hours.

Aged (30 day) soil treated with [^{14}C]isofenphos (radiochemically pure by TLC, specific activity 9.96 m Ci/mMol, Mobay Chemical Corporation) was extracted with methanol, filtered, then extracted again with methanol: water (70:30). The combined extracts were evaporated to near dryness.

Approximately 10 µl of the extract was applied at a distance 2.5 cm from the bottom of each TLC plate. The plates were developed in water to a distance 10 cm from the origin and allowed to dry. The development and drying of the TLC plates was repeated four additional times to simulate the five void volumes of water which were calculated to have passed through the 30 cm of soil in the column leaching study. Plates were visualized by autoradiography. Total radioactivity was determined by scraping 1.5 cm zones from the plates and analyzing the scrapings by LSC following combustion. The detection limit was 0.002-0.007 ppm.

REPORTED RESULTS:

General

[^{14}C]Isofenphos aged on sandy loam soil for 30 days decreased in radioactivity by 3.4% during aging. Approximately 74% of the applied radioactivity was extractable from the soil; 90% of the extractable was isofenphos and the other 10% was isofenphos oxygen analog.

Column Leaching

Aged [^{14}C]isofenphos residues were somewhat mobile in a column of sandy clay loam soil leached with ~22.5 inches of water over a 45-day period (Table 2). Following leaching, 9.4% of the [^{14}C]residues were recovered in the leachate. Isofenphos oxygen analog (6.92% of the applied) and isopropyl salicylate (0.23%) were identified in the leachate.

Soil TLC

[^{14}C]Isofenphos residues were somewhat mobile on soil TLC plates (Table 3).

DISCUSSION:

General

1. Although the registrant stated that the test substance was radiochemically pure by TLC, the specific radiochemical purity was not reported.

2. Soil/water relationship (K_d) values were not reported.

3. The description of the aging period was inadequate; incubation conditions, including temperature and soil moisture content, were not reported.

Column Leaching

1. [^{14}C]Residues were not characterized in the soil fractions after leaching. This should have been done since residues may have degraded over the 45-day leaching period.

Soil TLC

1. The soils were over-sieved (250-420 µm mesh sieve), which could have reduced the mobility of the test substance.

Table 1. Soil characteristics.

Soil type	Sand	Silt	Clay	Organic matter	pH	CEC (meq/100 g)
			%			
Kansas sandy clay loam[a]	56	23	21	0.7	6.0	6.9
Florida sand	92	7	1	3.7	6.9	26.6
Indiana sandy clay loam	56	21	23	0.6	5.5	24.6
Nebraska silt loam	18	57	25	5.1	7.9	40.0
Maryland silty clay	4	53	43	2.1	6.7	28.6

[a] Used in column leaching study.

Table 2. Distribution of radioactivity (% of recovered) in a column of sandy clay loam soil treated with aged (30 day) ring-labeled [^{14}C]isofenphos and leached with ~22.5 inches of water for 45 days.

Soil depth (cm)	[^{14}C]Residues
0 - 1.3	5.6
1.3 - 2.5	10.3
2.5 - 5.0	15.1
5.0 - 7.5	15.7
7.5 - 12.5	23.2
12.5 - 17.5	10.7
17.5 - 22.5	6.3
22.5 - 27.5	2.6
27.5 - 30.0	1.1
Leachate	9.4
Total	100.0

Table 3. Distribution of radioactivity (% of recovered) in aged (30 days) [^{14}C]isofenphos residues on soil TLC plates developed in distilled water.

R_f value	Soil type			
	Silty clay	Sandy clay loam	Sand	Silt loam
-0.05 - 0.10	11.6	30.9	67.1	6.4
0.10 - 0.25	28.1	40.5	16.4	56.2
0.25 - 0.40	40.8	5.8	6.8	23.2
0.40 - 0.55	4.1	5.3	6.9	7.0
0.55 - 0.70	7.0	12.0	1.9	5.7
0.70 - 0.85	7.8	4.8	0.2	0.7
0.85 - 1.00	0.6	0.7	0.7	0.8

CASE GS -- ISOFENPHOS STUDY 7 PM --

CHEM 109401 Isofenphos

BRANCH EAB DISC --

FORMULATION 04 - GRANULAR and 12 - EMULSIFIABLE CONCENTRATE

FICHE/MASTER ID No MRID CONTENT CAT 01
International Research and Development Corporation, Mattawan, MI. 1977. Soil persistence study. Mobay Report No's. 53965; 67380, 69133 and 69148. Submitted by Mobay Chemical Corporation, Kansas City, MO. Acc No. 257815.

FICHE/MASTER ID No MRID CONTENT CAT 01
Shaw, H.R. 1980. Gas chromatographic method for residues of oftanol and oftanol oxygen analog in soils. Report No. 53690. Submitted by Mobay Chemical Corporation, Kansas City, MO.

SUBST. CLASS = S.

DIRECT RVW TIME = 10 (MH) START-DATE END DATE

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

APPROVED BY: C. Eiden
TITLE: Groundwater Program Chemist
ORG: EAB/HED/OPP
TEL: 557-1450

SIGNATURE: DATE:

CONCLUSIONS:

Dissipation - Terrestrial Field

1. Data from the Tifton, Georgia site are scientifically sound and provides supplemental information towards the registration of isofenphos. Data from Stanley, Kansas, Yakima, Washington and Canby, Oregon sites are unacceptable because the data are either variable or sampling protocol was inadequate (only two sampling dates).

2. Isofenphos residues in field plots at the Kansas site treated five times with isofenphos (Amaze 10 G) at 160 oz ai/A, ranged from 0.11 to 27.5.

3. This portion of the study does not fulfill EPA Data Requirements for Registering Pesticides because no pretreatment samples were analyzed, degradates were not characterized, sampling depth was insufficient, field test data and meterological data were incomplete and no freezer storage stability data were provided.

Although terrestrial field dissipation data from the Tifton, Georgia site are scientifically sound, and data from Stanley, Kansas, Yakima, Washington and Canby, Oregon sites are either variable or sampling protocol was inadequate (only two sampling dates), the results provided may still be used in evaluating the potential risk of groundwater contamination by isofenphos. Field plots at the Kansas and Washington sites were treated five times with isofenphos (Amaze 10 G) at 160 oz ai/A, and the Oregon and Georgia sites were treated once with isofenphos (Amaze 6 EC) at 32 oz ai/A. Soil samples were analyzed at various sampling intervals up to 1157 days after the first treatment at the Kansas site, 1230 days after the first treatment at the Washington site 365 after the first treatment at the Oregon and Georgia sites. Isofenphos residues (uncharacterized) in the 0- to 6and 6- to 12-inch sampling depth ranged from 0.11 to 27.5 ppm and 0.08 to 1.62 ppm respectively at the Stanley, Kansas site, 0.46 to 18.1 ppm and 0.11, 14.40 ppm respectively at the Yakima, Washington site, 0.18 to 1.29 ppm and <0.001 to 0.85 ppm respectively at the Tifton, Georgia site and 6.75 to 23.7 ppm and 0.08 to 20.55 ppm respectively at the Canby, Oregon site. Isofenphos residues from all the sites appear to be persistent in the field and leach. A new field dissipation study addressing the degradates, analysis of pretreatment samples, deeper sampling depth, and complete field data are required to accurately assess the leaching potential of isofenphos and its degradates in the field.

MATERIALS AND METHODS:

Isofenphos (Amaze 10 G or 6 EC, test substance not further characterized) was applied (soil broadcast incorporated or post-hole) to field plots (20 x 60 feet) of silty clay loam soil located in Stanley, Kansas between June 24, 1974 and August 28, 1975, clay soil located in Yakima, Washington between June 12, 1974 and October 17, 1975, loamy sand soil located in Tifton, Georgia on June 4, 1980 and silt loam soil located in Canby, Oregon on May 30, 1980 (Table 1), at 160 or 32 oz ai/A. Untreated plots served as controls. Soil samples (0- to 6- and 6- to 12-inch depths) were taken immediately posttreatment and at various intervals up to 1230 days after the first treatment. Soil from untreated control plots were sampled at 0 days posttreatment. The samples were frozen up to ~1 to 3 1/2 years until analysis.

The soil samples were extracted (Soxhlet extraction for 16 to 24 hours) with chloroform:methanol (7:3). The extract was concentrated and partitioned three times with hexane:acetonitrile (1:1). The acetonitrile extracts were combined, evaporated to dryness and reconstituted in methanol:distilled water (2:5). The aqueous extract was partitioned three times with hexane and the extracts were combined. The flask was rinsed twice with acetone. The extracts and rinsings were combined, concentrated, adjusted to volume with acetone and analyzed by GC (detection unspecified). The aqueous phases were discarded. Reported recoveries from clay loam, sandy loam and silty clay loam samples fortified with isofenphos at 0.05 ppm ranged from 80 to 106%. The detection limit was 0.01 ppm.

REPORTED RESULTS:

At the Stanley, Kansas site in the 0- to 6- and 6- to 12-inch depth, isofenphos residues at 160 oz ai/A treatment rate varied from 6.42 to 27.5 ppm

after the first treatment with no discernible pattern. After the second treatment, isofenphos residues decreased from 21.1 to 5.36 ppm in the 0- to 6-inch depth and increased from 0.08 to 0.11 ppm in the 6- to 12-inch depth. After the third treatment, isofenphos residues in the 0- to 6- and 6- to 12-inch depth decreased from 9.48 to 4.40 ppm and 1.62 to 0.32 ppm respectively and after the fourth treatment the residues decreased from 10.8 to 0.67 ppm and 0.14 to 0.07 ppm respectively. No isofenphos residues were detected in the controls (Table 2). At the Yakima, Washington site in the 0- to 6- and 6- to 12-inch depth, isofenphos residues at 160 oz ai/A treatment rate decreased from 5.72 to 4.59 ppm and 4.65 to 0.16 ppm respectively after the first treatment and from 9.15 to 4.76 ppm and 4.57 to 1.66 ppm after the fifth treatment. After the second, third and fourth treatments, isofenphos residues were varible with no discernible pattern. No isofenphos residues were detected in the controls (Table 3).

At the Tifton, Georgia site treated at 32 oz ai/A, isofenphos residues decreased from 1.29 to 0.18 in the 0- to 6-inch depth and 0.85 ppm were recovered only at the last sampling interval. No isofenphos residues were detected in the controls (Table 4).

At the Canby, Oregon site treated at 32 oz ai/A isofenphos residues ranged from 15.15 to 7.0 ppm in the 0- to 6- inch depth and from 17.25 to 0.08 ppm in the 6- to 12-inch depth with no discernible pattern. No isofenphos residues were detected in the controls (Table 4).

DISCUSSION:

1. Data from the 160, 160 + 160, 160 + 160 + 160 and 160 + 160 + 160 + 160 oz ai/A treatments at Yakima, Washington site and data for the 160 oz ai/A treatment at Stanley, Kansas site were too variable to accurately assess the dissipation of isofenphos residues in soil (Tables 2 and 3).

2. No pretreatment soil samples were taken to confirm the absence of isofenphos residues. It is not clear if the control samples were taken from the actual test plots or not.

3. Degradates were not characterized.

4. Soil was not sampled to a sufficient depth to determine the extent of leaching; isofenphos residues were detected in the 6- to 12-inch depth.

5. Meterological data such as air temperatures were not provided. Soil temperature data provided were 10 to 160 miles away from the actual test site except at the Tifton, Georgia location were only one temperature in June 1980 was reported. Cumulative rainfall was reported only at the last sampling interval at the Canby, Oregon site.

6. Field test data such as slope of the field and depth to the water table were not reported.

7. Soil samples were stored for ~1 to 3 1/2 years after collection; however, no freezer storage stability data were provided.

8. The soil from Yakima, Washington site used in this study was misclassified. According to the USDA soil Classification System the soil reported as loam was a clay soil and is referred to as such in this review.

9. Terrestrial field dissipation data from 23 locations were submitted by the registrant; and data from only four locations were reviewed because all the data are not required by the EPA. However, the data from all 23 studies are variable with no discernible pattern of degradation of isofenphos residues.

Table 1. Soil characteristics.

Soil type	Sand	Silt	Clay	Organic matter	pH	CEC (mEg/100 g)
	%					
Clay Yakima, WA	36.2	41.0	22.8	2.38	6.0	17.16
Silty clay loam Stanley, KS	8	62	30	3.2	6.7	12
Loamy sand Tifton, GA	84	10	6	0.3	4.4	11.2
Silt loam Canby, OR	35	51	14	3.4	5.2	30.6

Table 2. Isofenphos residues (ppm) in silty clay loam soil from field plots in Stanley, Kansas, treated (soil broadcast incorporated) with isofenphos (Amaze 10 G).

Sampling interval (days)		Isofenphos residues sampling depth (inches)		Cumulative Rainfall inches
After first treatment	After most recent treatment	0- to -6	6- to-12	
		160 oz ai/A		
Control	Control	--	ND[a]	--
0	0	6.42	--	--
14	14	27.5	0.08	0.82
30	30	2.66	0.11	0.82
63	63	0.11	--	6.80
		160 + 160 oz ai/A		
81	0	21.1	1.62	11.01
95	14	18.1	0.53	11.01
112	31	11.9	1.17	13.02
269	188	3.56	0.32	22.12
		160 + 160 + 160 oz ai/A		
399	0	9.48	0.47	37.07
429	30	4.40	0.29	38.51
		160 + 160 + 160 + 160 oz ai/A		
430	0	10.8	--	38.51
460	30	3.04	0.14	42.70
554	124	1.00	0.15	47.79
610	180	0.79	0.03	48.57
669	239	0.91	0.76	52.89
792	362	1.10	0.08	64.80
1012	582	0.67	0.07	74.98
		160 + 160 + 160 + 160 + 160		
1157	0	15.7	--	98.77

[a] Not detected; detection limit was 0.01 ppm.

Table 3. Isofenphos residues (ppm) in loam soil from field plots in Yakima, Washington, treated (soil broadcast incorporated) with isofenphos (Amaze 10 G) at 160 oz ai/A.

Sampling interval (days)		Isofenphos residues sampling depth (inches)		Cumulative Rainfall inches
After first treatment	After most recent treatment	0- to -6	6- to-12	
		160 oz ai/A		
Control	Control	ND[a]	ND	--
0	0	5.72	4.65	--
14	14	5.31	0.25	0.01
30	30	3.68	0.11	0.08
62	62	4.59	0.16	0.08
		160 + 160 oz ai/A		
62	0	10.1	0.27	0.08
76	14	3.36	0.61	0.19
92	30	0.46	0.52	0.21
311	249	7.06	5.80	0.66
q				
		160 + 160 + 160 oz ai/A		
428	1	8.17	4.44	6.76
458	30	13.07	--	--
488	60	9.88	--	9.19
		160 + 160 + 160 + 160 oz ai/A		
498	91	17.0	3.52	11.17
623	125	1.70	14.4	11.23
679	181	18.1	3.10	12.89
921	242	12.9	4.16	13.66
1053	555	9.15	4.57	15.86
1230	732	4.76	1.66	19.10

[a] Not detected; detection limit was 0.01 ppm.

Table 4. Isofenphos residues (ppm) in the soil from two locations treated (post-hole) with Isofenphos (Amaze 6 EC) at 32 oz ai/A.

Sampling interval (days)		Isofenphos residues sampling depth (inches)		Cumulative Rainfall inches
After first treatment	After most recent treatment	0- to -6	6- to-12	
		Tifton, Georgia - loamy sand		
control	control	ND[a]	--	--
0	0	1.29	--	
30	30	1.12	<0.01	3.85
61	61	0.80	<0.01	6.00
92	92	0.66	<0.01	9.06
122	122	0.57	<0.01	11.26
274	274	0.25	<0.01	--
365	365	0.18	0.85	--
		Canby, Oregon - silt loam		
control	control	--	--	--
0	0	15.25	17.25	--
31	31	14.25	16.50	--
61	61	7.0	10.75	--
91	91	6.75	8.0	--
123	123	10.0	10.75	--
307	307	23.7	20.55	--
365	365	16.5	0.08	2.57

[a] Not detected; detection limit was 0.01 ppm.

CASE GS -- ISOFENPHOS STUDY 8 PM --

CHEM 109401 Isofenphos

BRANCH EAB DISC --

FORMULATION 90 - FORMULATION NOT IDENTIFIED

FICHE/MASTER ID No MRID CONTENT CAT 01

Strankowski, K.J. 1979. Amaze octanol/water partition coefficient. Mobay Report No. 68246. Prepared and submitted by Mobay Chemical Corporation, Agricultural Chemicals Division, Kansas City, MO. Acc. No. 257815.

SUBST. CLASS = S.

DIRECT RVW TIME = 4 (MH) START-DATE END DATE

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

APPROVED BY: C. Eiden
TITLE: Groundwater Program Chemist
ORG: EAB/HED/OPP
TEL: 557-1450

SIGNATURE: DATE:

CONCLUSIONS:

Ancillary Study - Octanol/Water Partition Coefficients

1. This study is scientifically sound and provides supplemental information towards the registration of isofenphos.

2. The octanol/water partition coefficient (K) values for [^{14}C]isofenphos (radiochemical purity 92%) were 4176-4283 in water-saturated octanol solutions containing 1 and 0.1 mg/mL isofenpos.

3. This study fulfill EPA Data Requirements for Registering Pesticides.

4. The octanol/water partition coefficient (K_d) vaules for [^{14}C]isofenphos were 4176-4283 in water saturated octanol solutions containing 1 and 0.1 mg/mL isofenphos.

MATERIALS AND METHODS:

In order to determine the partition equilibration time at 20°C, a centrifuge tube containing ring-labeled [^{14}C]isofenphos (radiochemical purity 92%, specific activity 1.93 mCi/mMol, source unspecified), at 1 mg/mL in water-saturated octanol:distilled water (1:24), was shaken

for 0.5, 1, 2, and 5 minutes. After each shaking, the tube was centrifuged (5 minutes) and the octanol layer was analyzed by LSC. Equilibrium was reached within one minute.

To determine the partition coefficient for isofenphos at 20°C, centrifuge tubes containing [^{14}C]isofenphos, at 1 and 0.1 mg/mL in water-saturated octanol:water (1:24) solutions, were shaken for 2 minutes, centrifuged, and the phases separated and analyzed by LSC.

The octanol/water partition coefficeint (K) values were calculated using the following formula:

$$K = \frac{\text{mg in octanol x mL of water used}}{\text{mg in water x mL of octanol used}}$$

REPORTED RESULTS:

K values for isofenphos at 1 and 0.1 mg/mL in water-saturated octanol: water (1:24) solutions were 4176 and 4283, respectively. The average K value for isofenphos was 4230.

DISCUSSION:

1. Characteristic of the water, including pH, dissolved oxygen content, hardness, and alkalinity, were not provided.

2. The source of the test substance was not specified.

EXECUTIVE SUMMARY

A final assessment of the leaching potential of isofenphos cannot be made until either new studies or additional data are provided. Based on the limited information available, it appears that isofenphos is somewhat mobile in sandy loam soil and persists in the environment sufficiently long enough to contaminate the groundwater.

The hydrolysis study does not provide information that may be used in evaluating the potential risk of groundwater contamination by isofenphos because discrepancies existed in the data. [^{14}C]Isofenphos degraded with a half-life of 28-98 days at 1 and 10 ppm in solutions buffered at pH 3 (calculated half-lives, 79 days at 1 ppm and 30 days at 10 ppm) and 9 (calculated 88 days at 1 ppm and 32 days at 10 ppm). Degradates included deaminated isofenphos, isofenphos oxygen analog, deaminated isofenphos oxygen analog, isopropyl salicylate, N-isopropyl salicylamide salicylic acid and deethylated isofenphos oxygen analog which accounted for ≤ 22% of the applied at 1 or 10 ppm. However, the study contained several discrepencies in the data, for example, one table indicated that 90% of the applied was recovered from day 98 samples of the pH 9 aqueous buffered solution at 10 ppm. Another table indicated that 4% of the applied was in the organic fraction, 4% was in the aqueous fraction, and 92% was lost. In the figure, volatiles totaled ~14% of the applied, but in the text, the registrant stated that 92% of the applied has volatilized. Due to the variability in the reported data, a new hydrolysis study is required with complete material balances, and an incubation temperature of 25 ±1°C.

Although the photodegradation in water study is unacceptable, it provides informaiton that may be used in evaluating the potential risk of groundwater contamination by isofenphos. Isofenphos in nonsensitized and sensitized (2% acetone) buffered solution irradiated with artificial light and incubated at ~20°C, degraded with half-lives of >30 days (calculated 51 days) and 12-24 hours (calculated 13.6 hours), respectively. In the dark controls of nonsensitized buffered solutions, [^{14}C]isofenphos decreased by 24% of the applied after 30 days of incubation. The major degradate (3,3-dimethyl isoindolin-1-one) in the sensitized irradiated buffered solutions accounted for a maximum of ~21% of the applied. Volatiles totaled 0.04-0.08% of the applied. The study results show that isofenphos is stable to photolysis in non-sensitized systems.

However, a new study is required with complete material balances (up to ~25% of the applied radioactivity was unaccounted for from the nonsensitized dark control and irradiated samples and up to 97% from the sensitized irradiated buffered solutions), comparison of artificial light source with natural sunlight, adequate degradate characterization and complete characterization of the test substance.

The study on photodegradation on soil provides information that may be used in evaluating the potential risk of groundwater contamination by isofenphos. Ring-labeled [^{14}C]isofenphos (purity unspecified), at ~302 µg/plate, degraded with a half-life of 1-3 days (calculated 2-6 days) on silt loam soil TLC plates irradiated with artificial light (0.34 W intensity). After 26 days of irradiation, isofenphos comprised 7% of the applied radioactivity, and the major degradates, isofenphos oxygen analog and des-N-isopropyl oxygen analog, comprised a combined total of 31% of the applied. The degradates des-N-isopropyl-isofenphos, isopropyl salicylate and phenol accounted for a maximum of 1-6% of the applied at 5-7 days posttreatment and were either not

detected or 1% at 26 days posttreatment. Unextractable residues totaled 25% of the applied at 26 days posttreatment. In the dark control, isofenphos comprised 95% of the applied radioactivity at 26 days posttreatment. The study results indicate that isofenphos is stable to photodegradation on soil.

Additional information on complete characterization of the test substance, comparison of the artificial light source to natural sunlight, complete material balances and either measuring or controlling volatiles are required.

Although the aerobic soil metabolism portion of the study is unacceptable, it provides information that may used in evaluating the potential risk of groundwater contamination by isofenphos. Isofenphos in nonsterile silt loam and sandy loam soils, incubated in the greenhouse, degraded with half-lives of 60 days (calculated 59 days) and 120-240 days (calculated 127 days), respectively. The major degradate, isofenphos oxygen analog, at 60 days posttreatment, accounted for 18% in nonsensitized silt loam soil, 11% in nonsensitized sandy loam soil, and was not detected in sterilized sandy loam soil. Unextractable residues 16-21% and volatiles totaled <26.2% at 340 and 165 days posttreatment respectively.

However, a new study is required with complete material balances (up to 61 and 69% of the applied was unaccounted for from sandy loam and silt loam soils respectively). When an attempt was made by the reviewer to combine volatile and soil residue data provided for the sandy loam soil study (which appeared to be the intent of the registrant in spite of having different sampling intervals), complete material balances could not be achieved. Also, the new study should report the incubation temperature, either measure or control the volatiles and maintain the soil moisture content at 75% of 0.33 bar.

The anaerobic soil metabolism portion of the study is scientifically sound and provides supplemental information that may be used in evaluating the potential risk of groundwater contamination by isofenphos. Ring-labeled isofenphos at 8.7 ppm degraded with a half-life of >90 days in sandy loam soil. At 90 days posttreatment isofenphos comprised 72% of the applied and the only degradate, isofenphos oxygen analog, accounted for 3% of the applied. Unextractable residues comprised 13% of the applied. This study indicates that isofenphos is stable to anaerobic soil metabolism.

However, the study was not done at 75% of 0.33 bar soil moisture content and volatiles were neither measured nor controlled. Also additional information on complete characterization of the test substance and incubation temperature should be reported.

The soil TLC leaching and adsorption/desorption study does not provide information that may be used in evaluating the potential risk of groundwater contamination by isofenphos because soils were sieved through 250-420 µm mesh screen, which could have reduced the mobility of the test substance. The sieved (250-420 µm) soils showed R_f values for isofenphos ranging from 0.14 to 0.23.

Information on soil/water relationship (K_d) values, characterization of the test substance and CEC of the test soils is required.

The column leaching portion of the study provides information that may used in evaluating the potential risk of groundwater contamination by isofenphos. Aged (30 days) [^{14}C]isofenphos residues (66.6% [^{14}C]isofenphos, 7.4% isofenphos oxygen analog, 26% unextractable) were somewhat mobile in a column of sandy clay loam soil leached with ~22.5 inches of water over a 45-day period, [^{14}C]residues were distributed throughout the soil column. Approximately 9.4% of the [^{14}C]residues were recovered in the leachate. Isofenphos oxygen analog and isopropyl salicylate were identified in the leachate. This study indicates that isofenphos is somewhat mobile in sandy clay loam soil. However, information on [^{14}C]residues in the soil fraction after leaching is required.

However, a new column leaching study is required with characterization of [^{14}C]residues in the soil fractions after leaching. Also, additional data on the purity of the test substance, incubation temperature, and soil moisture content and K_d values should be provided.

The soil TLC portion of the study does not provide information that may be used in evaluating the potential risk of groundwater contamination by isofenphos because the soils were sieved through 250 or 420 µm mesh screens, which could have reduced the mobility of the test substance.

Although terrestrial field dissipation data from the Tifton, Georgia site are scientifically sound, and data from Stanley, Kansas; Yakima, Washington; and Canby, Oregon sites are either variable or sampling protocol was inadequate (only two sampling dates), the results provided may, nevertheless, provide information useful in evaluating the potential risk of groundwater contamination by isofenphos. Field plots at the Kansas and Washington sites were treated five times with isofenphos (Amaze 10 G) at 160 oz ai/A, and the Oregon and Georgia sites were treated once with isofenphos (Amaze 6 EC) at 32 oz ai/A. Soil samples wre analyzed at various sampling intervals up to 1157 days after the first treatment at the Kansas site, 1230 days after the first treatment at the Washington site and 365 days after the first treatment at the Oregon and Georgia sites. Isofenphos residues (uncharacterized) in the 0- to 6- and 6- to 12-inch sampling depth ranged from 0.11 to 27.5 ppm and 0.08 to 1.62 ppm respectively at the Stanley, Kansas site, 0.46 to 18.1 ppm and 0.11 14.40 ppm respectively at the Yakima, Washington site, 0.18 to 1.29 ppm and <0.001 to 0.85 ppm respectively at the Tifton, Georgia site and 6.75 to 23.7 ppm and 0.08 to 20.55 ppm respectively at the Canby, Oregon site. Isofenphos residues from all the sites appear to be persistent in the field and leach.

However, a new field dissipation study addressing the degradates, analysis of pretreatment samples, deeper sampling depth and complete field data is required to accurately assess the leaching potential of isofenphos and its degradates in the field.

The octanol/water partition coefficient (K_d) values for [^{14}C]isofenphos were 4176-4283 in water saturated octanol solutions containing 1 and 0.1 mg/mL isofenphos.

RECOMMENDATIONS

Hydrolysis: A new study is required.

Photodegradation in water: A new study is required.

Photodegradation on Soil: Additional data are required before the study can be accepted. The purity of the test substance and comparison of artificial light to natural sunlight should be submitted and loss of the test compound due to volatilization should be confirmed.

Aerobic soil metabolism: A new study is required.

Anaerobic soil metabolism: Additional data are required before the study can be accepted. The purity and source of the test substance and incubation temperature should be submitted.

Leaching and adsorption/desorption: A new mobility study conducted either through column leaching, batch equilibrium or soil TLC is required.

Terrestrial field dissipation: A new field dissipation study is required.

The registrant should comply with all suggestions discussed under the executive summary by submitting either new studies or additional data, so that a final assessment of the leaching potential of isofenphos may be made.

REFERENCES:

The following studies were reviewed as new submittals:

Namara, F. T. 1977. Dissipation of [^{14}C]oftanol in buffered aqueous solution. Report No. 53617. Prepared and submitted by Mobay Chemical Corporation, Kansas City, MO Acc. No. 257815.

Poje, A.J. 1979. Amaze photoproduct identification. Mobay Report No. 68146 Prepared and submitted by Mobay Chemical Corporation, Kansas City, MO. Acc. No. 257815.

Weissenburger, B. and R.J. Pollock. 1979. Photodegradation of [^{14}C]amaze on a soil surface. Mobay Report No. 68245. Prepared by Analytical Development Corporation, Monument, CO, and submitted by Mobay Chemical Corporation, Agricultural Chemicals Division, Kansas City, MO. Acc. No. 257815.

Minor, R.G. and J.J. Murphy. 1977. Metabolism of [^{14}C]oftanol in soil. Mobay Report No. 53643. Prepared by Mobay Chemical Corporation, Kansas City, MO. Acc. No. 257815.

Thornton, J.S., J.B. Hurley, and J.J. Obrist. 1976. Soil thin-layer mobilty of twenty four pesticides chemicals. Mobay Report No. 5106 Prepared and submitted by Mobay Chemical Corporation, Kanasas City, MO. Acc. No. 257815.

Obrist, J.J. and J.S. Thorton. 1977. Leaching characteristics of aged oftanol soil residues. Mobay Report No. 53944. Prepared and submitted by Mobay Chemical Corporation, Kansas City, MO. Acc. No. 257815.

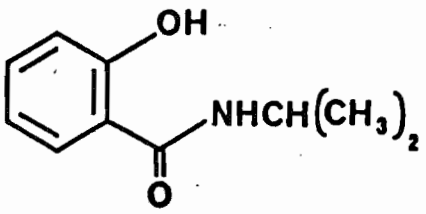
International Research and Development Corporation, Mattawan, MI. 1977. Soil persistence study. Mobay Report No's. 53965;067380, 69133 and 69148. Submitted by Mobay Chemical Corporation, Kansas City, MO. Acc No. 257815.

Shaw, H.R. 1980. Gas chromatographic method for residues of oftanol and oftanol oxygen analog in soils. Report No. 53690. Submitted by Mobay Chemical Corporation, Kansas City, MO.

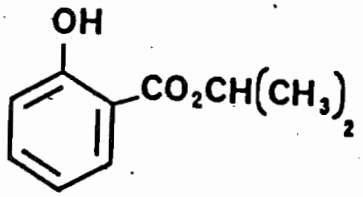
Strankowski, K.J. 1979. Amaze octanol/water partition coefficient. Mobay Report No. 68246. Prepared and submitted by Mobay Chemical Corporation, Agricultural Chemicals Division, Kansas City, MO. Acc. No. 257815.

APPENDIX

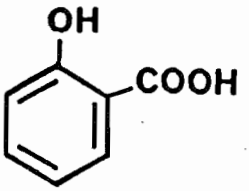
ISOFENPHOS AND ITS DEGRADATES



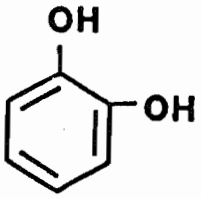
Isopropyl salicylamide



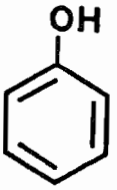
Isopropyl salicylate



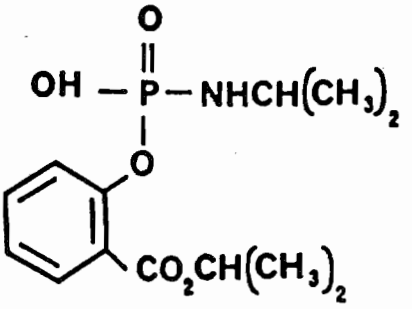
Salicyclic acid



Catechol

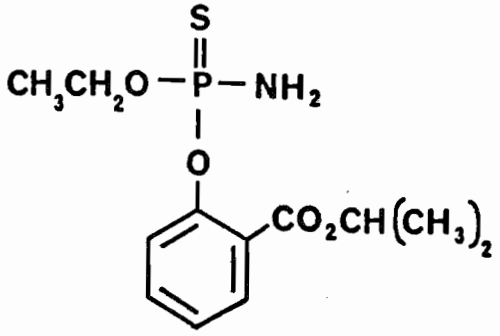


Phenol



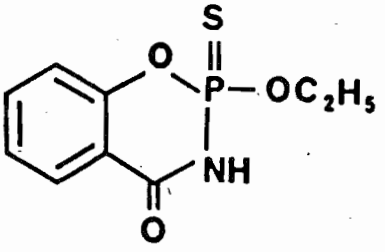
Isopropyl 2-[[(hydroxy)(isopropylamino phosphinyl]oxy]benzoate

(Deethylated isofenphos oxygen analog)



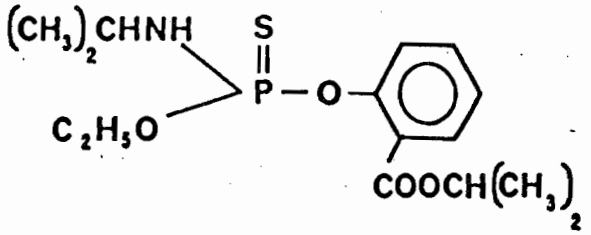
Isopropyl 2-[[(amino)(ethoxy)-phosphinothioyl]oxy]benzoate

(Des-N-isopropyl isofenphos)



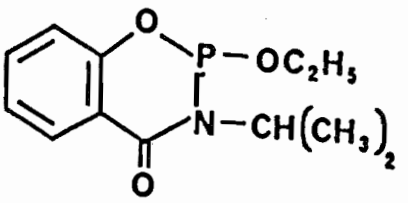
2-Ethoxy-3-hydro-4-oxo-2-thioxo-1,3,2-benzoxazaphosphorine

(Des-isopropyl cyclic isofenphos)



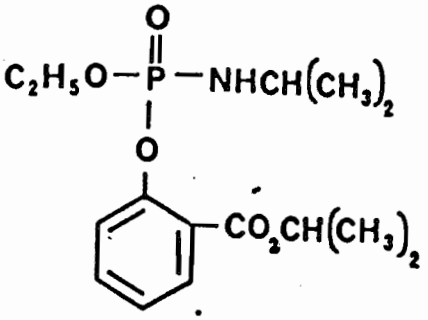
Isopropyl 2-[[(ethoxy)(isopropylamino)-phosphinothioyl]oxy]benzoate

(Isofenphos)



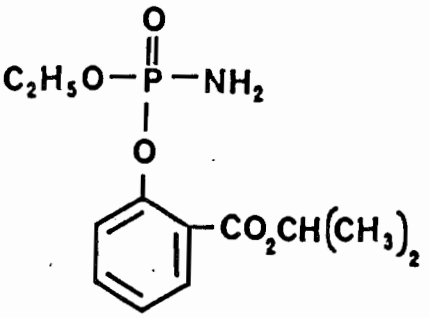
2-Ethoxy-3-isopropyl-4-oxo-2-thioxo-1,3,2-benzoxazaphosphorine

(Cyclic isofenphos)



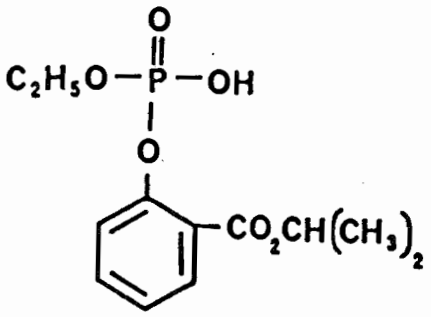
Isopropyl 2-[[(ethoxy)(isopropylamino)-phosphinyl]oxy]benzoate

(Isofenphos oxygen analog)



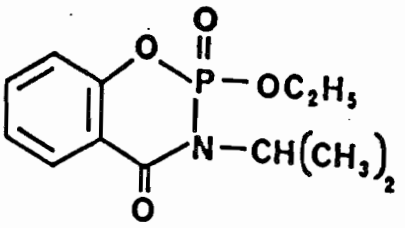
Isopropyl 2-[[(amino)(ethoxy)phosphinyl]-oxy]benzoate

(Des-N-isopropyl isofenphos oxygen analog)



Isopropyl 2-[[(ethoxy)(hydroxy)phosphinyl]-oxy]benzoate

(Deaminated isofenphos oxygen analog)



2,4-Dioxo-2-ethoxy-3-isopropyl-1,3,2-benzoxazaphosphorine

(Cyclic isofenphos oxygen analog)