

Santers
Schlosser
Ney

1 NOV 1971

Preliminary Registration Review of
 PP no. 1F1105 for Endothall
 (Dimethylalkylamine, potassium or sodium
 salts of 7-oxabicyclo-(2.2.1)heptane
 -2,3-dicarboxylic acid.) in water.

Submitted by Pennwalt Corporation
 Filed: March 25, ~~1970~~ 1971

Introduction

A separate evaluation is done for sugar beets.
~~same section number.~~
Propose tolerance

(a) In water - - - - - 0.2ppm
 expressed as endothall (negligible)

This tolerance is based on the fact
 that residues of endothall will be below
 0.2ppm when endothall formulations
 are used in accordance with good agricultural
 practices, recommended rates and as recommended
 on the label.

(b) "Since the propose usage is not
 reasonably expected to result in
 residues of endothall in milk, eggs,
 meat, poultry or fish, tolerances are
 unnecessary"

III Analytical methods for endosulf residues in water:

(1) GLC flame ionization detection. Water samples are filtered and passed thru a cation exchange resin column to convert any endosulf salts to the free acid. The dialkyl ester is formed ^{in addition with alcohol} ~~with~~ ~~hydrochloric acid~~. ~~Extract with~~ Chloroform extract and determined by G.L.C. A sensitivity of about 0.01 PPM is claimed. Samples collected for analysis should be boiled or preferably frozen immediately after collection to arrest further ~~loss~~ biodegradation.

(2) GLC nitrogen specific detector. Water samples are filtered and acidified with HCl and glacial acetic acid. The N-methoxyimide derivative is formed by reaction with methoxyamine hydrochloride. After final solution in methanol, sample is determined by ~~the~~ GLC. Sensitivity to 0.01 PPM is claimed.

~~Average recovery for the alkyl ester method is 89%~~
Average recoveries for both methods are 89%. The methoxyimide method is preferable because of simpler procedure with fewer interferences.

~~unacceptable.~~

Directions for use

The following commercial endophthal formulations are currently registered with the USDA on a "no residue basis".

Aquathol		4581-139
Aquathol K		" - 204
"	Granular	201
"	Plus	183
	Plus Granular	200
Hydrothol	47 Granular	175
"	47	173
"	191	174
"	191 Granular	172

New Formulations

Hydout - is double the strength of Hydrothol 191
 G-Drill is double the strength of Aquathol Granular

Cautions

1. Avoid contact with or drift to other crops or plants as injury may result.
2. Wash out spray equipment with water after each operation.
3. Do not store this material where it might contaminate seeds, feed or foodstuffs.
4. Do not use treated water for irrigation or for agricultural sprays on food crops or for domestic purposes within 7 days of treatment.
5. Do not use fish from treated water for food or feed within 3 days of treatment.
6. Areas treated with Aquathol may be used for swimming 24 hours after treatment.

Discussion of Data

[Fish : Caution - Do not use fish from treated water for food or feed within 3 days of treatment.

a. Data to support the caution

Two different types of fish were exposed to two different levels of Endothal. The two types of fish used were goldfish and silver salmon fingerlings. These species were chosen ^{because} ~~since~~ one represents a warm-water fish and the other requires a much lower water temperature. The goldfish were exposed to 6.0 and 12.0 ppm of endothal and the silver salmon were exposed to 2.5 and 5.0 ppm of endothal. The exposure was up to 5 $\frac{1}{2}$ days. ~~The fish were then extracted~~

The results of the study showed that C^{14} label endothal was widely distributed throughout the

Biological constituents of both types fish of fish. There were significant amounts of radioactivity in the three solvents (ether, methanol and water) as well as unextractable residue. Only a small percentage of the radioactivity in the fish could have been free endothal on the basis of ~~adsorbed~~ adsorption of Dowex 1. In addition, the elution pattern of the radioactivity adsorbed on this resin was sufficiently different than endothal so that it was concluded that the radioactivity was probably not in the form of the parent herbicide.

Fractions which could be endothal in goldfish exposed to 12 ppm for 5.5 days was derived by two dissimilar methods of analyses. In one case it contained 0.06 ppm ~~for 5.5 days~~ and in the other 0.07 ppm.

Goldfish exposed to 6 ppm for 5.5 days contained only 0.002 ppm which could be attributed to endothal.

Salmon exposed to 5 ppm for three days contained only 0.003 ppm which could be attributed to endothal.

The petitioner concludes that endothall is rapidly degraded by fish. The petitioner assumed that the fish absorbed the herbicide. Very little of the C^{14} label could be endothall as indicated by solvent and ion exchange fractionation. The radioactivity appears to be widely distributed indicating that the fragments of degradation entered the various metabolic pathways of the fish.

2. Irrigation: Do not use treated water for irrigation within 7 days of treatment.

9. Data to support Caution

Data below in reference to the disappearance of endosulfan indicates that ~~residues~~ endosulfan residues will be present in the water at 7 days.

We need residue data reflecting a zero level of endosulfan residues at ~~7 days~~ or data ~~to indicate~~ ^{to indicate} ~~show~~ that the crops irrigated with ~~endosulfan~~ treated water do not contain endosulfan residue at the time of harvest.

b. Disappearance of Endothall from water

Days	PPM Initial Concentration					
	0.1-0.5	0.5-1.5	2	3	4	5
1	0.24	.58	1.20	.06	2.96	4.86
2	0.32	.63	1.04			
3	0.22	.37	1.14	.91	3.23	4.95
5	0.22	.51	0.91		9.0	4.87
7	0.04	.29	1.02	.77	0.4	4.03
10	0.06	.15	.39	.20	1.07	3.00
15	0.11	.11	.26	.28	1.1	1.10
20	0.04	.15	.14	.03	.55	0.87
25				.005		
30						
40						

Samples of water were collected periodically from 38 ponds or pools which had whole body treatment with different endothal products at concentrations ranging from 0.1ppm endothal equivalent to 5ppm.

Exhibit no. 2 - The Disappearance of Endothall in water
Laboratory

The results of the experiments indicated that endothall at a rate of 7ppm was not detected after 24 hours in the water obtained from Arrowhead Lake. The ~~presence~~ presence of fish, ~~or fish and mud~~ ~~and~~ fish and mud had little effect on the rate of disappearance of endothall. When the rate of application was increased to 5ppm, after six days the endothall content had been

reduced to 2.5 ppm and after 10 days endothall was not detected.

In field studies Endothall was not detected 72 hours after application regardless of the water interval. In one case, ~~then~~ it was not detected as early as 48 hours after treatment.

3. Field study

4-H LAKE (2)

water volume app. 5 million pounds

Rate of application (50 lb 5% endothal) 0.5 ppm

Samples of water taken within treated area

Location no	0 hour	72 hours	170 hours
1	1.6 ppm	0.4	0.4
2	0.4 ppm	0.4	0.4
3	0.4 ppm	0.4	0.4
4	0.4 ppm	0.4	0.4
5	1.6 ppm	0.4	0.4
6	2.5 ppm	0.4	0.4

4. Laboratory study

Experiment no. I

	<u>Control</u>	<u>24 hours</u>	<u>248 hours</u>
no mud or fish	1ppm	0.4 ppm	0.4 ppm
4 fish	1ppm	0.4 ppm	0.4 ppm
1 layer mud plus fish	1ppm	0.4 ppm	0.4 ppm
Layer mud plus fish	1ppm	0.4 ppm	0.4 ppm

Dissipation rate of Endothall in water

5. Chromatography of C^{14} Endothall in different solutions

<u>Solution</u>	<u>R_f of spots in Diethyl-H₂O</u>
Na endo-H ₂ O	0.36 + 0.60
Na endo-H ₂ O-soil	0.41
Na endo-H ₂ O-soil-sucrose	0.075 + 0.18
Na endo-fresh H ₂ O	0.42 + 0.60

6. Degradation of endothall in water

Studies of the decomposition of endothall in water were ~~performed~~ performed using ~~C^{14} label~~ C^{14} labeled endothall. This was an aqueous solution of the disodium salt of endothall containing 4.5 mg per ml. Two sets of three jars each containing 4.5 ppm radiolabeled in the final solution were set up. One set of jars was held at room temperature, the other at ~~20~~ 0°C. At the end of seven days, samples of the water were taken and

chromatographed

Results

The trend of disappearance of the Radioactivity from jars one, two and three held at room temperature is shown in ~~the~~ ~~analogy~~ graph. ~~The~~ graph shows that there is a general loss of radioactivity probably as $C^{14}O_2$. The greatest loss occurs in the jars containing the trace of organic matter and it is this jar that conditions more nearly resembling that in a pond or a lake would be found. It is apparent that in the jar containing soil and organic matter together with the solution of endothal that the R_f value has changed appreciably. This suggests that metabolism of the radioendothal has occurred.

Additional evidence for the breakdown of Radioendothal in water is afforded by the experiment wherein the evolved gas from the solution was trapped in sodium hydroxide and counted. Finally, an examination of

The behavior of radioactivity in the different solutions upon boiling with dilute hydrochloric acid was determined.

These experiments indicated that ~~entot~~ endotoxin breaks down in water. Since water in lakes, ponds, irrigation ditches, drainage ditches, have at one time or another been in contact with soil, it is likely that these waters contain many of the same microorganisms as found in soil. Additional work would be required to quantitate these data.

7. Aquatic plants (Exhibit 35)

C^{14} was incorporated into normal constituents of the plant with particularly high levels in the insoluble portions, such as alkyl acids, proteins and fats. These portions are further utilized by the biochemical system of the organism and finally released in the form of CO_2 . No metabolic products of endophytes accumulate in the aquatic plant.

⑨ Residues of endothall in P.P.M. in farm reservoirs after application of endothall to control certain aquatic weeds.

Application number	Calculated initial conc. P.P.M.	Time after treatment				
		0.5 hr (P.P.M.)	4 days (P.P.M.)	8 days (P.P.M.)	12 days (P.P.M.)	20 days (P.P.M.)
1	3.0	2.70	1.20	1.30	1.15	
2	2.0	1.60	0.50	0.46	0.57	
3	1.9	1.90	1.90	1.60	1.60	
4	1.8	1.50	1.40	1.20	1.40	
5	1.7	1.25	1.15	1.65	1.15	
6	1.4	—	1.15	1.60	0.60	
7	0.9	0.41	0.23	0.10	0.03	
8	0.8	0.68	0.76	0.36	0.18	
9	0.7	0.60	0.09	0.60	0.60	
10	0.6	0.90	0.50	0.52	0.45	
11	0.5	—	0.76	0.68	0.80	0.80
12	0.4	0.40	0.19	0.22	0.21	
13	0.3	0.85	0.78	0.46	0.32	
14 ^a	0.3	1.20	0.44	0.25	0.12	0.60
14 ^b	—	0.60	0.12	0.17	0.10	0.00

Average 1.16

(a) Samples collected above thermocline.

(b) Samples collected below thermocline.

(3) (Continued). Water temperature, total hardness, pH, and ratio of bottom soil surface to volume of water did not appear to be associated with dissipation. ~~The presence of a thermocline in a body of water~~ if a thermocline is present the concentration below it is consistently less than the concentration initially applied and less than the concentration above the thermocline. Smallmouth bass, green sunfish, and mosquitofish inhabited the reservoirs, no dead or distressed fish were noted.

16 19

9. The movement of Endothall within a treated Pond.

This experiment was ~~de~~ designed by DR. R. R. Yeo, USDA, California, for the ~~pur~~ purpose of establishing how fast and how thoroughly endothall moves within a treated Pond.

Pond size -- 15 acre foot
Treatment -- ~~by boat~~ No endothall ~~by~~ by boat

PPM endothall acid equivalent

Time	<u>site 1</u>		<u>2</u>		<u>3</u>		<u>4</u>	
	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
2 hours	9.6	1.0	3.9	2.4	7.3	0.92	6.2	9.0
4 days	3.2	4.5	6.0	1.6	6.9	3.3	5.8	9.4
7 days	2.8	3.7	4.3	2.8	2.2	2.5	2.2	2.9
10 days	1.1	0.66	1.0	1.2	0.98	0.93	0.93	1.2
15 days	0.29	0.37	0.28	0.37	0.27	0.149	0.43	0.14
26 days	N.D.				N.D.	N.D.	N.D.	

~~17~~ 20

This data shows that it takes about 7-10 days for endothall to reach the same concentration on bottom and on surface, as well as to be evenly distributed in all points of the lake.

18 2.

10. A paper on the duration of toxicity of endosulfan in water is presented. The bioassay method of analysis was used.

Endosulfan applied P.P.M	Tank contents	Hours to reach 0.5 P.P.M endosulfan	Days to reach 0.1 P.P.M endosulfan
5	Lake water Lake water	957	61
5	" " "	478	40
5	" " , mud	236	13
5	" " "	236	13
5	Lake water	146	9
5	" " fish	—	5 (0.3 P.P.M)
5	" " "	166	6 "
5	Tap water, mud	166	6 "
5	Tap water 1/2, lake water 1/2; fish, mud	166	6 "
5	Lake water, fish, mud	166	6 "
5	Lake water, plant debris	172	12
5	Tap water fish	502	21
10	Lake water, plant debris	364	22
10	Lake water, mud	364	22
10	Lake water, plant debris, mud	364	22
10	Tap water, mud	337	20
10	Tap water, plant debris	337	20
10	Tap water, plant debris, mud	337	20
10	Lake water, plant debris	172	12

22

Soil and animal feeding studies
were evaluated in pp no. 2F0972
and given a favorable opinion.

V Conclusion

1. Fish studies should be conducted in pond water in the presence of algae
2. Fish should be analyzed at 0, 1, 3, 7, -
and up to 30 days at various
intervals in both Field and Laboratory
~~studies~~ experiments.
3. Analysis should be taken of the
whole eviscerated fish, deheaded and
descaled.
4. ^{the} three types of fish ^{that} should
be used in these experiments

23

are bottom, middle and top feeders.

§ We need to know if the crops irrigated with the endothall treated water will contain residues of endothall at the time of their harvest.

~~We need photodecomposition studies~~
~~run on endothall in water.~~

6. Photodecomposition studies ^{on endothall} should be carried out in water

~~Recommendation~~

~~Object to registration.~~
~~See conclusion. Additional residue data on fish are needed.~~

7. Soil persistence data are incomplete

8. Soil metabolism studies are insufficient in light of modern analytical technology
~~Hydrolysis studies in water at pH 5 and 7 are needed. The half-life should be determined~~

~~Recommendation~~
~~Object to registration~~ ^{pragmatic use} see conclusion