079401 CORE Fish LC50 #1 Tech 72-2

TDMS0030 DATA EVALUATION RECORD PAGE 1 OF 2

CASE GS0014 ENDOSULFAN A - (09/12/79) PM 110 10/19/79

CHEM 079401 Endosulfan (hexachlorohexahydromethano)

BRANCH EEB DISC 35 TOPIC 05100023

FORMULATION 00 - ACTIVE INGREDIENT (99%)

FICHE/MASTER ID 05008271 CONTENT CAT 03

Macek, K.J.; Lindberg, M.A.; Sauter, S.; Buxton, K.S.; Costa, P.A. (1976) Toxicity of Four Pesticides to Water Fleas and Fathead Minnows. Duluth, Minn.: U.S. Environmental Protection Agency, Environmental Research Laboratory. (EPA report no. EPA-600/3-76-099; available from: NTIS, Springfield, VA; PB-262912)

SUBST. CLASS = S.

OTHER SUBJECT DESCRIPTORS

PRIM: EEB -40-05151523 EEB -40-05054527 EEB -40-05151527
SEC: EEB -40-05054523 EEB -40-25550027 PM-R-50-05
EEB -40-25550023

DIRECT RVW TIME = 6 Hrs. (MH) START-DATE 12/12/79 END DATE 12/12/79

REVIEWED BY: Robert K. Hitch + John Tice
TITLE: Fish and Wildlife Biologist
ORG: EEB/HED/OPTS
LOC/TEL: CM #2

SIGNATURE: Robert K. Hitch DATE: 12/12/79 10-6-81

APPROVED BY:
TITLE:
ORG:
LOC/TEL:

SIGNATURE: DATE:

1. CHEMICAL: Acrolein, Heptachlor, Endosulfan and Trifluralin

2. FORMULATION: 99%, 98%, 99% and 97% ai. respectively

3. CITATION: Macek, K.J.; Lindberg, M.A.; Sauter, S.; Burton, K.S.; Costa, P.A. (1976). Toxicity of four pesticides to water fleas and fathead minnows, Duluth, Minn.: U.S. Environmental Protection Agency, Environmental Research Laboratory. (EPA Report No. EPA-600/3-76-099; available from: NTIS, Springfield, Va; PB-262912).

4. REVIEWED BY: John Tice
Fish and Wildlife Biologist, EEB

5. DATE REVIEWED: 10/6/81

6. TEST TYPE: This review evaluates the fathead minnow acute bioassay for the four chemicals.

TEST SPECIES: Fathead minnow (Pimephales promelas)

7. REPORTED RESULTS:

Chemical	Incipient LC_{50} (95% conf. limits)	Length of study
Acrolein	84 (54-130) ug/l *	6 day
Heptachlor	7.0 (5.7-8.5) ug/l	10 day
Endosulfan	0.86 (0.52-1.4) ug/l	7 day
Trifluralin	115 (48-2.1) ug/l	12 day

8. REVIEWERS CONCLUSIONS: ~~All from~~ FOUR 2/6/92 studies are scientifically sound and fulfill the guideline requirements for a freshwater fish acute toxicity test. With toxicity values of 84, 7.0 and 0.8 ug/l respectively for acrolein, heptachlor and endosulfan, this test characterizes these chemicals as very highly toxic. The results of 115 ug/l for trifluralin indicate it is highly toxic to fathead minnows.

MATERIALS AND METHODS: Acute bioassay procedures were generally those recommended in standard methods for the Examination of Water and Wastewater (APHA, 1971). Duplicate glass aquaria 30.5 x 90 x 30.5 cm tall were provided for each toxicant concentration. Water depth in each aquarium was 15 cm. Water temperature was maintained at 25 ± 1° C for these continuous-flow bioassays. The incipient LC_{50} was calculated when no additional significant mortality (< 10%) of test organisms was observed at any concentration during a 48-hour period. Ten fish were tested in each concentration with the exception of endosulfan where 20 were tested. The nominal test concentrations and percent mortality observed are listed below.

* NOTE: ug/l as printed means ug/l a ppb.

Acrolein, 20 day old fry

nominal conc. in ppb	890,	450,	220,	110,	60,	30
% mortality	100,	100,	100,	60,	10,	0

Heptachlor, 60 day old fry

nominal conc. in ppb	15,	11,	8.4,	6.3,	4.8,	3.6,	2.7
96 hr. % moratlity	70,	30,	30,	0,	0,	0,	0
10 day % mortality	100,	100,	83*	0,	0,	0,	0

*number is in error, correct number not ~~available~~ determined.

Endosulfan, age unknown. 20 fish/concentration

nominal conc. in ppb	2.0,	1.0,	0.5,	0.25
% mortality	100,	10,	5,	0

Trifluralin, 44 day old fry

nominal conc. in ppb	300,	150,	75,	37,	18
% mortality	90,	60,	70,	10,	0

The concentration and mortality data was obtained from EG&G Bionomics archives via telephone conversation with Bob Bently on 1-6-82.

JB.

1. CHEMICAL: Acrolein, Heptachlor, Endosulfan and Trifluralin

2. FORMULATION: 99%, 98%, 99%, 97% ai. respectively

3. CITATION: Macek, K.J., Lindberg, M.A., Sauter, S., Buxton, K.S., Costa, P.A. (1976). Toxicity of four pesticides to water fleas and fathead minnows, Duluth, Minn.: U.S. Environmental Protection Agency, Environmental Research Laboratory. (EPA Report No. EPA-600/3-76-099; available from: NTIS, Springfield, Va; PB-262912).

4. REVIEWED BY: John Tice
Fish and Wildlife Biologist, EEB

5. DATE REVIEWED: 10/6/81

6. TEST TYPE: This review will evaluate the Daphnia acute bioassay for the four chemicals.

TEST SPECIES: Daphnia magna

7. REPORTED RESULTS:

Chemical	48 hr. LC_{50} (95% conf. limits) ug/L *	Lowest nominal concentration having Toxicity induced mortality(ug/l)
Acrolein	57 (20-99)	50
Heptachlor	78 (46-113)	50
Endosulfan	166 (126-219) ug/1	150
Trifluralin	193 (115-327) ug/1	100

8. REVIEWERS CONCLUSIONS: All four studies are scientifically sound. With an LC_{50} value of 5 and 78 ug/1 respectively for acrolein and heptachlor the test demonstrates these chemicals are very highly toxic to daphnids. With the results of 166 and 193 ug/1 respectively for endosulfan and trifluralin, it demonstrates these chemicals are highly toxic to daphnids. All four studies fulfill the guideline requirements for a static aquatic invertebrate test.

MATERIALS AND METHODS: Acute bioassay procedures used were those recommended in Standard Methods for the Examination of Water and Wastewater (APHA, 1971). The 48 hr. LC_{50} for Daphnia magna was determined by using 5 daphnids < 24 hrs. old in each of four replicate containers for each concentration. Tests were conducted at 20° ± 1° C. A linear regression equation was calculated after converting test concentrations and percent mortality to logs and probits respectively. The concentrations tested and percents mortality are listed in Table 1.

DISCUSSION/RESULTS: The studies were classified as CORE

* ug/l = ug/l = ppb

Table 1

Heptachlor

conc. in ppb	500,	350,	200,	150,	100,	30,	10
% mortality	100,	95,	90,	70,	40,	25,	0

Endosulfan

Conc. in ppb	1000,	500,	350,	200,	150,	100
% mortality	100,	100,	100,	85,	50,	0

Trifluralin

Conc. in ppb	750,	490,	320,	210,	160,	100
% mortality	100,	80,	65,	45,	20,	30

Acrolein - no data available.

The date above was obtained from EG&G Bionomics archives via telephone conversation on 1/6/82 with Bob Bentley.

1. Chemical: Acrolein, Heptachlor, Endosulfan, and Trifluralin

2. Formulation: 99% 98% 99% 97% ai

3. Citation: Macek, K.J., Lindberg, M.A.; Sauter, S.; Buxton, K.S.; Costa, P.A. (1976). Toxicity of Four Pesticides to Water Fleas and Fathead Minnows. Duluth, Minn.: U.S. Environmental Protection Agency, Environmental Research Laboratory. (EPA Report No. EPA-600/3-76-099; available from: NTIS, Springfield, Va; PB-262912).

4. Review by: John Tice
Fish and Wildlife Biologist, EEB

5. Date Reviewed: 10-6-81

6. Test Type: This review will evaluate the Daphnia chronic test within this citation. Other reviews will evaluate the other tests cited.
Test Species: Daphnia magna

7. Reported Results: The MATC for the following chemicals are:

Acrolein	> 16.9	< 33.6 ug/l	(ppb)
Heptachlor	> 12.5	< 25.0 ug/l	(ppb)
Endosulfan	> 2.7	< 7.0 ug/l	(ppb)
Trifluralin	> 2.4	< 7.2 ug/l	(ppb)

8. Reviewers Conclusions: The studies using Acrolein, Endosulfan, and Trifluralin are scientifically sound and can be used to fulfill guideline requirements for registration. The above stated results show that these chemicals have an effect on reproduction at concentrations between 7 and 30 ug/l.

The study with heptachlor although being scientifically sound will not support registration because of the technical difficulties of assessing toxicant concentrations. This study does, however, indicate heptachlor does have an adverse reproductive effect at concentration greater than 25 ug/l.

Materials/Methods

Proportional diluters (Mount & Brungs, 1967) with a dilution factor of 0.5 and a syringe injector, delivered the test water and toxicant to the mixing chamber, mixing cells and ultimately to the test chambers. Five concentrations of toxicant and a control flowed to mixing containers and into separate glass delivery tubes leading to the replicate test chambers ~~(2 for each concentration)~~. Daphnia test system were glass battery jars, 17 cm tall, 13.5 cm diameter, with baffles. Water depth was 14 cm with a total volume of 2 liters. Four aquaria were provided for each test concentration* and the diluter was modified to include food cells which delivered a measured amount of food along with the toxicant and diluent water. Diluent water was Bionomic's "typical" well water without treatment.

* Each jar had 10 daphnids giving a total of 40 daphnids for each concentration.

Test Procedure

Survival and reproduction of Daphnia were recorded after one, two and three weeks. Reproduction was measured by recording the number of young in each experimental chamber weekly and discarding the progeny after weeks one and two. At the end of the third week, the number of original animals remaining were recorded, the specimens discarded, and 10 daphnids were randomly selected from each chamber to begin the second generation exposure. The same procedures were followed for the second and third generation.

Statistical Analysis

Due to the lack of available data, statistical analysis was not conducted. Authors conclusions were accepted.

Discussion/Results: **

Acrolein: The author reports the two highest concentrations (42.7 and 33.6 ppb) significantly reduced survival of first generation daphnids. During the second generation the effects on survival was cumulative at 33.6 ppb. Production of young was extremely variable during the first generation but generally indicate no significant reduction. Second and third generation showed less variability among treatments where reproduction occurred.

Heptachlor: Chemical analysis determined contamination of the Solvent system. Survival of Daphnia magna continuously exposed to nominal concentrations of 50 and 25 ug/l of heptachlor were reduced when compared to controls. Survival of daphnids exposed to 12.5 ug/l was not significantly different from controls. The analysis of data related to production of young per female during generations one, two and three indicates no diff. due to treatments for all concentrations. The MATC of >12.5 and < 25 ug/l is accurate.

Endosulfan: Continuous exposure to 79.7, 37.7, 15.3 and 7.0 ug/l reduced survival. The effect on survival was cumulative with survival of second generation daphnids being less than that of the first. Mean production of young per female at the 2.7 ug/l level zero for the third generation (condition blamed on a fungal growth). Despite this the data on Generation I and II are sufficient to accept the study (43 days). Current protocols call for a 21 day test.

Trifluralin: Continuous exposure of 52.7, 25.6, 14.0 and 7.2 ug/l significantly reduced survival of daphnids with survival being cumulatively less from generation to generation. Production of young per daphnia during the first two generations was significantly reduced during exposure to 52.7, 25.6 and 14.0 ug/l on days 22 and 38. On day 15 of generation one, production was reduced only for the 52.7 ug/l concentration indicating possible cumulative effects.

NOTE: ug/l = ug/l (ppb)

** Data Tables (Summed) provided at end of review.

Study Validation:

Acrolein: Core

Heptachlor: Supplemented - not repairable

Rational: The solvent system was contaminated with an unknown chemical

Endosulfan: Core

Trifluralin: Core

Endosulfan

TABLE 15. MEAN[a] PERCENT SURVIVAL OF *Daphnia magna* CONTINUOUSLY EXPOSED TO ENDOSULFAN FOR 64 DAYS

Mean Measured Conc. (µg/l).	GENERATION[b] I DAY			GENERATION II DAY			GENERATION III DAY		
	8	15	22	29	36	43	50	57	64
79.7	93	58	38	83	0	0	0	0	0
37.7	95	48	45	90	8	8	5	5	5
15.3	80	63	30	95	3	3	28	23	23
7.0	85	83	55	73	8	8	28	20	15
2.7	98	98	88	95	90	73	100	8	0
Control	100	100	100	93	90	85	80	44	15

[a]Each value represents the mean of four replicates

[b]Duration of exposure for generations I, II and III were days 1-22, 22-43, 43-64, respectively

TABLE 16. MEAN[a] PRODUCTION OF YOUNG PER FEMALE *Daphnia magna* CONTINUOUSLY EXPOSED TO ENDOSULFAN FOR 64 DAYS

Mean Measured Conc. (µg/l)	GENERATION[b] I DAY		GENERATION II DAY		GENERATION III DAY	
	15	22	36	43	57	64
79.7	7	17	-	-	-	-
37.7	7	23	5	2	5	12
15.3	4	15	23	43	14	14
7.0	6	9	18	19	15	21
2.7	13	12	19	24	0[c]	0
Control	8	12	17	34	6	17

[a]Each value represents the mean of four replicates

[b]Duration of exposure for generations I, II, and III were days 1-22, 22-43, 43-64, respectively

[c]Mortality of animals was apparently due to fungal growth in these containers

DER, Endosulfan, ID 05008271

Chemical: Endosulfan A

Formulation: 99% active material

Citation:

Macek, K.J.; Lindberg, M.A.; Sauter, S.; Buxton, K.S.; Costa, P.A. (1976) Toxicity of Four Pesticides to Water Fleas and Fathead Minnows. Duluthl, Minn.: U.S. Environmental Protection Agency. Environmental Research Laboratory. (EPA report no. EPA-600/3-76-099); available from NTIS, Springfield, VA; PB-262912.

Reviewed By: John Tice
Fish and Wildlife Biologist

Date Reviewed: 9/10/81

Test Type:

The test reported in this DER is a chronic life cycle test for the fathead minnow. This citation also contains Daphnia static and chronic tests using 4 different chemicals as well as fathead minnow static and chronic life cycle tests for the same 4 chemicals.

Reported Results:

MATC was reported to be >0.2 and <0.4 ug/l. ✓

The data and discussion show no effect after 40 weeks at the 0.2 ug/l level. No effects were observed at the 0.4 ug/l level at 60 days, after which time a diluter failure killed all fish. Control eggs transfered to this concentration did not survive.

Reviewer Conclusions:

This study is scientifically sound and demonstratic that a chronic exposure of 0.2 ug/l to fathead minnow does not adversely effect sexual development, spawning, hatchability of eggs, and survival and growth of offspring. The MATC is said to be >0. and <. ug/l. If required, This study is sufficient to meet Guideline requirements.

Reviewers Evaluations

Test Procedures:

Methodology followed the recommended bioassay procedure issued by EPA's National Water Quality Lab., Duluth, Minnesota. Duplicate glass aquaria 30.5 x 90 x 30.5 cm tall were provided for each of 5 toxicant concentrations. Water depth was maintained at 15 cm. Total volume of exposure solution was 41 L with a flow rate equal to 7 tank volumes per 24 hrs. Each aquarium was subdivided to provide space for two larval growth chambers. Concentrations tested along with the statistical information follows:

Nominal concentration ug/l	Measured concentration ug/l Mean ± SD	Range.	# Samples
0.60	0.4 ± 0.16	0.21 - 0.85	58
0.30	0.2 ± 0.08	0.05 - 0.39	29
0.15	0.10 ± 0.03	0.04 - 0.17	29
0.08	0.06 ± 0.03	0.02 - 0.13	28
0.04	0.04 ± 0.03	0.01 - 0.12	30

Statistical Analysis

Data was analized via SAS. The authors conclusions were verified.

Discussion/Results

Author reports that all fish in the 0.40 concentration died due to diluter malfunction on day 170. Prior to the malfunction all fish were described is "normal". The MATC listed as >0.2 and <0.4 may be in error. Despite the diluter malfunction at 0.4 ug/l the test is sufficiently close to the reported LC_{50} of 0.8 ug/l; and as such the test will meet guideline requirements for a fish life cycle test.

Study Validation (Branch) Supplemental/Core if required.