

US EPA ARCHIVE DOCUMENT

1-10-91

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AMENDMENT TO DER BY T. JOHNSTON, 4/12/82

1. CHEMICAL: Cypermethrin
2. FORMULATION: Technical grade, purity > 97%,
14-C labeled compound
3. STUDY/ACTION TYPE: Estuarine invertebrate acute toxicity
Mysidopsis bahia
4. CITATION: Cypermethrin: Determination of acute toxicity to
mysid shrimp Mysidopsis bahia. Summary report
submitted by ICI Americas for Phase 4 List B review.
MRID 92027-021.
5. REVIEWED BY: Ann Stavola
Aquatic Biologist
EEB/EFED
Signature: *Ann Stavola*
Date: *1/8/91*
6. APPROVED BY: Charles Lewis
Acting Section Head
EEB/EFED
Signature: *Charles Lewis*
Date: *1/10/91*
7. CONCLUSIONS: Based upon the summary report this study is found
not to be scientifically sound, and it does not meet
guideline requirements for an estuarine invertebrate
acute toxicity study for the following reasons:
Although a flow-through design was used the correct
measured concentrations are not given. The report
contains contradictions because it states they were
measured but it gives the same range of
concentrations and same LC50 values for both
measured and nominal concentrations. Additionally,
the mysids were 6 to 8 days old at the start of the
96-hr exposure period, not \leq 24-hr old as required.
The age difference is a significant factor in
determining the study is not acceptable.
8. RECOMMENDATIONS: A new mysid acute toxicity test is required.

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AMENDMENT TO DER BY T. JOHNSTON, 4/12/82

1. CHEMICAL: Cypermethrin
2. FORMULATION: Technical grade, purity not given
3. STUDY/ACTION TYPE: Estuarine invertebrate chronic toxicity
Mysidopsis bahia
4. CITATION: Cypermethrin: Invertebrate life-cycle test in mysid shrimp Mysidopsis bahia. Summary report submitted by ICI Americas for Phase 4 List B review. MRID 92027-024.
5. REVIEWED BY: Ann Stavola
Aquatic Biologist
EEB/EFED
Signature: *Ann Stavola*
Date: *1/8/91*
6. APPROVED BY: Charles Lewis
Acting Section Head
EEB/EFED
Signature: *Charles Lewis*
Date: *1/10/91*
7. CONCLUSIONS: Based upon the summary report this study was reevaluated and found to be scientifically sound, but it does not meet current EPA guideline requirements for an estuarine invertebrate chronic toxicity study for the following reasons: 1) mysids were 24- to 48-hr old not \leq 24-hr old as required; 2) only 20 mysids per concentration instead of 60 individuals at the beginning of exposure and then 20 randomly selected pairs per treatment when the mysids are sexually mature (day 10 to 14); 3) biological endpoints of live young produced daily by each pair; survival, dry weight total body length of each individual first-generation mysid alive at the end of the test are required; only mortality and offspring per replicate of 10 individuals were recorded. The study design and the data generated were inadequate to accurately assess chronic toxicity.
8. RECOMMENDATIONS: A new mysid chronic toxicity test is required. The registrant should refer to ASTM standard guide E 1191-90 for guidance.

DATA EVALUATION

CHEMICAL: Cypermethrin

FORMULATION: >97 % active ingredient (14C-labeled technical)

CITATION: Jaber, M.J. 1981 The acute and chronic toxicity of cypermethrin to mysid shrimp (Mysidopsis bahia). Unpublished report by EG&G Bionomics, submitted 12/28/81 by ICI Americas Inc., Wilmington, Delaware.

EPA Accession No. 070562

MRID 00089044

REVIEWED BY: Thomas B. Johnston
Biologist, EEB/HED

REVIEW DATE: April 12, 1982

TEST TYPE: 96-hr flow-through toxicity test and chronic (full life-cycle) study

REPORTED RESULTS: The reported 24, 48, 72, and 96-hr LC₅₀s of cypermethrin for mysid shrimp were 44.7, 16.5, 9.27, and 14.75 pptr, respectively. The 28-day MATC for cypermethrin was between 0.44 and 0.64 pptr.

REVIEWER'S CONCLUSIONS: This study is scientifically sound, and fulfills USEPA guideline requirements for acute and chronic toxicity tests using a marine invertebrate. With a 96-hr acute LC₅₀ of 4.75 pptr, cypermethrin is very highly toxic to mysid shrimp. The 28-day MATC for cypermethrin falls between 0.44 and 0.64 pptr.

MATERIALS/METHODS

Methods used generally followed USEPA guidelines. Tests were run at 25°C, with salinity of 28 ppt. Duplicate test chambers were run for each concentration, using a total of 20 shrimp per concentration.

STATISTICAL ANALYSES

Data were analyzed according to the methods of Stephan (USEDA Duluth laboratory analysis program).

RESULTS

Mean Measured Concentrations (pptr)	<u>No. Dead/No Exposed</u>			
	24 hrs	48 hrs	72 hrs	96 hrs
24	6/20	13/20	16/20	20/20
10	2/20	6/20	10/20	20/20
6.7	3/20	6/20	8/20	8/20
2.5	0/20	2/20	5/20	5/20
1.7	0/20	0/20	0/20	0/20
Solvent Control	0/10	0/10	0/10	0/10
Control	0/10	0/10	0/10	0/10

Acute flow-through test LC₅₀s = >24 pptr 16.5 9.27 4.75
(8.44-42.5) (5.09-18.1) (4.01-5.67)

Percent mortality of mysid shrimp exposed for 28 days under flow-through conditions

Control	Solvent Control	<u>Mean Measured Concentrations in pptr</u>				
		0.44	0.64	1.5	2.8	5.6
0	0	5	50	70	70	90

Production of offspring by mysid shrimp (chronic test)

Mean Measured Concentration (pptr)	Total Offspring	Females With Brood Ponches	Offspring Per Female
Control ^a	26	8	3.2
Solvent Control ^a	34	10	3.4
0.44	48	14	3.4
0.64	52	13	4.0
1.5	72	7	3.1
2.8	10	4	2.5 ^b
5.6	0	0	0 ^b

^aOnly one vessel. All test concentrations ran duplicate vessels

^bSignificantly (p<0.05) less than solvent control

The MATC of cypermethrin for mysid shrimp was between 0.44 and 0.64 pptr, based upon mortality in the F₀ mysid shrimp.

CONCLUSIONS:

Validation Category: Core

Category Rationale: N/A

Category Repairability: N/A

JOHNSTON CYPERMETHRIN STATIC ACUTE 24HR LC50 PINK SHRIMP

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB. (PERCENT)
94	20	20	100	9.53674E-05
58	20	2	10	.0201225
25	20	0	0	9.53674E-05
12	20	0	0	9.53674E-05
8.6	20	0	0	9.53674E-05

THE BINOMIAL TEST SHOWS THAT 58 AND 94 CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS, BECAUSE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS 70.0725

WHEN THERE ARE LESS THAN TWO CONCENTRATIONS AT WHICH THE PERCENT DEAD IS BETWEEN 0 AND 100, NEITHER THE MOVING AVERAGE NOR THE PROBIT METHOD CAN GIVE ANY STATISTICALLY SOUND RESULTS.

JOHNSTON CYPERMETHRIN STATIC ACUTE 96HR LC50 MYSID SHRIMP

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB. (PERCENT)
24	20	20	100	9.53674E-05
10	20	20	100	9.53674E-05
6.7	20	8	40	25.1722
2.5	20	5	25	2.06947
1.7	20	0	0	9.53674E-05

THE BINOMIAL TEST SHOWS THAT 2.5 AND 10 CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS, BECAUSE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS 7.04218

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
3	.0554254	4.75164	4.01337	5.72334

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
10	1.15101	4.54775	3.43287E-03
10	1.15101	4.54775	(CANNOT BE CALCULATED)

~~SINCE THE PROBABILITY IS LESS THAN 0.05, RESULTS CALCULATED USING THE PROBIT METHOD PROBABLY SHOULD NOT BE USED.~~

SLOPE = 3.73509
 95 PERCENT CONFIDENCE LIMITS = -.2721 AND 7.74228

LC50 = 5.13638

95 PERCENT CONFIDENCE LIMITS - 0 AND LIMITS

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JOHNSTON CYPERMETHRIN STATIC ACUTE 72HR LC50 MYSID SHRIMP

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB. (PERCENT)
24	20	16	80	.590897
10	20	10	50	58.8098
6.7	20	8	40	25.1722
2.5	20	2	10	.0201225
1.7	20	0	0	9.53674E-05

THE BINOMIAL TEST SHOWS THAT 2.5 AND 24 CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS, BECAUSE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS
3	.222195	9.44641	6.3109 15.1819

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
7	.124778	1	.753632

SLOPE = 2.39976
 95 PERCENT CONFIDENCE LIMITS = 1.55207 AND 3.24745

LC50 = 9.80523
 95 PERCENT CONFIDENCE LIMITS = 7.36367 AND 13.9609

LC10 = 2.89894
 95 PERCENT CONFIDENCE LIMITS = 1.52682 AND 4.15798

JOHNSTON CYPERMETHRIN STATIC ACUTE 48HR LC50 MYSID SHRIMP

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB. (PERCENT)
24	20	13	65	13.1588
10	20	6	30	5.76592
6.7	20	5	25	2.06947
2.5	20	2	10	.0201225
1.7	20	0	0	9.53674E-05

THE BINOMIAL TEST SHOWS THAT 6.7 AND 0 CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS, BECAUSE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS 16.533

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS
1	.806982	16.533	8.43529 55.8184

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
6	.180942	1	.684094

SLOPE = 1.95958
 95 PERCENT CONFIDENCE LIMITS = 1.12603 AND 2.79313

LC50 = 15.8959
 95 PERCENT CONFIDENCE LIMITS = 11.0197 AND 29.8774

LC10 = 3.57427
 95 PERCENT CONFIDENCE LIMITS = 1.60075 AND 5.37824

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