

US EPA ARCHIVE DOCUMENT

4-12-82

Duplicate

DATA EVALUATION

1. CHEMICAL: Cypermethrin
2. FORMULATION: 98.1 % active ingredient (Technical, WL 43467)
3. CITATION: Stephenson, R.R., and D.F. Kane (1980) the acute toxicity of cypermethrin (WL 43467) to the freshwater shrimp (Gammarus pulex) and larvae of the mayfly, (Cleon dipterum), in continuous-flow tests. Unpublished report from Shell Research Ltd, submitted 12/28/81 by ICI Americas, Wilmington, Delaware

EPA Accession No. 070562

4. REVIEWED BY: Thomas B. Johnston
Biologist, EEB/HED
5. REVIEW DATE: April 12, 1982
6. TEST TYPE: Acute toxicity in flow-through system (96-hr EC₅₀ and LC₅₀)
7. REPORTED RESULTS: The reported 96-hr EC₅₀ and LC₅₀ values of cypermethrin for Cleon dipterum are 4 and 20 pptr. The 96-hr EC₅₀ and LC₅₀ values for Gammarus pulex are 5 and 9 pptr.
3. REVIEWER'S CONCLUSIONS: This study is scientifically sound, and fulfills USEPA guideline requirements for an acute toxicity test using an aquatic invertebrate. With 96-hr EC₅₀s and LC₅₀s of < 20 pptr, cypermethrin is very highly toxic to mayfly larvae and freshwater shrimp (isopods).

MATERIALS/METHODS

Methods used generally followed USEPA guidelines. Concentrations used in the EC₅₀ and LC₅₀ calculations were mean measured values, rather than nominal ones. The EC₅₀ test criterion was inability to make normal escape movements in response to repeated tactile stimulation. Concentrations below detection limits were estimated by linear extrapolation. After the 96-hr period, the organisms still alive were transferred to clean water and observed for 24 hours.

STATISTICAL ANALYSES

Data were analyzed according to the probit method.

RESULTS

Gammarus pulex

| Concentrations (pptr) | No. Affected | No. Dead | No. Exposed |
|-----------------------|--------------|----------|-------------|
| 24 | 10 | 10 | 10 |
| 10 | 10 | 7 | 10 |
| 7 | 5 | 1 | 10 |
| 2 | 3 | 0 | 10 |
| 0.7 | 0 | 0 | 10 |
| Control | 0 | 0 | 10 |

EC₅₀ 4 pptr. (95% confidence limits 2-7 pptr.)
LC₅₀ 9 pptr. (95% confidence limits 7-10 pptr.)

Cleon dipterum

| Concentrations (pptr) | No. Affected | No. Dead | No. Exposed |
|-----------------------|--------------|----------|-------------|
| 83 | 15 | 13 | 15 |
| 47 | 15 | 7 | 15 |
| 24 | 15 | 5 | 15 |
| (6) | 10 | 7 | 15 |
| (2) | 4 | 2 | 15 |
| Control | 1 | 1 | 15 |

EC₅₀ = 4 pptr (2-6 pptr)
LC₅₀ = 20 pptr (10-70 pptr)

The relatively small changes in the EC₅₀ values from 24 hrs to 96 hrs indicate that the 96 hr values were close to the threshold values for the two species. Therefore, longer exposure periods would be unlikely to produce lower EC₅₀ values. Both species showed some decline in LC₅₀ from 24 hrs to 96 hrs, which indicates that for lethal effects a threshold might not have been reached by 96 hrs.

G. pulex were shown to recover the ability to make escape responses when returned to uncontaminated water. The ability of C. dipterum to do so was not assessed because of high control mortalities.

CONCLUSIONS:

Validation Category: Core

Category Rationale: N/A

Category Repairability: N/A

JOHNSTON CYPERMETHRIN 96HR FLOW-THROUGH EC50 GAMMARUS PULEX

| CONC. | NUMBER EXPOSED | NUMBER DEAD | PERCENT DEAD | BINOMIAL PROB (PERCENT) |
|-------|----------------|-------------|--------------|-------------------------|
| 24 | 10 | 10 | 100 | .0976563 |
| 10 | 10 | 10 | 100 | .0976563 |
| 7 | 10 | 5 | 50 | 62.3047 |
| 2 | 10 | 3 | 30 | 17.1875 |
| .7 | 10 | 0 | 0 | 0976563 |

THE BINOMIAL TEST SHOWS THAT .7 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.

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

| SPAN | G | LC50 | 95 PERCENT CONFIDENCE LIMITS | |
|------|---------|---------|------------------------------|---------|
| 3 | .115454 | 3.82181 | 2.68263 | 5.61214 |

RESULTS CALCULATED USING THE PROBIT METHOD

| ITERATIONS | G | H | GOODNESS OF FIT PROBABILITY |
|------------|---------|---|-----------------------------|
| 6 | .199139 | 1 | .116917 |

SLOPE = 2.81819
 95 PERCENT CONFIDENCE LIMITS = 1.56058 AND 4.07581

LC50 = 4.02374
 95 PERCENT CONFIDENCE LIMITS = 2.42798 AND 6.06021

LC10 = 1.42556
 95 PERCENT CONFIDENCE LIMITS = .463857 AND 2.37658

JOHNSTON CYPERMETHRIN 96HR FLOW-THROUGH LC50 GAMMARUS PULEX

| CONC. | NUMBER EXPOSED | NUMBER DEAD | PERCENT DEAD | BINOMIAL PROB (PERCENT) |
|-------|----------------|-------------|--------------|-------------------------|
| 24 | 10 | 10 | 100 | .0976563 |
| 10 | 10 | 7 | 70 | 17.1875 |
| 7 | 10 | 1 | 10 | 1.07422 |
| 2 | 10 | 0 | 0 | .0976563 |
| .7 | 10 | 0 | 0 | .0976563 |

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AN APPROXIMATE LC50 FOR THIS SET OF DATA IS 8.94619

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

| SPAN | G | LC50 | 95 PERCENT CONFIDENCE LIMITS | |
|------|---------|---------|------------------------------|---------|
| 3 | .227759 | 9.99477 | 6.46001 | 16.4731 |

NO CONVERGENCE IN 25 ITERATIONS. THE PROBIT METHOD PROBABLY CANNOT BE USED WITH THIS SET OF DATA

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JOHNSTON CYPERMETHRIN 96HR FLOW-THROUGH EC50 CLEON DIPTERUM

| CONC. | NUMBER EXPOSED | NUMBER DEAD | PERCENT DEAD | BINOMIAL PROB (PERCENT) |
|-------|----------------|-------------|--------------|-------------------------|
| 83 | 14 | 14 | 100 | 6.10351E-03 |
| 47 | 14 | 14 | 100 | 6.10351E-03 |
| 24 | 14 | 14 | 100 | 6.10351E-03 |
| 6 | 14 | 9 | 64.2857 | 21.1975 |
| 2 | 14 | 3 | 21.4286 | 2.86865 |

THE BINOMIAL TEST SHOWS THAT 0 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.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS 4.20292

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD
 SPAN G LC50 95 PERCENT CONFIDENCE LIMITS
 2 .150857 4.20932 2.38183 6.39319

RESULTS CALCULATED USING THE PROBIT METHOD
 ITERATIONS G H GOODNESS OF FIT PROBABILITY
 6 .26052 1 .937913

SLOPE = 2.91082
 95 PERCENT CONFIDENCE LIMITS = 1.42511 AND 4.39655

LC50 = 4.03064
 95 PERCENT CONFIDENCE LIMITS = 2.50845 AND 6.18719

LC10 = 1.47595
 95 PERCENT CONFIDENCE LIMITS = .426733 AND 2.4028

JOHNSTON CYPERMETHRIN 96HR FLOW-THROUGH LC50 CLEON DIPTERUM

| CONC. | NUMBER EXPOSED | NUMBER DEAD | PERCENT DEAD | BINOMIAL PROB (PERCENT) |
|-------|----------------|-------------|--------------|-------------------------|
| 83 | 14 | 12 | 85.7143 | .646972 |
| 47 | 14 | 6 | 42.8571 | 39.5263 |
| 24 | 14 | 4 | 28.5714 | 8.97827 |
| 6 | 14 | 6 | 42.8571 | 39.5263 |
| 2 | 14 | 1 | 7.1429 | .0915527 |

THE BINOMIAL TEST SHOWS THAT 2 AND 83 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 51.3172

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD
 SPAN G LC50 95 PERCENT CONFIDENCE LIMITS
 4 .224782 30.5791 18.7859 54.7832

RESULTS CALCULATED USING THE PROBIT METHOD
 ITERATIONS G H GOODNESS OF FIT PROBABILITY
 5 2.32764 2.72414 .0425795

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

SLOPE = 1.00482
 95 PERCENT CONFIDENCE LIMITS = -.528195 AND 2.53783

LC50 = 29.6523
 95 PERCENT CONFIDENCE LIMITS = 0 AND +INFINITY

LC10 = 1.61491
 95 PERCENT CONFIDENCE LIMITS = 0 AND 12.6258

6

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