109701

4-9-80

1. Chemical: Cypermethrin (PP383)

2. Formulation: Technical, 92.9%

3. Citation: Hill, R. W., B. G. Maddock and B. Hart (1976). Determination of the acute toxicity of PP383 to Rainbow Trout (Salmo gairdnerii). ICI Brixham Laboratory Report No. BL/B/1711, March 1976. (Acc. #241598)

4. Reviewed by: Carol Matti Natella
Wildlife Biologist
EEB/HED

5. Date Reviewed: April 9, 1980

6. Test Type: Fish acute 96-hour LC_{50} (Rainbow Trout)

7. Reported Results:

The LC_{50} at 101.7 hours is 0.82 ppb as determined by probit analysis (c.l. 0.72 and 0.95). The LC_{10} is 0.68 ppb (c.l. 0.49 and 0.77). The reported 96-hour LC_{50} derived from the Geometric Mean Survival Periods is 0.8 ppb.

8. Reviewer's Conclusions:

The study is scientifically sound and indicates that Cypermethrin is very highly toxic to Rainbow Trout. The study does fulfill the requirements for a fish acute 96-hour LC_{50}.

Materials/Methods

Test Procedures

A continuous flow-through bioassay system was used. Dosing of the concentrated stock solution was achieved by a series of peristaltic pumps; fresh water was dosed to the system by a further series of peristaltic pumps. The dilution water was obtained from a 20,000 gallon reservoir. The test vessels were made of glass of 20 liter capacity and each test vessel was fed with the required test concentration at a rate of 200 ml/min. The system was designed to achieve a complete exchange of the test solutions within a period of 3 hours.

In order to prepare the necessary stock solutions prior to dilution in the exposure vessels a stock working solution was prepared of 0.1 mg/l PP383 (Cypermethrin) in Dimethyl Sulfoxide (DMSO)/water mixture. This solution although slightly turbid did not settle out. The reported 96 hr. LC_{50} value of DMSO to Rainbow Trout is 32,300 mg/l (Wilford, W.A., U.S. Department of the Interior Resource Publication 37. April 1967). The exposure levels of DMSO in fish test vessels were maintained at a level of below 10 mg/l.

Statistical Analysis

The individual times of death of the fish were recorded in minutes and a computer program was used to process these times to obtain the Geometric Median Survival Periods (GMSP). A toxicity graph was constructed by plotting the GMSP values against concentration on logarithmic scales. The resulting graph was used to read off 24, 48, and 96 hr. LC_{50} values.

Discussion/Results

24 hr LC_{50} value = *5.3 ppb
48 hr LC_{50} value = *2 ppb
96 hr LC_{50} value = *0.8 ppb

*calculated from the Geometric Median Survival Periods. See table and graph.

The first symptoms noted in all concentrations were rapid swimming with frequent thrashing of the body about a central transverse axis perpendicular to the dorsal line. In all cases this was followed by exaggerated and involuntary jaw spasms. After death all fish were seen to have pronounced spinal curvature and blackening of the dorsal area was noted.

Reviewer's Evaluation

A. Test Procedure

The test procedure generally complies with USEPA protocol for a basic flow-through acute toxicity test. However, the fish used in the study were slightly smaller than the 0.5-5g recommended by the guidelines; the average weight was 0.442g.

B. Statistical Analyses

The LC_{50} values given in this study were not determined by probit analysis. Only one of the nine dose levels resulted in a partial mortality at 96 hours (5760 minutes). For probit analysis, at least two partial mortalities are required. Therefore, in order to compare the values given in the study with an LC_{50} determined by a probit analysis, mortality data at 101.7 hours (6100 minutes) were used. The five lowest dose levels were used in the analysis.

Conc. ppb	Number exposed	Number dead at 6100 minutes
4.7	10	10
3.3	10	10
1.5	10	10
1.	10	9
.68	10	1

The probit analysis derived an LC_{50} value at 101.7 hours of 0.82 ppb with confidence limits of 0.72 and 0.95. This is comparable to an LC_{50} value of 0.76 ppb at 101.7 hours determined from the Geometric Median Survival Period graph. The 96-hour LC_{50} value determined from this same graph is 0.8 ppb.

The LC_{10} at 101.7 hours derived by probit analysis is 0.68 ppb (c.l. 0.49 and 0.77).

C. Conclusions

1. Category: Core
2. Rationale: N/A
3. Repairability: N/A

5. Results

The individual times of death of the fish were recorded in minutes and these are tabulated in Table 1.

These times were then used to estimate the time for 50% of the test population to die (ET_{50}) by using the following formula.

$$\text{Log } ET_{50} = \frac{\text{Antilog } \Sigma \log (\log t)}{n}$$

where t = survival time in minutes for each fish

n = number of test fish used in each concentration (10)

A computer programme was used to process the times of death and obtain the Geometric Median Survival Periods (GMSP). These values are reported in Table 1.

```
SLOPE  =          15.3111
95 PERCENT CONFIDENCE LIMITS = 6.40205     AND     24.2201

LC50   =          .824595
95 PERCENT CONFIDENCE LIMITS =    .717745     AND     .946861

LC10 =            .680033
95 PERCENT CONFIDENCE LIMITS  =   .494685     AND     .767021
**************************************************************************
```

Carol Natella
LC50, Rainbow trout,
Cypermethrin

```
SRU       1.314 UNTS.

RUN COMPLETE.
9000 data 5
9001 dataa4.7,3.3,1.5,1.0,0.68
9002 data 10,10,10,10,10
9003 data 10,10,10,9,1
run

 80/04/09. 08.34.00.
BASIC      PROGRAM   S79LC50
```

Inbow Trout 101.7 hr. LC50

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**************************************************************************
CONC.          NUMBER          NUMBER          PERCENT         BINOMIAL
               EXPOSED         DEAD            DEAD            PROB.(PERCENT)
 4.7           10              10              100             9.76563E-2
 3.3           10              10              100             9.76563E-2
 1.5           10              10              100             9.76563E-2
 1             10              9               90.             1.07422
 .68           10              1               10.             1.07422

THE BINOMIAL TEST SHOWS THAT  .68  AND  1  CAN BE
USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT
CONFIDENCE LIMITS SINCE THE ACTUAL CONFIDENCE LEVEL
ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.


AN APPROXIMATE LC50 FOR THIS SET OF DATA IS  .824621


--------RESULTS CALCULATED USING THE MOVING AVERAGE METHOD
SPAN           G               LC50            95 PERCENT CONFIDENCE LIMITS
 2             .167754         .824621          .660531         .950579


--------RESULTS CALCULATED USING THE PROBIT METHOD
ITERATIONS     G               H               GOODNESS OF FIT PROBABILITY
 7             .338703         1                .999998

SLOPE  =          15.3108
95 PERCENT CONFIDENCE LIMITS = 6.40019     AND     24.2214

LC50   =          .824595
95 PERCENT CONFIDENCE LIMITS  =   .717725     AND     .946866

LC10 =            .680031
95 PERCENT CONFIDENCE LIMITS  =   .494609     AND     .767024
**************************************************************************
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