

US EPA ARCHIVE DOCUMENT

FORMULATION:				IA	JB	T	FW	EC	R		
% a.i.	SC#	CHEMICAL NAME		Validator:				Date:			
? Technical		Permethrin PP557		R. Balcomb				Nov. 29, 1977			
				Test Type:							
				Acute 96-hr. LC ₅₀ : Bluegill Sunfish							
				Test ID # ES-F-3							

CITATION: Hill, R.W. et al. "Determination of the Acute Toxicity of PP557 to Bluegill Sunfish (*Lepomis macrochirus*) BL/B/1701, January, 1976.

VALIDATION CATEGORY: *Supplemental*

RESULTS: 96-hr. LC₅₀ = 0.00079 mg/L

The toxicity of PP557 to Sunfish was studied at 13 concentrations ranging from 0.68 to 0.00068 mg/L of technical material. After 96 hours, 0% mortality was observed at the 0.00068 level and 100% mortality at the next higher level (0.001 mg/L).

VALIDATION CATEGORY RATIONALE: No partial mortalities were obtained at the concentrations tested (96 hours). LC₅₀ values calculated without partial mortality data are unacceptable.

CATEGORY REPAIRABILITY/RATIONALE: The study is not repairable.

DATA REVIEW NUMBER : (ES)(103 0) F 2

TEST : Fish Acute LC₅₀

SPECIES : Bluegill Sunfish, *Lepomis macrochirus*

RESULTS :

24-Hour LC₅₀ = 0.0086 ppm

48-Hour LC₅₀ = 0.0018 ppm

96-Hour LC₅₀ = 0.0009 ppm

CHEMICAL : Permethrin (PP557): ?% a.i.

TITLE : Determination of the acute toxicity of PP557 to Bluegill Sunfish
(*Lepomis Macrochirus*)

ACCESSION NO: 227722

STUDY DATE : January, 1976

RESEARCHER : Hill, R. W., et. al.

REGISTRANT : ICI United States, Inc.

VALIDATION CATEGORY : Invalid

CATEGORY REPAIRABILITY : No

ABSTRACT :

The continuous-flow 24, 48 and 96-Hour LC₅₀'s for bluegill sunfish versus PP557 (permethrin) were determined.

ADDITIONAL INFORMATION/COMMENTS

A. Additional Test Data

1. Methodology/Protocol

- a. The apparatus used in these studies was a continuous flow through bioassay system which is described in detail in Reference a.
- b. Dosing of the concentrated stock solution was achieved by a series of peristaltic pumps; freshwater was dosed to the system by a further series of peristaltic pumps.
- c. Mixing to achieve the required concentration was carried out in glass splash heads before the test solution passed into the test vessels.
- d. The dilution water was obtained from a 20,000 gallon reservoir which was monitored daily for total hardness. This hardness ranged from 24.5 mg/l to 30.0 mg/l as CaCO_3 over the test period. The values obtained are reported in Table 4.
- e. The test vessels were made of glass of 20 litre capacity and each test vessel was fed with the required test concentration at a rate of 200 ml/minute.
- f. The system was designed to achieve a complete exchange of the test solutions within a period of 3 hours.
- g. Ten Bluegill Sunfish were used in each concentration tested and a control was run simultaneously with each set of experiments. The temperature was maintained at 23°C throughout the test period.
- h. In initial experiments involved in the preparation of the concentrated stock solutions, acetone was used as the preferred solvent. At high rates of dilution used of the order of 130:1 required to undertake the test, problems with separation of the compound occurred. In order to overcome this difficulty dimethyl sulphoxide was used at a fish exposure level of 50 mg/l in the first test series and 10mg/l in the second and third series. The reported level of the toxicity of DMSO to Bluegill Sunfish as a 48-Hour LC_{50} value is 33, 500 mg/l by Willford (Ref. b)

i. Series:

Series I--0.68, 0.33, 0.15, 0.068, 0.033, 0.022, 0.015 mg/l
PP557

Series II--0.015, 0.01, 0.0047, 0.0015, 0.001 mg/l PP557

Series III--0.00008 mg/l PP557

In series I the DM50 fish exposure level was 50 mg/l while in Series II and III the level was 10 mg/l.

Two concentrations of 0.015 mg/l were tested one each in series I and II. There was complete agreement between these two tests indicating that the difference in concentrations in DMSO at the two levels tested had no effect on the toxicity measured.

- j. Dissolved oxygen levels in each test vessel were measured twice daily using a Yellow Springs Incorporated Model 51A dissolved oxygen meter.
- k. The lowest recorded oxygen level was 96% of the air saturated value at the test temperature of 23°C.
- l. The pH levels were measured twice daily using a Western Biological meter. The values obtained ranged from 7.85 to 8.10 pH units for the series of experiments and are shown in Table 3.
- m. Temperature readings were taken twice daily and no deviation was recorded from the nominal values of 23°C \pm 0.5°C for the tests.
- n. The fish were held for two months in stock tanks at a temperature of 23°C \pm 1°C and then acclimatized for a further period of two days in the fish exposure vessels.
- o. The average weight of the fish was 1.60 gms with a range of 1.10 to 1.90 gms. The average length of the fish was 42mm with a range of 31 to 49 mm.

2. Additional Test Results:

The individual times of death of the fish were recorded in minutes and these were then used to estimate the time for 50% of the test population to die (ET₅₀) 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 obtained the Geometric Median Survival Periods (G M S P).

A toxicity graph was constructed by plotting the ET₅₀ values against concentration of PP 557 on logarithmic scales, ~~(see figure 1)~~. The graph obtain of this plot was used to read off 24, 48, and 96 hour LC₅₀ values.

24 hour LC₅₀ value = 0.0086mg/l PP 557

48 hour LC₅₀ value = 0.0018mg/l PP 557

96 hour LC₅₀ value = 0.0009mg/l PP 557

No deaths occurred at a test level of 0.00068 mg/l during the 96-Hour exposure but continuation of the experiment resulted in 100% mortality within 175 hours.

Toxic Symptoms Observed

In the higher concentrations tested from 0.68 to 0.15mg/l of PP 557 initial agitation was noted when the exposure vessels were spiked prior to commencement of the dosing. This agitation coupled with increased activity continued with the fish swimming in the top of the test vessels instead of the normal pattern in the lower portion of the vessels. After 30 minutes exposure, the respiratory movements had become rapid but weaker and activity slowly decreased until after 210 minutes all fish in the 0.68 and 0.33 mg/l solutions were intermittently keeled.

The above symptoms were also noted to a lesser degree in the exposure levels from 0.068 to 0.015 mg/l after 210 minutes.

The fish exposed below 0.015 mg/l took progressively longer for symptoms to develop but when this occurred the same pattern as observed previously was noted, with the exception that in the lower concentrations the tendency to swim under the sealed lids was more pronounced.

In all concentrations tested there was a tendency for the fish to swim on their sides.

3. References:

- a. Maddock B. G. and Williams B. R. H.

A continuous Flow Apparatus for Assessing the Toxicity of Substances of Aquatic Animals.
I C I Brixham Laboratory Report BL/A/1579

- b. Willford W. A.

Toxicity of Dimethyl Sulfoxide (DMSO) to fish
Investigations in Fish Control No. 20
United States Department of the Interior Resources Publication 37
Washington, D.C.
April 1967.

B. Validation Category/Rationale:

This study is invalid because the methodology of the study does not provide for the determination of lethal concentrations which cause 50% mortality at 24, 48, and 96 hours. The methodology used determine's Geometric Median Survival Periods (GMSP) (or, in other words, the estimated time for 50% of a test population to die) at each toxicant concentration level tested. It appears this method was chosen, for 100% mortality occurred in all concentrations (including the no effect level concentration), and, in most cases, it occurred prior to 24 hours. Said data, therefore, precludes the development of any statistically derived best estimate of the LC₅₀ at 24, 48 or 96 hours.

C. Category Repairability/Rationale

As is, this study can never be reclassified to supplementary or core status for a definitive test must meet both of the following criteria so that the LC₅₀ or EC₅₀ can be calculated with reasonable accuracy:

- a. Except for the controls, the concentration of toxicant in each treatment must be at least 60% of the next higher one for BASIC tests and at least 50% of the next higher one for EFFLUENT tests.
- b. One treatment other than the control must have killed or affected less than 35% of the organisms exposed to it, and one treatment must have killed or affected more than 65% of the organisms. This requirement does not apply to EFFLUENT test if 100% effluent does not kill or affect more than 65% of the organisms exposed to it.

This data cannot meet these criteria.