UCES Project #: 11506-07-01

ACUTE TOXICITY OF TRIPHENYL PHOSPHATE C7041-152-6 TO THE FATHEAD MINNOW Pimephales promelas Rafinesque

Prepared for

FMC Corporation Princeton, NJ

Prepared by

UNION CARBIDE ENVIRONMENTAL SERVICES Union Carbide Corporation Tarrytown, New York 10591

December 21, 1978



UNION CARBIDE CORPORATION ENVIRONMENTAL SERVICES TARRYTOWN TECHNICAL CENTER TARRYTOWN, NEW YORK 10591 • PHONE: (914) 345-3974

Client:	FMC Corporation
Date:	The test was conducted from November 27, 1978 through December 1, 1978.
Material:	Triphenyl Phosphate, C7041-152-6
UCES Project #:	11506-07-01
Summary:	The 96 hour LC_{50} for Triphenyl Phosphate to fathead minnow is 3.8 mg/1. This value is based upon nominal concentrations of the chemical in soft reconstituted water.
Species:	Fathead minnow
Length:	50 mm
Weight:	1.05 grams
Source:	UCES Laboratory
96 Hour LC ₅₀ :	3.8 mg/1
95% Conf. Intervals:	2.8-5.0 mg/1
96 Hour Observed No Effect Level:	1.0 mg/1
Water Quality:	Soft
Temperature:	20.6°C ± 0.6°C
pH:	7.52
Total Hardness as CaCO3:	43 mg/l
Notebook Ref .:	No. 5266, pages 1,2

INTRODUCTION

This study was conducted at the request of the FMC Corporation to determine the static acute toxicity of Triphenyl Phosphate, C7041-152-6 to fathead minnows. The test was performed at Union Carbide Environmental Services' (UCES) toxicity laboratory in Tarrytown, New York. Triphenyl Phosphate is a flaky white acetone-soluble solid that initially formed oily droplets on the surface of all concentrations which crystallized on the surface after one hour.

The fathead minnow, <u>Pimephales promelas</u> Rafinesque, is a warm water fish found in ponds, lakes and sluggish streams. They feed on a variety of aquatic organisms including small insects, aquatic invertebrates and algae. In addition, fathead minnows serve as a food source for larger predatory fish. Fathead minnows prefer temperatures above 20°C and can tolerate a wide pH range. Because of their wide geographic distribution, temperature requirements and importance as a food chain organism, fathead minnows have been recommended by the Committee on Methods for Toxicity Tests with Aquatic Organisms (1975) as a bioassay organism.

METHODS

Dilution water used in all basic toxicity tests at the UCES laboratory is obtained from a well on the Tarrytown site, treated with a Continental Reverse Osmosis Water System (Model 3020) and deionized. After treatment, the water is reconstituted to the desired pH and hardness according to the procedures of Marking and Dawson (1973). For this test the soft reconstituted water was characterized as having a pH of 7.52, total hardness of 43 mg/l as CaCO₃, total alkalinity of 28 mg/l as CaCO₃ and a specific conductance of 140 μ mhos/cm. Hardness and alkalinity were determined according to standard analytical procedures (American Public Health Association, 1976), pH with an ORION pH Meter, conductivity with a YSI Conductivity Bridge and dissolved oxygen with a YSI Oxygen Meter.

Five concentrations, a control and solvent control were used in determining the toxicity of Triphenyl Phosphate to fathead minnows. Test methodology followed recommended bioassay practices (U. S. Environmental Protection Agency, 1975) with the exception that replicate concentrations were not used. Fresh stock solution for the test was prepared by weight to a precision of 0.1 mg, diluted with reagent grade acetone and introduced into the test vessels. The test was conducted in 19.6 liter, chemically clean, glass jars containing 15 liters of water. The test was started by introducing the toxicant into test vessels containing dilution water, thoroughly mixing and then introducing the fish. The amount of solvent in the solvent control equalled the amount used in the highest concentration.

Fathead minnows used in this test were cultured in the UCES laboratory from a parental stock obtained from the National Water Quality Laboratory, Duluth, Minnesota. The fish were maintained in the laboratory at 22°C according to the procedures of Brauhn, Schoettger and Mueller (1975). Mortalities in the stock culture over a one month period were less than two percent. Fathead minnows at the time of testing were approximately 5 months old and had a mean (10 organisms) length of 50 mm and a mean weight of 1.05 grams. Fish used in this test were

-2-

randomly selected from the stock culture and acclimated to the test water for 24 hours prior to testing. Forty-eight hours before initiating the test the fish were taken off feed. Ten individuals were placed in each of the 19.6 liter test vessels. Biological loading was 0.70 g/l.

Dissolved oxygen and pH were determined initially and every 24 hours thereafter for the control, solvent control and all test concentrations. Water bath temperature was determined initially and at 24 hour intervals subsequent to the initiation of the test. In addition to obtaining the above chemical and physical parameters, abnormal behavioral responses of the test fish were noted and recorded at 24 hour intervals.

The concentration of toxicant lethal to 50% of the population (LC_{50} 's) and 95% confidence intervals were determined at 24, 48, 72 and 96 hour exposure periods by the Spearman-Kärber Estimator (Finney, 1971). The 24 hour LC_{50} calculations could not be made due to an absence of sufficient mortalities. The LC_{50} determinations were based upon nominal concentrations of the test material in soft reconstituted water. The no effect level was determined at the 96 hour exposure period. This value is based upon observed abnormal behavior and may not necessarily be related to death.

RESULTS

The 96 hour LC_{50} with 95% confidence intervals for Triphenyl Phosphate to fathead minnows is 3.8 (2.8-5.0) mg/1. Percent mortalities and LC_{50} values with their respective confidence intervals are presented in Table 1. The chemical and physical parameters monitored

-3-

during the test are presented in Table 2. Behavioral observations made during the 96 hour test period indicated that fathead minnows exposed to concentrations of 1.8 mg/l and higher exhibited abnormal surfacing behavior. Fish in the 1.8 mg/l and 3.2 mg/l concentrations exhibited irritation. Fathead minnows in the 3.2 mg/l concentration also exhibited dark discoloration and swimming on their sides. The minnows in the 3.2 mg/l and 5.6 mg/l concentrations also exhibited hemorrhagic areas. The 96 hour observed no effect level is 1.0 mg/l.

It should be noted that LC_{50} values may vary with different species, temperatures and water qualities.

-4-

Table 1 - Percent Mortalities and LC₅₀ Values

FMC Corporation Triphenyl Phosphate, C7041-152-6 Test Material: Triphenyl Phosphe Test Organism: Fathead minnows Client:

	Nomin
ccent Mortality	Test Material,
Pel	

			Τ	sst Materia	al, Nominal	. Conc. mg/	1
0	Control	Solvent Control	1.0	1.8	3.2	5.6	10.0
	0	0	0	0	0	0	0
	0	0	0	10.	20	50	90
	0	0	0	10.	30	70	100
	0	0	0	10	- 40	70	100

LC50 Values

		24 Hour	48 Hour	72 Hóur	96 Hour
LCso mg/l		> 10.0	5.0	4.0	3.8
958	Lower	N.A.	3.7	3.0	2.8
Limits	Upper	N.A.	6.8	5.3	5.0

N.A. = Not available due to the absence of sufficient mortalities. The 96 hour observed no effect level is 1.0 mg/l.

ŭ

B

Client: FMC Corporation Test Material: Triphenyl Phosphate, C7041-152-6 Test Organism: Fathead minnow

Hq	Conductance µmhos/cm	Temperature °C	Hardness mg/l as CaCO₃	Alkalinity mg/l as CaCO ₃
7.52	140	20.6 ± 0.6	43	28

Dilution Water

Dissolved Oxygen, mg/l

		Columnt	Test Material, Nominal Conc. mg/1					
	Control	Control	1.0	1.8	3.2	5.6	10.0	
Initial	9.0	8.8	8.9	8.7	9.0	8.6	9.0	
24 hour	4.9	4.2	3.5	3.6	4.8	4.2	4.5	
48 hour	3.4	1.7	1.6	1.9	1.7	1.3	1.7	
72 hour	3.2	1.8	2.0	2.1	2.0	1.4	1.9	
96 hour	3.8	2.2	2.3	2.1	2.4	2.0	*	

рH

		Solvent	Test Material, Nominal Conc. mg/1					
	Control	Control	1.0	1.8	3.2	5.6	10.0	
Initial	7.52	7.51	7.50	7.50	7.53	7.48	7.49	
24 hour	7.14	7.05	7.00	7.01	7.12	7.05	7.08	
48 hour	7.01	6.87	6.86	6.87	6.89	6.86	6.90	
72 hour	7.00	6.84	6.86	6.87	6.87	6.85	6.88	
96 hour	6.99	6.88	6.91	6.93	6.94	6.92	*	

*Data not collected after 100% mortality occurs.

UNION CARBIDE ENVIRONMENTAL SERVICES

28-2

Report Prepared By

Charles le. Calulache

Charles W. Calmbacher Aquatic Toxicologist

Report Approved By

G. Vilhas indas

Algindas C. Vilkas Section Leader Aquatic Toxicology

.

Report Approved By

Curt Hutchinson Manager UNION CARBIDE CORPORATION ENVIRONMENTAL SERVICES

December 21, 1978