

ACUTE TOXICITY TO FISH

TEST SUBSTANCE

Identity: Perfluorooctanoic acid, ammonium salt; may also be referred to as PFOA ammonium salt, Ammonium perfluorooctanoate, PFO, FC-116, FC-126, FC-169, or FC-143. (Octanoic acid, pentadecafluoro-, ammonium salt, CAS # 3825-26-1)

Remarks: The 3M production lot number was 37. The test sample is FC-143. It's purity was not sufficiently characterized, though current information indicates it is a mixture of 96.5 - 100% test substance and 0 - 3.5% C₆, C₇, and C₉ perfluoro analogue compounds.

METHOD:

Method: USEPA 660/3-75-009, 1975

Type: Static acute

GLP: No

Year completed: 1980

Species: *Pimephales promelas*

Supplier: Dale Fattig of Brady, Nebraska.

Analytical monitoring: Temperature, pH and DO

Exposure period: 96-hours

Statistical methods: Probit analysis

Test fish age: Not noted.

Length and weight: Average length = 3.6 cm
Average weight = 0.40 g

Pretreatment: Not noted.

Test conditions:

Dilution water: Carbon-filtered well water.

Dilution water chemistry:

Temperature: 17°C

Dissolved Oxygen: 10.0 ppm

pH: 8.0

Test conditions remarks: A daily photoperiod of 16 hours light and 8 hours dark, with a 30 minute transition period was maintained throughout the acclimation and testing period.

Stock and test solution preparation: Not noted

Concentrations dosing rate: Once

Stability of the test chemical solutions: Not noted

Exposure vessels: 35 X 20 X 25 cm deep glass aquariums containing 16 liters test solution.

Number of replicates: two

Number of fish per replicate: 20

Loading rate: 0.50 g/L

Number of concentrations: five plus a blank control

Water chemistry during the study:

Dissolved oxygen range (24 – 96 hours): 4.0 – 5.0 mg/L

pH range (24 – 96 hours): 7.9 – 8.0

Test temperature (24 – 96 hours): 18-19°C

RESULTS

Nominal concentrations: Bk control, 560, 650, 750, 870, and 1000 mg/L

Element value: 96-hour LC₅₀ = 766 (743 – 789) mg/L

Element value based on nominal concentrations.

CONCLUSIONS

The test sample 96-hour LC₅₀ for fathead minnow was determined to be 766 mg/L with a 95% Confidence Interval of 743 to 789 mg/L.

Submitter: 3M Company, Environmental Laboratory, P.O. Box 33331, St. Paul, Minnesota, 55133

DATA QUALITY

Reliability: Klimisch ranking 2. Testing meets the criteria for quality testing at the time it was conducted. However, sample purity was not properly characterized and it lacks analytical confirmation of test substance concentrations.

REFERENCES

3M Technical Report Summary, Aquatic Toxicity Testing: FC-143 (Lot-37) L.R. 5625 S, Report Number 037, Project Number 9970012600, M. T. Elnabarawy, May 8, 1980.

OTHER

Last changed: 5/24/00

TECHNICAL REPORT SUMMARY

Date 5/8/80

TO: TECHNICAL COMMUNICATIONS CENTER - 201-2CN

Important - If report is printed on both sides of paper, send two copies to TCC.)

Division Environmental Laboratory (EE & PC), St. Paul, Minnesota	Dept. Number 0535
Project Commercial Chemicals	Project Number 9970012600
Report Title Aquatic Toxicity Testing: FC-143 (Lot-37) L.R. 5625 S	Report Number 037
To E. A. Reiner	
Author(s) M. T. Elnabarawy - 2-3E	Employee Number(s) 46981
Notebook Reference 50012: 23	No. of Pages Including Coversheet 5

SECURITY ☒ Open ☐ Closed (Special Authorization)	3M CHEMICAL REGISTRY ☒	New Chemicals Reported ☐ Yes ☒ No
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KEYWORDS:
(Select terms from 3M
Thesaurus. Suggest other
applicable terms.)

EE & PC - Div.
(Env. Lab)

Toxicity
(Aquatic)

CURRENT OBJECTIVE:

To determine the acute aquatic LC₅₀ following exposure to varying concentrations of FC-143 (lot-37).

REPORT ABSTRACT: (200-250 words) This abstract information is distributed by the Technical Communications Center to alert 3M'ers to Company R&D.

The acute static aquatic 96-hour LC₅₀ values obtained for fathead minnows (*Pimephales promelas*) following exposure to FC-143 in replicated experiments were 776 (743-812) and 754 (723-787) mg/l. The combined 96-hour LC₅₀ was 766 (743-789) mg/l.

Data generated include LC₅₀ values with 95% confidence limits.

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CONCLUSIONS

In these replicated 96-hour LC₅₀ aquatic tests, the calculated values for fathead minnows (Pimephales promelas) were 776 and 754 mg/l. Materials possessing an LC₅₀ of this order of magnitude are considered to be practically nontoxic based on the NIOSH criteria for aquatic toxicity interpretation. (2)

INTRODUCTION:

The test substances is a white fine powder, soluble in water at room temperature. Tests performed on this material evaluated its potential aquatic toxicity and the data generated form the basis of this report.

ACCLIMATION AND EXPERIMENTAL DESIGN:

The test protocol utilized for this study was modeled after that described by USEPA (1975). (1)

The fathead minnows (Pimephales promelas) were obtained from a private hatchery (a). Stock fish were held in a flow through system fiberglass holding tank filled with carbon-filtered well-water at 14-16 degrees C. A daily photoperiod of 16 hours light and 8 hours dark, with a 30-minute transition period was maintained throughout the acclimation and testing period. The fish were fed Tetra-Min (b) daily, food being withheld 48 hours prior to and throughout the test period. Fish were acclimated to test temperature for 2 days prior to use in assays.

Twenty (20) fathead minnows, uniform in size, were tested at each chemical. All-glass aquaria, 35x20x25 cm containing 16 liters of diluent plus toxicant comprised a study chamber. Test fish were randomly allocated to each test chamber within 30 minutes following toxicant addition. The fathead minnow experiments were conducted at 19±2 degrees C. Mortality, temperature, dissolved oxygen level, and pH of all test solutions were measured at 24-hour intervals or until total mortality had occurred. General observations were recorded relative to swimming pattern and behavioral changes induced by exposure to the test chemical.

The acute short-term static bioassays were performed on FC-143 using carbon-filtered well water of known composition and constant quality as the diluent (Tables 1,2).

The 96-hour fish studies were performed in replicate using the following FC-143 logarithmic concentrations: 560, 650, 750, 870, and 1,000 mg/l.

LC₅₀ values with 95% confidence limits were calculated using the probit program and 3M TRAC Computer system.

Monitoring equipment used included ASTM thermometers, Orion temperature--compensating pH meter, a Yellow Springs dissolved oxygen meter, and a Taylor temperature chart recorder.

a) Dale Fattig Fish Farm, Brady, Nebraska.

b) Commercial Fish Food of known composition.

RESULTS:

The fathead minnows (Pimephales promelas) used in these studies had an average weight of 0.4 grams and a length of 3.6 cm. The loading factor was 0.5 g/l; the maximum recommended loading factor is 0.8 g/l (1). Temperature, pH, and dissolved oxygen values and ranges obtained during this study were: 19+ 10 C., 7.9 - 8.0 pH units, and 96-hour dissolved oxygen values ranged from 4.0 - 5.0 mg/l. These latter values calculated out to a minimal oxygen saturation of 45-56%.

In this replicated study, the fish 96-hour LC₅₀ values were 776 and 754 mg/l. Chemicals possessing an LC₅₀ value in this range are considered to be practically nontoxic to the aquatic environment (2).

The data reported herein are based on studies performed by M.T. Elnabarawy. Accompanying data sheets comprise original data. A copy of this report is filed in the Environmental Laboratory Archive System, Building 2-3E.

It should be noted that the generated results were reported in the absence of information relative to the "purity" and the "stability" of the chemical substance FC-143 (Lot 37). The reported LC₅₀ values were calculated on the basis of the "observed mortality rates" and in the absence of the actual measured final concentrations of FC-143 (Lot 37) in test solutions.

REFERENCES:

- (1) US/EPA - Methods for Acute Toxicity Tests with Fish, Macroinvertebrates and Amphibians, Ecological Research Series 660/3-75-009, 1975.
- (2) Registry of Toxic Effects of Chemical Substances, '76 Edition, Christensen, H. E., and E. J. Fairchild, Eds., p. XV and Ci, U.S. Department of Health, Education and Welfare; National Institute for Occupational Safety and Health, Washington, D.C. (June, 1976).

TABLE 1
WELL WATER QUALITY

SAMPLE DATE: 4/30/80
SAMPLE TAKEN: 3M Bldg. 2-3E

SAMPLE DATE 4/30/80 (TAKEN FROM TANK #4)

PARAMETER	CONCENTRATION	ENV. LAB WATER QUALITY BOOK REF.
pH	7.6	8
Residual Chlorine	<0.02 mg/l	9
Ammonia Nitrogen	<0.1 mg/l as N	8
Conductivity	400 umhos/cm at 25°C	9
Alkalinity	226 mg/l as CaCO ₃	8
Total Solids	378 mg/l	8
Total Hardness	272 mg/l as CaCO ₃	8
Total Fluoride	<0.02 mg/l	9
Dilute COD	1.3 mg/l	9
Total Coliform	negative	10
Standard Plate Count	42 per ml	10
Aluminum as Al*	0.01 mg/l	14
Arsenic as As*	<0.005 mg/l	14
Boron as B*	<0.2 mg/l	14
Cobalt as Co*	<0.002 mg/l	14
Copper as Cu*	0.018 mg/l	14
Chromium as Cr*	<0.005 mg/l	14
Cadmium as Cd*	<0.002 mg/l	14
Iron as Fe*	0.022 mg/l	14
Nickel as Ni*	0.005 mg/l	14
Lead as Pb*	<0.005 mg/l	14
Silver as Ag*	<0.002 mg/l	14
Zinc as Zn*	0.13 mg/l	14
Mercury as Hg*	<0.2 ug/l	14
PCB's**	<0.50 ug/l	36
Total Organochlorine** Pesticides	<0.50 ug/l	36
Total Organophosphorus** Pesticides	<0.50 ug/l	36

* Sample Date 3/31/80

**Sample Date 2/26/80

TABLE 2

ENVIRONMENTAL LABORATORY, BLDG. 2-3E, ST. PAUL, MINNESOTA
 FIRST QUARTERLY REPORT, 1980
 WELL WATER SUPPLY FOR AQUATIC TOXICITY TESTING

PARAMETER	January 24	February 26	March 31	AVERAGE ($\pm$ S)
TOTAL HARDNESS* as mg/l CaCO ₃	260	268	264	264 $\pm$ 4
TOTAL "M" ALKALINITY* as mg/l CaCO ₃	223	220	225	223 $\pm$ 3
ELECTRICAL SPECIFIC CONDUCTANCE* as umhos per cm ² at 25°C	380	370	400	383 $\pm$ 15
TOTAL SOLIDS* as mg/l	350	408	402	387 $\pm$ 32
pH**	7.6	7.6	7.6	7.6 $\pm$ 0
STANDARD PLATE COUNT*** per 1.0 ml	29	30	19	26 $\pm$ 6

CRITERIA OF CONSTANT QUALITY

* Monthly ranges should be less than 10% of their respective averages. (Draft #10, ASTM Committee E-35 on Pesticides).

** Monthly range of pH should be less than 0.4 unit. (Draft #10, ASTM Committee E-35 on Pesticides).

*** Total bacterial densities should not be greater than 500 organisms per ml. (USEPA-600/8-78-017, page 101.)