

ACUTE TOXICITY TO FISH

TEST SUBSTANCE

Identity: Perfluorooctanesulfonate; may also be referred to as PFOS or FC-95. (1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptafluoro-, potassium salt, CAS # 2795-39-3)

Remarks: The test substance is a white powder. Sample was taken from 3M lot number 217. Sample was stored under ambient conditions prior to testing. Purity determined to be 90.49% by LC/MS, ¹H-HMR, ¹⁹F-NMR and elemental analyses techniques.

METHOD

Method: OECD 203 and OPPTS 850.1075

Type: Static acute

GLP: Yes

Year completed: Study completed 1999. Report completed 2000

Species: *Pimephales promelas*

Supplier: In-house cultures, Wildlife International, Ltd., Easton, MD

Analytical monitoring: PFOS measured at 0, 48, 96-hours

Exposure period: 96-hours

Statistical methods: LC₅₀ values calculated, when possible, by probit analysis, moving average method or binomial probability with non-linear interpolation using the computer software of C.E. Stephan.

Test fish age: Approximately 126 days old

Length and weight: 35 (30-38) mm, 0.36 (0.21-0.49) g

Loading: 0.24 g fish/L

Pretreatment: None

Test conditions:

Dilution water: 0.45 µm filtered well water

Dilution water chemistry (during the 4-week period immediately preceding the test):

hardness: 131 (128-136) mg/L as CaCO₃

alkalinity: 177 (176-178) mg/L as CaCO₃

pH: 8.3

TOC: < 1.0 mg/L

Conductivity: 311 (310-315) µmhos/cm

Stock and test solution preparation: Primary stock prepared in dilution water at 27 mg/L and mixed for ~22 hours prior to use.

After mixing, primary stock solution was proportionally diluted with dilution water to prepare the four additional test concentrations.

Concentrations dosing rate: Once

Stability of the test chemical solutions: Extremely stable

Exposure vessels: 25L polyethylene aquaria containing approximately 15L of test solution; water depth approximately 17.6 cm.

Number of replicates: two

Number of fish per replicate: ten

Number of concentrations: five plus a negative control

Water chemistry during the study:

Dissolved oxygen range (0 – 96 hours):

7.8 – 8.8 mg/L (control exposure)

7.7 – 9.0 mg/L (28 mg/L exposure)

pH range (0 – 96 hours)

8.3 – 8.6 (control exposure)

8.4 – 8.5 (28 mg/L exposure)

Test temperature range (0 – 96 hours)

20.4 – 22.1°C (control exposure)

21.3 – 22.3°C (28 mg/L exposure)

- Method of calculating mean measured concentrations: arithmetic mean

RESULTS

Nominal concentrations: Bk control, 3.6, 5.9, 9.9, 16, 27 mg/L

Measured concentrations: <LOQ, 3.3, 5.6, 9.5, 17, 28 mg/L

Element value: 24-hour LC₅₀ = > 28 mg/L (C.I. not calculable)

48-hour LC₅₀ = > 28 mg/L (C.I. not calculable)

72-hour LC₅₀ = 27 (22 – 41) mg/L

96-hour LC₅₀ = 9.5 (8.0 – 11) mg/L

All element values based on mean measured concentrations

Statistical Evaluation of Mortality:

Confidence limits for 24 and 48-hours could not be calculated due to lack of mortality. The 72-hour LC₅₀ value is questionable because a concentration-effect relationship was not demonstrated over a reasonable range of percent dead. The 24 and 48-hour LC₅₀ values were determined by visual interpretation. Probit was used to calculate the 72-hour LC₅₀ and Moving Average for the 96-hour LC₅₀.

Analytical Methodology: Analyses of test solutions were performed at Wildlife International Ltd. using high performance liquid chromatography with mass spectrometric detection (HPLC/MS). When determining the

concentration of the test substance in the test solutions, the same and most prominent peak response for perfluorooctanesulfonate was used. No attempt was made to quantify on the basis of individual isomeric components. The LOQ (limit of quantitation) was 0.458 mg/L in this study. The mean percent recovery of matrix fortifications analyzed concurrently during sample analysis was 97.9. Samples collected at test initiation had measured values from 85.3 to 117% of nominal. Measured values for samples taken at 48-hours ranged from 86.3 to 101% of nominal. Measured values for samples taken at 96-hours ranged from 87.6 to 98.3% of nominal.

Summary of analytical chemistry data:

Nominal Test Concentration, mg/L	Measured Duplicate Values at 0, 48, and 96-hours, Respectively, mg/L	Mean Measured Concentration, mg/L	Percent of Nominal
Negative Control	All < LOQ	<LOQ	-
3.6	3.16, 3.53, 3.08, 3.22, 3.46, 3.13	3.3	92
5.9	6.05, 5.07, 5.48, 5.89, 5.70, 5.55	5.6	95
9.9	8.99, 9.47, 9.88, 9.33, 9.70, 9.52	9.5	96
16	18.2, 19.3, 15.0, 15.6, 14.8, 16.2	17	106
27	28.5, 28.5, 27.0, 27.8, 26.8, 26.6	28	104

Biological observations after 96-hours: Fish in the negative control and the 3.3 mg/L exposure concentration appeared normal. Some or all of the surviving fish were observed to be swimming erratically (4/16 in 5.6 mg/L exposure, 10/10 in 9.5 mg/L, 4/4 in 17 mg/L) at test termination.

Cumulative percent mortality:

Mean Measured Test Conc., mg/L	24-hours	48-hours	72-hours	96-hours
Neg. Control	0	0	0	0
3.3	0	0	0	0
5.6	0	0	0	20
9.5	0	0	0	50
17	0	0	15	80
28	0	0	50	100

Lowest concentration causing 100% mortality: 28 mg/L
Mortality of controls: None

CONCLUSIONS

The potassium perfluorooctanesulfonate 96-hour LC₅₀ for fathead minnow was determined to be 9.5 mg/L with a 95% confidence interval of 8.0 –11 mg/L. The 96-hour no mortality and no effects concentration was 3.3 mg/L.

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

DATA QUALITY

Reliability: Klimisch ranking = 1

REFERENCES

This study was conducted at Wildlife International Ltd., Easton, MD at the request of the 3M Company.

OTHER

Last changed: 5/3/00

000542