

ACUTE TOXICITY TO AQUATIC INVERTEBRATES (E.G., DAPHNIA)

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 field: 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 202 and OPPTS 850.1010

Test type: Static acute

GLP: Yes

Year Completed: Study completed 1999. Report completed 2000

Species: *Daphnia magna*

Analytical monitoring: PFOS measured at 0, 24, 48-hours

Statistical methods: EC₅₀ 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 daphnid source: Obtained from cultures maintained by Wildlife International Ltd., Easton, MD. Identification of the original brood stock was verified by the Academy of Natural Sciences, Philadelphia, PA.

Test daphnid age at study initiation: < 24-hours

Test conditions

Dilution water: 0.45 µm filtered well water

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

hardness: 132 (128-136) mg/L as CaCO₃

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

pH: 8.3 (8.2-8.3)

TOC: < 1.0 mg/L

Conductivity: 313 (310-315) µmhos/cm

Ca/Mg ratio: 35/13.5

Na/K ratio: 21.3/6.62

Lighting: Colortone® 50 fluorescent lights, intensity approximately 359 lux. Photoperiod of 16-hours light, 8-hours dark with a 30-minute transition period.

Stock and test solutions preparation: A primary stock solution was prepared in dilution water at 91 mg/L. It was mixed for ~19.5 hours prior to use. After mixing, the primary stock was proportionally diluted with dilution water to prepare the four additional test concentrations. All test solutions appeared clear and colorless.

Exposure vessels: 250 mL plastic beakers containing 240 mL of test solution. The approximate depth of test solution was 6.4 cm.

Number of replicates: two

Number of daphnids per replicate: ten

Number of concentrations: five plus a negative control

Water chemistry during the study:

Dissolved oxygen range (0 – 48 hours):

8.6 – 8.9 mg/L (control exposure)

8.6 – 9.1 mg/L (91 mg/L exposure)

pH range (0 – 48 hours)

8.2 – 8.5 (control exposure)

8.5 – 8.6 (91 mg/L exposure)

Test temperature range (0 – 48 hours)

19.5 – 20.2°C (control exposure)

19.3 – 20.1°C (91 mg/L exposure)

Element basis: mortality and immobilization

Method of calculating mean measured concentrations:
arithmetic mean

RESULTS

Nominal concentrations: Bk control, 12, 20, 33, 55, 91 mg/L

Measured concentrations: <LOQ, 11, 20, 33, 56, 91 mg/L

Element value: 24-hour EC_{10} = 82 (81-83) mg/L

24-hour EC_{50} = >91 mg/L (C.I. not calculable)

24-hour EC_{90} = >91 mg/L (C.I. not calculable)

48-hour EC_{10} = 53 (<11->91) mg/L

48-hour EC_{50} = 61 (33-91) mg/L

48-hour EC_{90} = 63 (<11->91) mg/L

All element values based on mean measured concentrations

Statistical Evaluation: The EC_{50} values and 95% confidence intervals were calculated when possible by probit analysis, the moving average method or binomial probability with non-linear interpolation using the computer software of C.E. Stephan. The EC_{10} and EC_{90} values were calculated when possible using the Bruce-Versteeg method because there were less than two concentrations with partial mortality or immobility.

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 4.58 mg/L in this study. The mean percent recovery of matrix fortifications analyzed concurrently during sample analysis was 96.2. Samples collected at test initiation had measured values from 85.5 to 112% of nominal. Measured values for samples taken at 24-hours ranged from 92.2 to 115% of nominal. Measured values for samples taken at 48-hours ranged from 91.6 to 106% of nominal.

Summary of analytical chemistry data:

Nominal Test Concentration, mg/L	Measured Duplicated Values at 0, 24, and 48-hours, Respectively, mg/L	Mean Measured Concentration, mg/L	Percent of Nominal
Negative Control	All < LOQ	<LOQ	-
12	10.5, 10.6, 11.5, 12.5, 10.9, 12.0	11	92
20	17.2, 18.1, 22.8, 21.6, 21.4, 18.8	20	100
33	30.2, 34.1, 34.0, 36.1, 31.3, 34.0	33	100
55	50.5, 49.9, 57.0, 63.0, 56.8, 56.4	56	102
91	87.6, 102, 90.1, 84.4, 88.7, 92.4	91	100

Biological observations after 48-hours: Daphnids in the negative control, the 11 and the 20 mg/L treatments appeared healthy and normal throughout the test with no mortality, immobility or overt clinical signs of toxicity. Five percent mortality was observed at 48-hours in the negative control. The effects noted in this study were mortality; no immobilization was noted at any test concentration.

Cumulative percent mortality:

Mean Measured Test Conc., mg/L	24-hours	48-hours
Neg. Control	0	5
11	0	0
20	0	0
33	0	0
56	0	35
91	35	100

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Control response: satisfactory

CONCLUSIONS

The potassium perfluorooctanesulfonate 48-hour EC50 for *Daphnia magna* was determined to be 61 mg/L with a 95% confidence interval of 33-91 mg/L. The 48-hour noimmobilization and no observed effect concentration was 33 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

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