TOXICITY TO AQUATIC PLANTS (SELENASTRUM CAPRICORNUTUM)

TEST SUBSTANCE

Identity: Perfluorooctanoic acid, tetrabutylammonium salt; may also be referred to as PFOA tetrabutylammonium salt, tetrabutylammonium perfluorooctanoate, N2803-2, or as a major component of L-13492. (Octanoic acid, pentadecafluoro-, tetrabutylammonium salt, CAS # 95658-53-0)

Remarks: The 3M production lot number was 2327. The test sample is referred to by the testing laboratory as N2803-2. The T.R. Wilbury study number is 890-TH. The purity of the sample was not sufficiently characterized, although current information indicates it is a solution of 44.9% tetrabutylammonium perfluorooctanoate, 27.9% water, and 27.2% isopropanol

The following summary applies to the test sample as a mixture of the test substance in an isopropanol/water solution with incompletely characterized concentrations of impurities. Data may not accurately relate toxicity of the test sample with that of the test substance.

METHOD

Method: U.S. EPA-TSCA Guideline 797.1050
Test: Acute static
GLP: Yes
Year completed: 1995
Species: *Selenastrum capricornutum*
Source: Originally from The Culture Collection of Algae at the University of Texas at Austin, maintained in culture medium at T.R. Wilbury, Inc., Marblehead, MA.
Element basis: Algal cell count (cells/mL), and specific growth rate.
Exposure period: 96-hours
Test organisms laboratory culture: Algae cultures were growing in U.S. EPA-recommended sterile enriched medium for at least 14 days prior to test initiation.
Statistical methods: The average specific growth rate was calculated as the natural log of the number of cells/mL at the exposure period minus the natural log of the number of cells/mL at 0 hours divided by the exposure period. The percent change from the control was calculated by subtracting the treatment average specific growth rate from the control average specific growth rate, dividing the difference by the average specific growth rate in the control, and multiplying that value by 100. The EC_{50} values were calculated by probit analysis. The NOEC was determined using a parametric one-way analysis of variance and the

average specific growth rate and the number of cells/mL in each test vessel at the end of the test.

Test Conditions:

Dilution water source: The algae medium was prepared to U.S. EPA recommended concentrations by spiking deionized water with nutrient stocks. The pH of the synthetic algal medium at test initiation was 7.5.

Stock and test solutions preparation: A 160 mg/L primary stock solution was prepared in sterile enriched media. Appropriate amounts of this stock solution were added directly to dilution water to formulate the test media.

Exposure vessels: 250 mL glass Erlenmeyer flasks containing 50 mL of test solution.

Agitation: Continuously at 100 rpm

Number of replicates: 3

Initial algal cell loading: 1.0 X 10^4 cells/mL

Number of concentrations: Five plus a negative control

Lighting: Continuous lighting at ~380 ft-c using cool-white fluorescent lamps

Water chemistry:

pH range: (0 – 96 hours)

7.5 – 10.8 (control exposure)

7.5 – 8.4 (16 mg/L exposure)

Test temperature range: (0 – 96 hours)

23.4 – 23.7°C

RESULTS

Nominal concentrations: Blank control, 0.99, 2.0, 4.0, 8.0, 16.0 mg/L.

Element value and 95% confidence interval:

24-hour EC_{10} (cell density) = 4.1 (0 – 9.0) mg/L
24-hour EC_{50} (cell density) = >16 (7.7 - >16) mg/L
24-hour E_rC_{50} (growth rate) = >16 mg/L (CI not calculable)
24-hour EC_{90} (cell density) = >16 mg/L (CI not calculable)
48-hour EC_{10} (cell density) = 1.2 (<0.99 – 1.6) mg/L
48-hour EC_{50} (cell density) = 7.1 (6.0 – 8.6) mg/L
48-hour E_rC_{50} (growth rate) = >16 mg/L (CI not calculable)
48-hour EC_{90} (cell density) = >16 mg/L (CI not calculable)
72-hour EC_{10} (cell density) = <0.99 (<0.99 – 1.9) mg/L
72-hour E_rC_{10} (growth rate) = 2.2 (1.6 – 2.8) mg/L
72-hour EC_{50} (cell density) = 2.8 (1.1 – 5.8) mg/L
72-hour E_rC_{50} (growth rate) = 11 (9.4 - 15) mg/L
72-hour EC_{90} (cell density) = 8.4 (4.5 – >16) mg/L

72-hour E_rC_{90} (growth rate) = >16 mg/L (CI not calculable)
96-hour EC_{10} (cell density) = 1.4 (<0.99 – 2.4) mg/L
96-hour E_rC_{10} (growth rate) = 2.3 (<0.99 – 3.6) mg/L
96-hour EC_{50} (cell density) = 2.9 (1.0 – 7.7) mg/L
96-hour E_rC_{50} (growth rate) = 8.4 (5.9 - 14) mg/L
96-hour EC_{90} (cell density) = 6.0 (3.5 - >16) mg/L
96-hour E_rC_{90} (growth rate) = >16 mg/L (CI not calculable)

96-hour NOEC (cell density): 0.99 mg/L
96-hour NOEC (growth rate): 2.0 mg/L

Element values were based on nominal concentrations.

Control response: Satisfactory

Biological observations after 96-hours:

Nominal Concentration, mg/L	Mean Number of Cells per mL	Percent Inhibition via Density	Percent Inhibition via Growth Rate
Control	3,227,000	-	-
0.99	3,633,000	-13	-2
2.0	2,440,000	24	5
4.0	581,000	82	30
8.0	169,000	95	52
16	61,000	98	68

Observations: Algal cell counts in each test vessel were determined by means of direct microscope counts with a hemocytometer. After 96 hours of exposure, there were no signs of aggregation, flocculation or adherence of the algae to the flasks in the control or any test treatment group. In addition, there were no noticeable changes in cell size, color or morphology when compared to the control.

Reversibility of Growth Inhibition: Effect of the test substance was determined to be algistatic based on the results of the post-definitive test exposure.

Remarks: Testing was conducted on the mixture as described in the Test Substance Remarks field. The values reported apply to that mixture and not the fluorochemical component alone.

CONCLUSIONS

The test sample 96-hour EC_{50} and 95% confidence interval for *Selenastrum capricornutum* was determined using two calculation methods. The test substance 96-hour EC_{50} for *Selenastrum capricornutum* was determined to be 2.9 mg/L with a 95% confidence interval of 1.0 – 7.7 mg/L, when calculated using cell density. The 96-hour EC_{50} for *Selenastrum capricornutum* was determined to be 8.4 mg/L with a 95% confidence interval of 5.9 – 14 mg/L using growth rate. No signs of aggregation, flocculation, or adherence were noted in any of the test solutions. This test substance was determined to be algistatic.

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

DATA QUALITY

Reliability: Klimisch ranking 2. The study lacks analytical measurement of test substance concentrations in the test solutions and sample purity is not sufficiently characterized.

REFERENCES

This study was conducted at T.R. Wilbury Laboratories, Inc., Marblehead, MA, at the request of the 3M Company, Lab Request number N2803-2, 1995.

OTHER

Last changed: 4/1/01