TOXICITY TO AQUATIC PLANTS

TEST SUBSTANCE

Identity: A mixture containing perfluorooctanesulfonate, which may also be referred to as PFOS, FC-95, or as a component of FC-603F. (1-Octanesulfonic acid) (CAS # 2795-39-3).

Remarks: The 3M production lot number was 501. The test sample is FC-603F. Current information indicates it is a mixture of 0.5% PFOS, 7% diethylene glycol butyl ether, 82.95% water, 2% acrylic foamer, 4% Alkylether sulfate, 1.45% Xanthan gum, 1.4% calcium acetate, 0.07% N-(3-Chloroallyl)hexaminium chloride, 0.5% triethanolamine, 0.05% sodium hydroxide, 0.03% cis-1-(3-Chloroallyl)-3,5,7-triaza-1-azoniaadamantane chloride, and 0.05% tolytriazole.

The following summary applies to a mixture with incompletely characterized concentrations of impurities. Data may not accurately reflect the toxicity of the fluorochemical component of the test sample.

METHOD:

Method: OECD Guideline 201, and EPA CFR 40 797.1050
Type: Acute static
GLP: No
Year study performed: 1995
Species: *Selenastrum capricornutum*
Source: In-house cultures. Originally from ATCC, Rockville, MD
Element basis: Algal cell counts (cells/mL) and growth rate.
Exposure period: 96 hours
Statistical Methods: Not applicable due to study results.
Analytical monitoring: Not given

Test Conditions:

Algal Nutrient Medium: Nutrient medium for freshwater algae per OECD method. This nutrient medium served as the diluent for all algal operations. The pH of this synthetic algal medium was 7.9.

Stock and test solution preparation: A 1000 mg/L primary stock solution was prepared by diluting 500 mg of test substance in 500 mL of standard algal nutrient medium. Aliquots were then added directly to dilution water in test vessels to create test solutions.
Exposure vessels: Not given
Agitation: Not given
Number of replicates: Not given.
Initial cell loading: 1×10^4 cells/mL

Number of concentrations: one plus a blank control
Lighting: Continuous.
Water Chemistry: Not given

RESULTS

Nominal concentrations: Blank control and 1000 mg/L

96-Hour Algal Growth Response

Exposure Conc. (mg/L)	Mean Growth Rate	Percent Change in Growth Rate
Control	1.348	---
1000	0.896	34

Element values: 96-hour IC_{50} = >1000 mg/L

Element values are based on nominal concentrations.

Reversibility of Growth Inhibition: Not given.

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

CONCLUSIONS

FC-603F exhibits a 96-hour IC_{50} of >1000 mg/L. This concentration inhibited the algal growth rate by 34%.

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

DATA QUALITY

Reliability: Klimisch ranking = 4. Not all laboratory data could be located. Sample purity was not properly characterized and the study lacks analytical confirmation of the amount of fluorochemical proportion in the solution.

REFERENCES

This study was conducted by the 3M Company, Environmental Laboratory, St. Paul, MN, Lab Request number M1655, 1995.

OTHER

Last changed: 6/26/00.

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PREPARATION WORKSHEET FOR
FRESHWATER ALGA GROWTH INHIBITION TEST[1]

LR SEE BELOW
PAGE OF
DATE 10/4/95
ANALYST S

M1655 EC1603F Lot 501 Light amber viscous gel. Soluble in water.
Stock: 500mg/500mL Std. Algal Nutrient Medium.
Initial pH 7.8.

N3188 EC3017 Light water Brand AFFF. Clear amber colored liquid. Miscible in water
Stock 500mg/500mL Std. Algal Nutrient Medium
Initial pH 7.9

N3194 EC3554 (L-11729) Protective Chemical. Off white emulsion with mild odor.
Miscible in water. Stock 500mg/500mL Std. Algal Nutrient Medium
Initial pH 8.0.

N3281 EC2014F Amber brown liquid. Miscible in water.
Stock 500mg/500mL Std Algal Nutrient Medium
Initial pH 8.0

3L of Standard Algal Nutrient Medium was prepared;
2L for stock solution preparation and 1L for Blk Controls.
Initial pH 7.9

Inoculum: Cells used were from 4 day old culture that was the
2nd transfer after initial.
Cells/mL = 5.4×10^7
5.6×10^7 } $\bar{X} = 5.5 \times 10^7$
5.5×10^7
Need 10,000 cells/mL or 1×10^4/100mL
Used 0.020mL culture/100mL
Initial Blk Control Count 1×10^4 cells/mL

[1] Test methodology conforms with the following two test protocols:
OECD #201 "Alga, Growth Inhibition Test" and Fed. Reg. Vol. 40, No. 797.1050, "Algal Acute Toxicity Test."

LR M1655
N3188
N3194
N3281

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STANDARD NUTRIENT MEDIUM FOR FRESHWATER ALGAE

NUTRIENT	CONCENTRATION IN STOCK SOLUTION	FINAL CONCENTRATION IN TEST SOLUTION
STOCK SOLUTION 1: MACRONUTRIENTS		
NH_4Cl	1.5 g/L	15 mg/L
$MgCl_2 \cdot 6H_2O$	1.2 g/L	12 mg/L
$CaCl_2 \cdot 2H_2O$	1.8 g/L	18 mg/L
$MgSO_4 \cdot 7H_2O$	1.5 g/L	15 mg/L
KH_2PO_4	0.16 g/L	1.6 mg/L
STOCK SOLUTION 2: Fe-EDTA		
$FeCl_3 \cdot 6H_2O$	80 mg/L	80 ug/L
$Na_2EDTA \cdot 2H_2O$	100 mg/L	100 ug/L
STOCK SOLUTION 3: TRACE ELEMENTS		
H_3BO_3	185 mg/L	185 ug/L
$MnCl_2 \cdot 4H_2O$	415 mg/L	415 ug/L
$ZnCl_2$	3 mg/L	3 ug/L
$CoCl_2 \cdot 6H_2O$	1.5 mg/L	1.5 ug/L
$CuCl_2 \cdot 2H_2O$	0.01 mg/L	0.01 ug/L
$Na_2MoO_4 \cdot 2H_2O$	7 mg/L	7 ug/L
STOCK SOLUTION 4: NaHCO3		
$NaHCO_3$	50 g/L	50 mg/L

Sterilize stock solutions 1-4 by membrane filtration (0.2 um).

SOLUTION 5: NUTRIENT CONCENTRATE

Add 100 mL of STOCK SOLUTION 1;
10 mL of STOCK SOLUTION 2;
10 mL of STOCK SOLUTION 3;
and 10 mL of STOCK SOLUTION 4.

Make up to 1000 mL with Millipore Milli-Q™ water.

SOLUTION 6: STANDARD ALGAL NUTRIENT MEDIUM

Add 100 mL of the pH-adjusted Nutrient Concentrate Solution to 900 mL of Millipore Milli-Q™ water. Initial pH of the medium after equilibration with air is ~ 8.0

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*LR SEE BELOW

FRESHWATER ALGA GROWTH INHIBITION TEST[1]
SPECIFIC GROWTH RATE [2]

ALGAL SPECIES: Freshwater Green Algae, *Selenastrum capricornutum*

DATE INITIATED: 10/9/95 1600 DATE TERMINATED: 10/13/95 1600 ANALYST: [illegible]

TEST SUBSTANCE CONCENTRATION mg/L	24 HRS		48 HRS		72 HRS		96 HRS	
	MEAN GR RATE	% CHANGE [3]	MEAN GR RATE	% CHANGE [3]	MEAN GR RATE	% CHANGE [3]	MEAN GR RATE	% CHANGE [3]
BK CONTROL STD NUTRIENT	2.104	—	1.698	—	1.477	—	1.348	—
M1655 1000 mg/L	1.988	5.5	1.282	22	1.166	21	0.896	34
N3188 1000 mg/L	1.792	15	1.498	9.1	1.238	16	1.125	17
N3194 1000 mg/L	0.531	75	0.597	64	0.580	61	0.520	61
N3281 1000 mg/L	1.841	13	1.417	14	1.155	22	1.105	18
DATE/ ANALYST	10/10/95 [illegible] 3		10/11/95 [illegible] 3		10/12/95 [illegible] 3		10/13/95 [illegible] 3	

[1] Test methodology conforms with the following two test protocols:
OECD #201 "Alga, Growth Inhibition Test" and Fed. Reg. Vol. 40, No. 797.1050, "Algal Acute Toxicity Test".

[2] Specific Growth Rate (u) = $\ln N_t - \ln N_0/t$. Where N_t is the mean measured final cell density; N_0 is the initial cell density and t is the time of the measurement.

[3] Percent Change in Growth Rate % = (Mean Control Value - Mean Sample Value)/Mean Control Value x 100.