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-201AF. (1-Octanesulfonic acid) (CAS # 2795-39-3).

Remarks: The 3M production lot number was not noted. The test sample is FC-201AF. Current information indicates it is a mixture of 3% PFOS, 18.59% diethylene glycol butyl ether, 37.81% water, 14% ethylene glycol, 8.25% Acrylic foamer, 9% sodium octyl sulfate, 0.3% sodium lauryl sulfate, 3% triethanolamine, 6% sullfonated alkyl ether salts, and 0.05% tolyltriazole.

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), specific growth rates.
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 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 netrient 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, 1000 mg/L

Algal Growth Response EC_{50} values

Exposure (Contact) Hours	Mean Percent Change in Specific Growth Rate (1000 mg/L Conc.)	EC50 (mg/L)
24	13	>1000
48	14	>1000
72	22	>1000
96	18	>1000

Element values are based on nominal concentrations.

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 components alone.

CONCLUSIONS

The test substance exhibits a 96-hour EC_{50} for specific growth rate of >1000 mg/L.

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. There is no characterization of the test substance purity, analytical measurement of the test concentrations, and confirmation of the amount of fluorochemical components in the solution.

REFERENCES

This test was conducted by the 3M Environmental Laboratory, St. Paul, MN, Lab Request number N3281, 1995.

OTHER

Last changed: 6/26/00

LAB REQUEST NO. N3281
REQUESTOR NAME: SBS/SHARI LOUSHIN
DEPARTMENT: 3058
PROJECT NO: BILTWENVIR
DATE RECEIVED: 09/28/1995
DESC: FC-201AF LIGHT WATER

CONTRACT LAB(S):
EXP COMP DATE: 12/04/1995
DATE COMPLETED: 01/17/1996
PROJECT LEAD: TL HATFIELD
PHONE NO: 651-778-7863
3M FAX NO: 651-778-6176

Results for toxicity to fish, Daphnia, Microtox and activated sludge resp. can be found on lab request N2964
sab 10/3/95
Standard testing for AFFF products. Formulation is on Doc. # 07-2573-9 in PRISM. 3M ID number given as ZF-0002-0843-7.
sab 10/3/95

Results from algae toxicity test:

Test Conc.	Mean Percent change in Specific Growth Rate			
mg/L	24-hrs	48-hrs	72-hrs	96-hrs
1000	13	14	22	18
EC50	>1000	>1000	>1000	>1000

sab 1/16/96

SAMPLE	DATE	CODE	DESCRIPTION	RESULT	MDL or (95% C.I.)
1	09/04/95	FC-201AF	Dark Liquid		
	IC50-ALGAE	ALGAE ASSAY - IC50		>1000 MG/L	(-)

ENVIRONMENTAL LABORATORY

PREPARATION WORKSHEET FOR
FRESHWATER ALGA GROWTH INHIBITION TEST[1]

LR SEE BELOW
PAGE OF
DATE 10/A/95
ANALYST 3

M1655 EC 1603F Lot 501 Light amber viscous gel. Soluble in water.
Stock: 500mg/500mL Std. Algal Nutrient Medium.
Initial pH 7.8.

N3188 EC 3017 Light water Brand AFFF. Clear amber colored liquid. Miscible in water
Stock 500mg/500mL Std. Algal Nutrient Medium
Initial pH 7.9

N3194 EC 3554 (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 EC-20AF 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 Bk 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 Bk 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

ENVIRONMENTAL LABORATORY
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.

ENVIRONMENTAL LABORATORY

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	—	1.648	—	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.