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-3017. (1-Octanesulfonic acid) (CAS # 2795-39-3).

Remarks: The 3M production lot number was not noted. The test sample is FC-3017. Current information indicates FC-3017 is a mixture of 0.67% PFOS, 20% diethylene glycol butyl ether, 55.41% water, 21% ethylene glycol, 1.33% Hydroxy foamer, 1% sodium octyl sulfate, 0.5% polyoxyethylene monooctylphenyl ether, 0.04% sodium lauryl sulfate, and 0.05% tolyltraizole.

The following summary applies to a mixture with incompletely characterized concentrations of impurities. Data may not accurately reflect 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: 1996
Species: *Selenastrum capricornutum*
Source: In-house cultures. Originally stock 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. The pH of this 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

Algal Growth Response E_rC_{50} values

Exposure (Contact) Hours	Mean Percent Change in Specific Growth Rate (1000 mg/L Conc.)	E_rC50 (mg/L)
24	15	>1000
48	9.1	>1000
72	16	>1000
96	17	>1000

Element values are based on nominal concentrations.

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 proportion alone.

CONCLUSIONS

FC-3017 exhibits a 96-hour E_rC_{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. Study lacks description and records of the method followed. Sample purity was not properly characterized and the study lacks analytical confirmation of the amount of fluorochemical proportion in the solution.

REFERENCES

This test was conducted by 3M Company, Environmental Laboratory, St. Paul, MN, Lab Request number N3188, 1996.

OTHER

Last changed: 6/26/00

LAB REQUEST NO. N3188
REQUESTOR NAME: SBS/BOB COX
DEPARTMENT: 3058
PROJECT NO: BILTWENVIR
DATE RECEIVED: 09/20/1995
DESC: FC-3017 (LIGHT WATER)

CONTRACT LAB(S): ASCI
EXP COMP DATE: 11/22/1995
DATE COMPLETED: 05/23/1996
PROJECT LEAD: SA BEACH
PHONE NO: 651-778-7452
3M FAX NO: 651-778-6176

Standard set of tests. Please make this a priority project as Europe needs data as quickly as possible without incurring additional costs. Please also copy Agnes Vidal and Rene Lehenaff on testing results. MSDS Doc.# 10-3922-1.

BOD and COD will be put on another lab request.
sab 9/28/95

Results from Microtox Test:

Test Conc.	Percent Light Loss		
mg/l	5-min exp.	15-min exp.	30-min exp.
125	6.5	9.5	14
250	16	22	28
500	26	37	46
1000	44	57	67
EC50	> 1000	780	560
95% CI	(-)	(730 - 850)	(540 - 570)

sab 9/28/95

Results from 96-hr Fathead Minnow Toxicity Test:
Test was run as a static-renewal. Beakers were renewed at 48 and 72-hrs of exposure. This was done because the dissolved oxygen levels dropped below the required 60% of saturation. (1000 mg/L renewed at both times, 100 mg/L renewed only at 72 hours. sab 10/27/95

Test	Percent Mortality			
Conc., mg/L	24-hrs exp.	48-hrs exp.	72-hrs exp.	96-hrs exp.
1.0	0	0	0	0
10	0	10	10	10
100	0	0	0	0
1000	0	0	0	0
Duplicate 1000	0	0	0	0
LC50	>1000	>1000	>1000	>1000

NOTE: The blank controls and 1000 mg/L concentrations were duplicated; this test combined a range finder with a definitive test at 1000 mg/L.
sab 10/27/95

Results from Activated Sludge Respiration Inhibition Test:

Test	Percent Inhibition in Respiration Rate	
Conc., mg/L	30-min Exp.	3-hr Exp.
1000	0	0
Dup. 1000	0	0
EC50	> 1000	> 1000

No significant inhibition in respiration rate was seen after 30-minutes and 3-hours of exposure to 1000 mg/L.

sab 10/17/95

BOD AND COD ARE ON LR N3688.
sab 11/27/95

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	15	9.1	16	17
EC50	>1000	>1000	>1000	>1000

sab 1/16/96

Results from Daphnia magna acute toxicity test:

Test Conc.	Percent Immobilization	
mg/L	24-hrs Exp.	48-hrs Exp.
1000 (all 4 reps)	0	0
EC50	>1000	>1000

sab 5/22/96

SAMPLE	DATE	CODE	DESCRIPTION	RESULT	MDL or (95% C.I.)

* = CONTRACT LAB DATA

LAB REQUEST NO. N3188 CONTINUED

SAMPLE	DATE	CODE	DESCRIPTION	RESULT	MDL or (95% C.I.)
1		FC-3017	Amber Liquid		
ASCI		48-HR-EC50	*DAPHNIA ACUTE TEST	>1000 MG/L	
		96-HR-LC50	FISH ACUTE TEST - 96 HOUR	>1000 MG/L	(-)
		IC50-ALGAE	ALGAE ASSAY - IC50	>1000 MG/L	(-)
		MICROTOX	MICROTOX - EC50	560 MG/L	(540 - 570)
		SLUDG-RESP	SLUDGE RESPIRATION - EC50	>1000 MG/L	(-)

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

ENVIRONMENTAL LABORATORY

PREPARATION WORKSHEET FOR
FRESHWATER ALGA GROWTH INHIBITION TEST[1]

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 AEFE. 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 EC-201AF 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.