ACTIVATED SLUDGE RESPIRATION INHIBITION TEST

TEST SUBSTANCE

Identity: A mixture containing perfluorooctanesulfonate, which may also be referred to as PFOS, FC-95, or as a component of FC-203CE. (1-Octanesulfonic acid) (CAS # 2795-39-3).

Remarks: The 3M production lot number was 519.
The test sample is FC-203CE. Current information indicates it is a mixture of 1.84% PFOS, 30% diethylene glycol butyl ether, 60.23% water, 2.56% Sultone foamer, 3.1% sodium octyl sulfate, 2.1% polyoxyethylene monooctylphenyl ether, 0.12% sodium lauryl sulfate, 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 209
GLP: No
Year Completed: 1989
Analytical monitoring: Dissolved oxygen concentrations, pH, and temp.
Statistical methods: Results were determined by calculation of the % inhibition in respiration rate.
Test organism source: Activated sludge mixed liquor collected from the Metro Waste Treatment Plant, St. Paul, MN
Test conditions:

Dilution water: Millipore Milli-Q™ water
Synthetic sewage: per OECD method
Reference and test solution preparation: A stock solution of the reference substance, 3,5-dichlorophenol, was prepared by dissolving 500 mg in 10 mL 1N NaOH, diluted to 30 mL with Millipore Milli-Q™ water, then brought to the point of incipient precipitation with 1N H_2SO_4 and diluted to 1L with Milli-Q™ water. The pH of the reference solution was measured to be 7.8. Test substance was added directly to test vessels.
Test vessels: Not given.
Number of concentrations: 5 plus 1 reference substance and 2 blank controls
Temperature: 19 – 21 °C
Total suspended solids and pH on day of testing: 4.1 g/L (TSS), initial pH 7.2 and final pH 7.5
Element Basis: Respiration inhibition as determined by oxygen consumption.

Remarks: Values corrected to 20 °C for calculations.

RESULTS

Nominal concentrations: 2 Blank controls, reference substance, 100, 180, 320, 560, and 1000 mg/L

Element values: 30-minute EC_{50} = >1000 mg/L
3-hour EC_{50} = >1000 mg/L

Element values 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 proportion alone.

CONCLUSIONS

The test substance 3-hour EC_{50} for activated sludge respiration inhibition was determined to be >1000 mg/L.

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

DATA QUALITY

Reliability: Klimisch ranking 2. Testing meets all criteria for quality testing. However, 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 G1358-1, 1989.

OTHER

Last changed: 6/26/00

LR G1358-1
Date 6-9-89
Analyst SLB

ENVIRONMENTAL LABORATORY

ACTIVATED SLUDGE MIXED LIQUOR

Type Test OECD Activated Sludge Respiration Inhibition #209

Source Metro Waste Treatment Plant St Paul, MN

Date Obtained 6-9-89 Date Used 6-9-89

Mixed Liquor Suspended Solids (MLSS) 4.1 g/L Adjustment None g/L

pH Initial = 7.2 Final = 7.5

Comments

Test Substance

Sample Description FC-203CE Lot 519

Sample pH Highest Conc, 1000 mg/L = 7.2 Adjustment None

Comments

Reference Substance

Sample Description 3,5-Dichlorophenol

Sample pH Stock Soln. = 7.8 Adjustment None

Comments

Exposure Conditions

Test Duration 3-Hours

Test Temperature 19-21 °C

Comments Ran with LR G1357-2

001109

Form 10820-8-D-PWO

Lab Request No. G1358-1

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Date: 6-9-89

Analyst: SAB

Environmental Lab — Work Sheet

Sample Description
FC-203CE Lot 519

OECD ACTIVATED SLUDGE
RESPIRATION INHIBITION TEST #209

Test Solutions Preparation

Test Conc. mg/L	mg added per 500 ml		ml DI water per 500 ml		ml syn. sewage feed per 500 ml		ml microbial inoculum per 500 ml		Total volume ml
Blank Controls	—		284	+	16	+	200	=	500
100	50	+	284	+	16	+	200	=	500
180	90	+	284	+	16	+	200	=	500
320	160	+	284	+	16	+	200	=	500
560	280	+	284	+	16	+	200	=	500
1000	500	+	284	+	16	+	200	=	500

Initial pH highest conc. tested, 1000 mg/L = 7.2

Control I shared with LR G1357-2 as Control II

LR 61358-1

ENVIRONMENTAL LABORATORY

OECD ACTIVATED SLUDGE RESPIRATION INHIBITION TEST #209

RAW DATA

Test Substance: FC-203CE Lot 519

Source of Activated Sludge Mixed Liquor: Metro Waste Treatment Plant St Paul, MN

Date Received: 6-9-89 Date Used: 6-9-89

Analyst: Susan A. Boach

30 - MINUTE EXPOSURE

DISSOLVED OXYGEN CONCENTRATIONS mg/L

Test Substance Concentration (mg/L)	TIME-MINUTES 0.5	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	TEMP C°
CONTROL I	7.8	7.6	7.0	6.5	6.0	5.5	5.0	4.5	4.0	3.5	3.0	20
100	6.5	6.2	5.5	5.0	4.4	3.9	3.3	2.8	2.3	1.8	1.3	20
180	7.3	7.0	6.3	5.7	5.0	4.4	3.7	3.1	2.5	1.9	1.3	20
320	6.3	5.9	5.1	4.4	3.7	2.9	2.2	1.5	0.8	0.5 / 8:25		20
560	6.2	5.8	4.9	4.0	3.0	2.1	1.2	0.5 / 6:45				20
1000	6.8	6.4	5.6	4.8	4.0	3.1	2.3	1.5	0.7	0.5 / 8:20		19
CONTROL II	7.2	7.0	6.5	5.9	5.4	4.9	4.3	3.8	3.3	2.7	2.2	21

3 - HOUR EXPOSURE

DISSOLVED OXYGEN CONCENTRATIONS mg/L

Test Substance Concentration (mg/L)	TIME-MINUTES 0.5	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	TEMP C°
CONTROL I	7.8	7.6	7.0	6.5	6.0	5.4	4.9	4.3	3.9	3.3	2.8	21
100	7.1	6.8	6.3	5.8	5.2	4.7	4.2	3.7	3.2	2.7	2.2	20
180	8.9	8.8	8.5	8.1	7.7	7.3	6.9	6.4	6.1	5.7	5.3	19
320	8.6	8.5	8.2	7.8	7.4	7.1	6.7	6.3	5.9	5.5	5.1	19
560	8.4	8.3	7.9	7.6	7.2	6.8	6.4	6.0	5.6	5.2	4.7	20
1000	7.6	7.4	6.8	6.3	5.8	5.2	4.7	4.2	3.6	3.1	2.6	21
CONTROL II	7.3	7.1	6.6	6.0	5.4	4.9	4.3	3.8	3.2	2.7	2.1	21

pH of Activated Sludge Mixed Liquor: Initial 7.2 Final 7.5

pH of highest concentration tested: Initial 7.5 Final 7.0

Test Temperature: 19-21°C

ENVIRONMENTAL LABORATORY

ACTIVATED SLUDGE RESPIRATION INHIBITION TEST #209
CALCULATION OF RESULTS

LR G1358-1
Date 6-9-89
Analyst SAB

Test Substance FC-203CE Lot 519

30 - MINUTE EXPOSURE

Test Substance Concentration (mg/L)	Oxygen Uptake Rate R	R Corrected[1] to 20°C	% Inhibition in Respiration Rate[2]
CONTROL I	0.5055	0.5055	-
100	0.5388	0.5388	-
180	0.6333	0.6333	-
320	0.7249	0.7249	-
560	0.9248	0.9248	-
1000	0.8137	0.8519	-
CONTROL II	0.5345	0.5105	-

Percent Difference in Controls[3] 1.0 %

EC_{50} (95% Confidence Limits) mg/L > 1000 mg/L

3 - HOUR EXPOSURE

Test Substance Concentration (mg/L)	Oxygen Uptake Rate R	R Corrected[1] to 20°C	% Inhibition in Respiration Rate[2]
CONTROL I	0.5315	0.5076	-
100	0.5127	0.5127	1.3
180	0.3964	0.4150	20
320	0.3800	0.3979	23
560	0.3958	0.3958	24
1000	0.5327	0.5088	2.0
CONTROL II	0.5558	0.5309	-

Percent Difference in Controls[3] 4.5 %

EC_{50} (95% Confidence Limits) mg/L > 1000 mg/L

(1) Temp. Correction = $\frac{R_{T,obs}}{\theta^{x}}$ (mg O_2/L-min.)

(2) % Inhibition = $\frac{\left(\frac{RC_1 + RC_2}{2}\right) - R_S}{\left(\frac{RC_1 + RC_2}{2}\right)} \times 100$

(3) % Difference = $\frac{|RC_1 - RC_2|}{\left(\frac{RC_1 + RC_2}{2}\right)} \times 100$

The two control respiration rates should be within 15% of each other

Where:
R = Oxygen uptake rate (mg O_2/L-min.)
T,obs = Sample temp., C°
θ = 1.047, x = T,obs - 20°C
C = Control

See pg 1 for test Soln. prep.

orm 10620-8-D-PWO

Lab Request No. G1357-2 G1358-1

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Date: 6-9-89

Analyst: SdB

Environmental Lab — Work Sheet

OECD ACTIVATED SLUDGE
RESPIRATION INHIBITION TEST #209

Sample Description
3,5-Dichlorophenol
Reference Substance
Aldrich Red Label
Lot D7-060-0

Stock and Test Solutions Preparation

STOCK SOLUTION: 500 mg 3,5-DCP / 1.0 L Each 1.0 ml = 0.5 mg

- Dissolved 500 mg 3,5-DCP in 10 ml 1.0 N NaOH
- Diluted to 30 ml with Milli-Q Water
- Added, under stirring, 1.0 N H_2SO_4 dropwise until incipient ppt.
- Diluted to 1.0 Liter with Milli-Q water

Stock Solution pH = 7.8

Test Conc. mg/L	ml stock soln per 500 ml		ml DI water per 500 ml		ml syn. sewage feed per 500 ml		ml microbial inoculum per 500 ml		Total volume ml
Blank Controls	—		284	+	16	+	200	=	500
10	10	+	274	+	16	+	200	=	500

Controls Shared with LR G 1358-1

G1357-2
LR G1358-1

ENVIRONMENTAL LABORATORY

OECD ACTIVATED SLUDGE RESPIRATION INHIBITION TEST #209 Pg 2 of 3

RAW DATA

Test Substance: 3,5- Dichlorophenol Reference Substance

Source of Activated Sludge Mixed Liquor: Metro Waste Treatment Plant St Paul, MN

Date Received: 6-9-89 Date Used: 6-9-89

Analyst: Susan A. Beach

30 - MINUTE EXPOSURE

DISSOLVED OXYGEN CONCENTRATIONS mg/L

Test Substance Concentration (mg/L)	TIME-MINUTES 0.5	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	TEMP C°
CONTROL I	7.8	7.6	7.0	6.5	6.0	5.5	5.0	4.5	4.0	3.5	3.0	20
10	8.0	7.9	7.6	7.3	7.0	6.7	6.4	6.0	5.7	5.4	5.1	21
CONTROL II	7.2	7.0	6.5	5.9	5.4	4.9	4.3	3.8	3.3	2.7	2.2	21

3 - HOUR EXPOSURE

DISSOLVED OXYGEN CONCENTRATIONS mg/L

Test Substance Concentration (mg/L)	TIME-MINUTES 0.5	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	TEMP C°
CONTROL I	~~7.8~~ 7.3 SWB	~~7.6~~ 7.1 SWB	7.0	6.5	6.0	5.4	4.9	4.3	3.9	3.3	2.8	21
10	9.3	9.3	9.1	9.0	8.8	8.6	8.5	8.3	8.1	8.0	7.8	18
CONTROL II	7.3	7.1	6.6	6.0	5.4	4.9	4.3	3.8	3.2	2.7	2.1	21

pH of Activated Sludge Mixed Liquor: Initial 7.2 Final 7.5

pH of highest concentration tested: Initial 7.5 Final 7.9

Test Temperature: 18-21°C

ENVIRONMENTAL LABORATORY

ACTIVATED SLUDGE RESPIRATION INHIBITION TEST #209
CALCULATION OF RESULTS

LR 61357-1 61358-1
Date 6-9-89
Analyst SLB

Test Substance 3,5- Dichlorophenol Reference Substance

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30 - MINUTE EXPOSURE

Test Substance Concentration (mg/L)	Oxygen Uptake Rate R	R Corrected[1] to 20°C	% Inhibition in Respiration Rate[2]
CONTROL I	0.5055	0.5055	-
10	0.3145	0.3004	41
CONTROL II	0.5345	0.5105	-

Percent Difference in Controls[3] 1.0 %

EC_{50} (95% Confidence Limits) mg/L 10 mg/L induced 41 % inhibition

3 - HOUR EXPOSURE

Test Substance Concentration (mg/L)	Oxygen Uptake Rate R	R Corrected[1] to 20°C	% Inhibition in Respiration Rate[2]
CONTROL I	0.5315	0.5076	-
10	0.1655	0.1814	65
CONTROL II	0.5558	0.5309	-

Percent Difference in Controls[3] 4.5%

EC_{50} (95% Confidence Limits) mg/L 10 mg/L induced 65 % inhibition

(1) Temp. Correction = $\frac{R_{T,obs}}{\theta^x}$ (mg O_2/L-min.)

(2) % Inhibition = $\frac{\left(\frac{RC_1 + RC_2}{2}\right) - R_S}{\left(\frac{RC_1 + RC_2}{2}\right)} \times 100$

(3) % Difference = $\frac{|RC_1 - RC_2|}{\left(\frac{RC_1 + RC_2}{2}\right)} \times 100$

The two control respiration rates should be within 15% of each other

Where:
R = Oxygen uptake rate (mg O_2/L-min.)
T,obs = Sample temp., C°
θ = 1.047, x = T,obs - 20°C
C = Control

See pg 1 for test soln. prep.