

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-206CE. (1-Octanesulfonic acid) (CAS # 2795-39-3).

Remarks: The 3M production lot number was 502.
The test sample is FC-206CE. Current information indicates it is a mixture of 0.92% PFOS, 15% diethylene glycol butyl ether, 76.09% water, 4% urea, 1.28% Sultone foamer, 1.55% sodium octyl sulfate, 1.05% polyoxyethylene monooctylphenyl ether, 0.06% sodium lauryl sulfate, 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 209

Test type: Acute static

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 condition:

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 10mL 1N NaOH, diluted to 30mL with Millipore Milli-Q™ water, then brought to the point of incipient precipitation with 1N H₂SO₄ and diluted to 1L with Milli-Q™ water. The pH of the reference solution was measured to be 7.6. Test substance was added directly to the test vessels and was apparently miscible with water.

Test vessels: Not given.

Number of concentrations: five plus 1 reference substance and 2 blank controls

Temperature: 20 – 22 °C

Total suspended solids and pH on day of testing: 3.6 g/L (TSS), initial pH 7.3 and final pH 7.3

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 FC-206CE 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 G1358-2, 1989.

OTHER

Last changed: 6/26/00

LR G1358-2Date 6-23-89Analyst SLBENVIRONMENTAL LABORATORY
ACTIVATED SLUDGE MIXED LIQUORType Test OED Activated Sludge Respiration Inhibition Test #209Source Metro Waste Treatment Plant St Paul, MNDate Obtained 6-23-89 Date Used 6-23-89Mixed Liquor Suspended Solids (MLSS) 3.6 g/L Adjustment None g/LpH Initial = 7.3 Final = 7.3Comments Test run with LR G1750Test SubstanceSample Description FC - 206 CE Lot 502Sample pH Highest Conc. 1000mg/L = 7.2 Adjustment None

Comments _____

Reference SubstanceSample Description 3,5-DichlorophenolSample pH 7.6 (stock soln.) Adjustment None

Comments _____

Exposure ConditionsTest Duration 3-HoursTest Temperature 20-22 °C

Comments _____

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Lab Request No. G1358-2

Environmental Lab — Work Sheet

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Sample Description

FC-206CE

Lot 502

Yellow Liquid

OECD ACTIVATED SLUDGE
RESPIRATION INHIBITION TEST #209Date: 6-23-89Analyst: Juan A. Beach

Test Solutions Preparation

Test Conc.	mg added		M.Q.					
mg/L	per 500 ml		ml DI water		ml syn. sewage		ml microbial	Total volume
			per 500 ml		feed per 500 ml		inoculum per 500 ml	ml
Blank (1) 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 ⁽²⁾	500	+	284	+	16	+	200	= 500

⁽¹⁾ Blank Control II shared with LRG 1750, as Blank Control I⁽²⁾ Test Substance apparently miscible with water.

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

Milli-Q water used: Prepared 6-19-89, aeration started 6-20-89

pH = 6.0

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ENVIRONMENTAL LABORATORY

OECD ACTIVATED SLUDGE RESPIRATION INHIBITION TEST #209

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RAW DATA

Test Substance: FC-206CE Lot 502Source of Activated Sludge Mixed Liquor: Metro Waste Treatment Plant St PaulDate Received: 6-23-89Date Used: 6-23-89Analyst: Juan A. Beach

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30 - MINUTE EXPOSURE

Test Substance Concentration (mg/L)	DISSOLVED OXYGEN CONCENTRATIONS 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
CONTROL I	7.4	7.2	6.6	6.1	5.6	5.1	4.5	4.0	3.5	3.0	2.5
100	8.1	7.8	7.3	6.8	6.3	5.8	5.3	4.8	4.3	3.8	3.3
180	7.8	7.5	7.0	6.4	5.9	5.3	4.8	4.2	3.7	3.2	2.7
320	7.7	7.4	6.8	6.2	5.6	5.0	4.4	3.8	3.2	2.6	2.0
560	7.4	7.1	6.5	5.8	5.1	4.5	3.8	3.1	2.5	1.8	1.2
1000	5.8	5.4	4.6	3.9	3.1	2.4	1.7	0.9	0.5 7.30		
CONTROL II	7.3	7.1	6.6	6.1	5.5	5.0	4.5	4.0	3.5	3.0	2.5

SAB

3 - HOUR EXPOSURE

Test Substance Concentration (mg/L)	DISSOLVED OXYGEN CONCENTRATIONS 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
CONTROL I	7.5	7.2	6.7	6.2	5.6	5.1	4.6	4.1	3.5	3.0	2.5
100	8.0	7.9	7.5	7.1	6.7	6.2	5.8	5.4	5.0	4.6	4.1
180	8.3	8.1	7.7	7.4	7.0	6.6	6.2	5.8	5.5	5.1	4.7
320	8.3	8.1	7.7	7.3	6.9	6.5	6.1	5.7	5.3	4.9	4.5
560	8.3	8.1	7.8	7.5	7.1	6.8	6.4	6.0	5.7	5.3	4.9
1000	8.0	7.8	7.5	7.1	6.7	6.3	5.9	5.5	5.1	4.7	4.3
CONTROL II	7.3	7.1	6.5	6.0	5.5	5.0	4.4	3.9	3.3	2.9	2.3

pH of Activated Sludge Mixed Liquor: Initial 7.3
 pH of highest concentration tested: Initial 7.5
 Test Temperature: 20-22°C

Final 7.3
 Final 7.5

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ACTIVATED SLUDGE RESPIRATION INHIBITION TEST #209
CALCULATION OF RESULTSLR G1358-2Date 6-28-89Analyst SABTest Substance FC-206CE Lot 502

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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	0.5206	0.4749	-
100	0.5000	0.4776	-
180	0.5388	0.5388	-
320	0.6000	0.5731	-
560	0.6618	0.6321	-
1000	0.7462	0.7127	-
CONTROL II	0.5127	0.4677	-

Percent Difference in Controls⁽³⁾ 1.5%EC₅₀ (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	0.5255	0.4794	-
100	0.4200	0.4200	13
180	0.3776	0.3776	22
320	0.4000	0.4000	17
560	0.3576	0.3576	26
1000	0.3945	0.3945	18
CONTROL II	0.5291	0.4827	

Percent Difference in Controls⁽³⁾ 0.7%EC₅₀ (95% Confidence Limits) mg/L > 1000 mg/L(1) Temp. Correction = $\frac{R_{T,obs}}{\theta^x}$ (mg O₂/L-min.)(3) % Difference = $\frac{|RC_1 - RC_2|}{\left(\frac{RC_1 + RC_2}{2}\right)} \times 100$ (2) % Inhibition = $\frac{\left(\frac{RC_1 + RC_2}{2}\right) - R_S}{\left(\frac{RC_1 + RC_2}{2}\right)} \times 100$

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

See pg 1 for test soln. Prep.

Where:

R = Oxygen uptake rate (mg O₂/L-min.)T_{obs} = Sample temp., °Cθ = 1.047, x = T_{obs} - 20°C

C = Control

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61358-2

Lab Request No. G1750

Environmental Lab — Work Sheet

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

OECD ACTIVATED SLUDGE
 RESPIRATION INHIBITION TEST #209

Date: 6-23-89Analyst: SAB

Purple crystals

Stock and Test Solutions Preparation

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

- Dissolved 500mg 3,5-DcP in 10ml 1.0N NaOH
- Diluted to 30 ml with Milli-Q water
- Added, under stirring, 1.0N H₂SO₄ dropwise until incipient ppt
- Diluted to one liter with Milli-Q water.

Stock soln. pH = 7.6

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 (1)	—	284	16	200	500
Controls	—	284	16	200	500
10	10	274	16	200	500

(1) Controls shared with LR G1750

Milli-Q water used: Prepared 6-19-89, aeration started 6-20-89
 pH = 6.0

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ACTIVATED SLUDGE RESPIRATION INHIBITION TEST #209
CALCULATION OF RESULTSTest 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	0.5127	0.4677	-
10	0.3000	0.2737	43
CONTROL II	0.5424	0.4948	-

Percent Difference in Controls⁽³⁾ 5.6%EC₅₀ (95% Confidence Limits) mg/L 10 mg/L induced 43% 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	0.5291	0.4827	-
10	0.2152	0.2055	57
CONTROL II	0.5255	0.4794	-

Percent Difference in Controls⁽³⁾ 0.7%EC₅₀ (95% Confidence Limits) mg/L 10 mg/L induced 57% inhibition

$$(1) \text{ Temp. Correction} = \frac{R_{T, \text{obs}}}{\theta^x} \quad (\text{mg O}_2/\text{L-min.})$$

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

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

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

See pg 1 for stock + test soln. prep

Where:

R = Oxygen uptake rate (mg O₂/L-min.)T_{obs} = Sample temp., °Cθ = 1.047, x = T_{obs} - 20°C

C = Control

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