

BIODEGRADATION (BOD/COD)

TEST SUBSTANCE

Identity: A mixture containing perfluorooctanesulfonate, which may also be referred to as PFOS, FC-95, or as a component of L-4647. (1-Octanesulfonic acid) (CAS # 2795-39-3).

Remarks: The test sample is 1.356% solution of L-4647. Current information indicates it is a mixture of 6.6% PFOS, 20% polyethylene glycol, 20% hexahydric alcohol, 39% sodium decyl sulfate, 13.2% Hydroxy foamer, 1% sodium ethylhexyl sulfate, 0.1% methylhydroquinone, and 0.1% biphenylol, sodium salt, tetrahydrate.

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

METHOD:

Method: BOD protocol 3/10/80.

Type: Aerobic

GLP: No

Year completed: 1980

Contact time: 20 days

Inoculum: Chemolite sewage.

RESULTS

Chemical Oxygen Demand (COD):	17,000 mg/L
	16,000 mg/L (duplicate)
Biochemical Oxygen Demand (BOD):	
5-Day:	7,700 mg/L
10-Day:	8,600 mg/L
20-Day:	11,000 mg/L

CONCLUSIONS

No conclusions given.

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

DATA QUALITY

Reliability: Klimisch ranking 3. Study lacks description and records of the method followed. The inoculum was not properly characterized. There is no characterization of the test substance purity, 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 5623S, 1980.

OTHER

Last changed: 6/26/00

PRODUCT ECOLOGICAL ASSESSMENT
REQUEST FOR LABORATORY WORK

of: ENVIR. ASSESS. INC. #
Commercial Chemical DIVISION
PRODUCT: L-4647, L.W. AFF
Extinction Conc

LAB REQUEST NO. 56235
6-22-80

REQUESTER

Name: Eric A Reiner Phone No. 5079
Request Date: April 21 1980
Project No.: 9570012600 Prob. No. _____
Code No.: _____
Sample Date: _____ Date Needed: _____
Description: Solution of L-4647
Purpose of Tests: Environmental Screen

LABORATORY

Date Received Sample: 4-21-80
Analyst: MIL, MTE
Date Completed: 5-21-80
Hours Spent: 10-HR + MTE - 16 =
Y _____ B _____ P _____
Please Call Requester If Delays Are Encountered. 26 HR TOTAL

PHYSICAL & CHEMICAL PROPERTIES

Heat of Combustion Cal/G (BTU/Lb.)

Density

Ash

Other

①
1.356 %
L4647 Solution

②
Calculated
Value for
100% L4647

③
QA

140

WATER POLLUTION

pH cod dupl

COD

BOD₅

BOD, Ultimate

TOC

GC

Oxygen Uptake

Dehydrogenase Activity (TTC)

Other

1.29/g
16,000 mg/kg
17,000 mg/kg
7700 mg/kg
10 day BOD (sample #1)
8600 mg/kg
20-day BOD
11,000 mg/kg

BIOASSAY

Specify Organism and Method:

96 Hr LC50 Fish

X 71550 mg/l

W. Sal
5-22-80

LEACHATE FROM LEACHING TEST

pH

COD

BOD₅

BOD, Ultimate

TOC

GC

Bioassay

Other

Repeated
See old
data

THER

Bioaccumulation

Persistence

Degradation Products

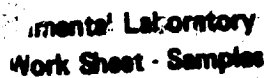
Lab Req. No. 5623	BOD Run No. 80-17
Analyst M. Roberts	Date Started 4/25/80
	5 - Day BOD Readings
Analyst M. Roberts	Date 4-30-80

Sample Description L4647	
Initial Dilution 2.01g	of Sample diluted to 100 ml with DI water
Initial Dilution Factor 49.8	(Dilution factor = 1 if undiluted)

Bottle No.	Conc. of Sample ¹	Sample Size ²	Initial D.O. (D ₁)	Present D.O. (D ₂)	Total D.O. Depletion (D ₁ - D ₂)	Depletion Due To Sample	5 - Day BOD	Average 5 - Day BOD
17	270	4.0 4.0	9.00	6.45	2.55			*
16	540	8.0	9.00	4.35	4.65			
97	1100	16	8.90	50.5				
60	2100	32	8.80	50.5				

- Note: 1. Conc. = Concentration of sample (ml/l or mg/l) in BOD bottles.
 2. Sample Size = ml or g of sample or diluted sample added to BOD Bottle.

Comments
Desire 2.0g $\Rightarrow$ 100
COD $\approx$ 15,100
* BOD calculated using formula #5 under section 3.7 of the March 10, 1980 BOD protocol, using the seeded blanks rather than the non-seeded blanks to account for any depletion other than that due to the sample.
Data sheet is attached.



Sample Description	L4447	
Initial Dilution	2.018	of Sample diluted to 100 ml with DI water
Initial Dilution Factor	49.8	(Dilution factor = 1 if undiluted)

[illegible]

Note:

1. Conc. = Concentration of sample (ml/l or mg/l) in BOD bottles.
2. Sample Size = ml or g of sample or diluted sample added to BOD Bottle.

2. Sample Size = ml or g of sample or undisturbed sample

Comments

Dose = 2.0g → 100

CD = 15.100

* See 5-day comments

mental Laboratory
Work Sheet - Samples

3M

Lab Req. No. 56 23	BOD Run No. 80-17
Analyst M. Roberts	Date Started 4/25/80
	20 - Day BOD Readings
	Analyst M. Roberts
	Date 5-15-80

Sample Description L 4647	
Initial Dilution	2.018 of Sample diluted to 100 ml with DI water
Initial Dilution Factor	49.8 (Dilution factor = 1 if undiluted)

Bottle No.	Conc. of Sample ¹	Sample Size ²	Initial D.O. (D ₁)	Percent D.O. (D ₂)	Total D.O. Depletion (D ₁ - D ₂)	Depletion Due To Sample	$\frac{\text{BOD}}{\text{Day}}$	$\frac{\text{Average BOD}}{\text{Day}}$
17	270	4.00	9.00	3.60	5.40			*
16	540	8.0	9.00	1.40	7.60			
97	1100	16	8.90					
60	2100	32	8.80					

- Note:
1. Conc. = Concentration of sample (ml/l or mg/l) in BOD bottles.
 2. Sample Size = ml or g of sample or diluted sample added to BOD Bottle.

Comments
Dilution 2.0g $\Rightarrow$ 100
COD = 15.100
* See 5 day comments

Request No. $\blacklozenge$		BOD Run No. $\blacklozenge$ 80-17	
Test	Date Started 4-25-80	5 Day BOD Readings	
Type & Source Hamlet Sewage	Seed Concentration 60 ml/l	Analyst M. Roberts	Date 4/30/80

Unseeded Dilution - Water Blank

Bottle No.	Initial D.O. (A ₁)	Present D.O. (A ₂)	D.O. Depletion (A ₁ - A ₂)	Average D.O. Depletion ($\bar{A}_1 - \bar{A}_2$)
120	8.70	8.05	0.65	0.53
9	8.50	8.05	0.45	
123	8.50	8.00	0.50	

Seeded Dilution - Water Blank (optional)

Bottle No.	Initial D.O. (C ₁)	Present D.O. (C ₂)	D.O. Depletion (C ₁ - C ₂)	Average D.O. Depletion ($\bar{C}_1 - \bar{C}_2$)
21	9.00	8.45	0.55	0.48
3	8.85	8.45	0.40	
128	9.00	8.50	0.50	

Seed Controls

Bottle No.	Sample Size	Initial D.O. (B ₁)	Present D.O. (B ₂)	D.O. Depletion (B ₁ - B ₂)
144	20	8.45	7.75	0.70
21	40	8.30	7.35	0.95
93	60	7.90	7.00	0.90
6	120	7.25	5.65	1.60 ← used to calc

Glucose - Glutamic Acid Standard

Bottle No.	Sample Size	Initial D.O. (D ₁)	Present D.O. (D ₂)	Total D.O. Depletion (D ₁ - D ₂)	Depletion Due To Standard	5 Day BOD	Average 5 Day BOD
15	3.0	8.90	6.65	2.25	1.71	191	200 7/18
1	5.0	8.95	5.20	3.75	3.21	193	
79	7.0	8.90	3.40	5.50	4.97	213	

Potassium Hydrogen Phthalate Standard (optional)

Bottle No.	Sample Size	Initial D.O. (D ₁)	Present D.O. (D ₂)	Total D.O. Depletion (D ₁ - D ₂)	Depletion Due To Standard	5 Day BOD	Average 5 Day BOD

Request No. BOD Run No. 80-17	
Analyst M. Roberts	Date Started 4-25-80 Day BOD Readings 10
Seed Type & Source Chemical - Sewage	Seed Concentration 6.0 ml/l Analyst M. Roberts Date 5-5-80

Nonseeded Dilution - Water Blank

Bottle No.	Initial D.O. (A ₁)	Present D.O. (A ₂)	D.O. Depletion (A ₁ - A ₂)	Average D.O. Depletion ($\bar{A}_1 - \bar{A}_2$)
120	8.70	7.95	0.75	0.62
9	8.50	8.00	0.50	
123	8.50	7.90	0.60	

cont.

Seeded Dilution - Water Blank (optional)

Bottle No.	Initial D.O. (C ₁)	Present D.O. (C ₂)	D.O. Depletion (C ₁ - C ₂)	Average D.O. Depletion ($\bar{C}_1 - \bar{C}_2$)
21	9.00	8.40	0.60	0.57
312	8.85	8.40	0.45	
128	9.00	8.35	0.65	

Seed Controls

Bottle No.	Sample Size	Initial D.O. (B ₁)	Present D.O. (B ₂)	D.O. Depletion (B ₁ - B ₂)
144	20	8.45	7.45	1.00
21	40	8.30	6.80	1.50
93	60	7.90	6.05	1.85
6	120	7.25	4.55	2.70

Glucose - Glutamic Acid Standard

Bottle No.	Sample Size	Initial D.O. (D ₁)	Present D.O. (D ₂)	Total D.O. Depletion (D ₁ - D ₂)	Depletion Due To Standard	$\frac{\text{BOD}}{\text{Day}}$	Average $\frac{\text{BOD}}{\text{Day}}$
15	3.0	8.90	6.25	2.65			
1	5.0	8.95	4.45	4.50			
74	7.0	8.90	2.40	6.50			

Potassium Hydrogen Phthalate Standard (optional)

Bottle No.	Sample Size	Initial D.O. (D ₁)	Present D.O. (D ₂)	Total D.O. Depletion (D ₁ - D ₂)	Depletion Due To Standard	$\frac{\text{BOD}}{\text{Day}}$	Average $\frac{\text{BOD}}{\text{Day}}$

Request No. BOD Run No. <u>80-17</u>	
Analyst <u>M. Roberts</u>	Date Started <u>4-25-80</u> 20 - Day BOD Readings
Seed Type & Source <u>Chemical - Acetate</u>	Seed Concentration <u>1.0 ml/l</u> Analyst <u>M. Roberts</u> Date <u>5/15/80</u>

Nonseeded Dilution - Water Blank

Bottle No.	Initial D.O. (A ₁)	Present D.O. (A ₂)	D.O. Depletion (A ₁ - A ₂)	Average D.O. Depletion ($\bar{A}_1 - \bar{A}_2$)
120	8.70	6.75	1.95	1.55
9	8.50	7.75	0.75	
123	8.50	6.55	1.95	

cont.

Seeded Dilution - Water Blank (optional)

Bottle No.	Initial D.O. (C ₁)	Present D.O. (C ₂)	D.O. Depletion (C ₁ - C ₂)	Average D.O. Depletion ($\bar{C}_1 - \bar{C}_2$)
21	9.00	6.80	2.20	2.13
3	8.85	8.6.85	2.00	
128	9.00	6.80	2.20	

Seed Controls

Bottle No.	Sample Size	Initial D.O. (B ₁)	Present D.O. (B ₂)	D.O. Depletion (B ₁ - B ₂)
744	20	8.45	4.20	4.25
21	40	8.30	2.50	5.80
93	60	7.90	0.70	7.20
6	120	7.25	<0.5	

Glucose - Glutamic Acid Standard

Bottle No.	Sample Size	Initial D.O. (D ₁)	Present D.O. (D ₂)	Total D.O. Depletion (D ₁ - D ₂)	Depletion Due To Standard	<u> </u> - Day BOD	Average <u> </u> - Day BOD
15	3.0	8.90	4.10	4.80			
1	5.0	8.95	2.45	6.50			
74	7.0	8.90	<0.5				

Potassium Hydrogen Phthalate Standard (optional)

Bottle No.	Sample Size	Initial D.O. (D ₁)	Present D.O. (D ₂)	Total D.O. Depletion (D ₁ - D ₂)	Depletion Due To Standard	<u> </u> - Day BOD	Average <u> </u> - Day BOD

ENVIRONMENTAL ENGR. LAB - WORK SHEET

SAMPLE DESCRIPTION

Date: _____

Analyst: _____

Hrs.: _____

(5-DAY)

Fc 326

0.5 mg

insufficient depletion

1.4 mg

2.45 - 0.48

insufficient depletion

1.9

$$2.85 - 0.48 \left(\frac{298.1}{300} \right) = 370 \text{ mg/l}$$

$\frac{1.9}{300}$

$$2.85 - 0.48 \left(\frac{299.998}{300} \right) = 370,000 \text{ mg/kg}$$

$\frac{0.0019}{300}$

Fc-803

4.0 *insuff. depletion*

8.0 (g)

$$2.80 - 0.48 \left(\frac{292}{300} \right) \times 32.8 = 2870$$

$\frac{8}{300}$

16

$$3.40 - 0.48 \left(\frac{284}{300} \right) \times 32.8 = 1810$$

$\frac{16}{300}$

32

$$3.35 - 0.48 \left(\frac{268}{300} \right) \times 32.8 = 898$$

$\frac{32}{300}$

$\approx 1900 \text{ mg}$

L-4647 (g)

4.1

$$2.55 - 0.48 \left(\frac{295.9}{300} \right) \times 49.8 = 7570$$

$\frac{4.1}{300}$

8.0

$$4.65 - 0.48 \left(\frac{292}{300} \right) \times 49.8 = 7810$$

$\frac{8}{300}$

 $\approx 7700 \text{ mg/kg}$

Reviewed by: _____

ENVIRONMENTAL ENGR. LAB - WORK SHEET

SAMPLE DESCRIPTION

Date: _____

Analyst: _____

Hrs.: _____

(10-day)

FC-803 (g)

4.0

missed depl.

8.0

$$3.45 - 0.57 \left(\frac{292}{300} \right) \times 32.8 = 3560$$

16

$$5.90 - 0.57 \left(\frac{284}{300} \right) \times 32.8 = 3300$$

32

$$7.20 - 0.57 \left(\frac{268}{300} \right) \times 32.8 = 2060$$

as = 3000 mg/kg

L-4647 (g)

4.1

$$2.90 - 0.57 \left(\frac{295.9}{300} \right) \times 49.8 = 8520$$

8.0

$$5.20 - 0.57 \left(\frac{292}{300} \right) \times 49.8 = 8670$$

as = 8600 mg/kg

Reviewed by: _____

ENVIRONMENTAL ENGR. LAB - WORK SHEET

SAMPLE DESCRIPTION:

Date: _____

Analyst: _____

Hrs.: _____

(20 day)
STD (ml)

3.0

$$4.80 - 2.13 \left(\frac{297}{300} \right) = 269$$

$$\frac{3}{300}$$

5.0

$$6.50 - 2.13 \left(\frac{295}{300} \right) = 264$$

$$\frac{5}{300}$$

as = 270 mg/l

FC-383 (g)

4.0

small def.

8.0

$$4.8 - 2.13 \left(\frac{292}{300} \right) \times 123 = 12,600$$

$$\frac{8}{300}$$

mg/kg

FC-326 (g)

0.0019

$$4.95 - 2.13 \left(\frac{299.9981}{300} \right) \times 1 = 445,000$$

$$\frac{0.0019}{300}$$

mg/kg

FC-803 (g)

Kg

$$7.00 - 2.13 \left(\frac{284}{300} \right) \times 32.8 = 3,100$$

$$\frac{16}{300}$$

mg/kg

FC-4647 (g)

4.1

$$5.40 - 2.13 \left(\frac{295.9}{300} \right) \times 49.8 = 12,000$$

$$\frac{4.1}{300}$$

8.0

$$7.60 - 2.13 \left(\frac{292}{300} \right) \times 49.8 = 10,300$$

$$\frac{8}{300}$$

as = 11,000 mg/l

Reviewed by: _____