

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 FC-603EF. (1-Octanesulfonic acid) (CAS # 2795-39-3).

Remarks: The 3M production lot number is not noted. The test sample is FC-603EF. Current information indicates it is a mixture of 1.30% PFOS, 10% diethylene glycol butyl ether, 54.15% water, 22.5% ethylene glycol, 2.6% propanesultone foamer, 5% Alkylether sulfate, 0.1% N-(3-Chloroallyl)hexaminium chloride, 0.9% Xanthan gum, 0.9% starch, 1.0% triethanolamine, and 0.05% tolyl triazole.

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

METHOD:

Method: Modified CBOD test

Type: Aerobic

GLP: No

Year completed: 1996

Contact time: 28 days

Inoculum: Polyseed-NX Lot # A306, Polybac Corp., Bethlehem, PA.

RESULTS

Chemical Oxygen Demand (COD):	740,000 mg/kg
Biochemical Oxygen Demand (BOD):	
5-Day:	216,189 mg/kg 110,163 mg/kg (duplicate)
10-Day:	376,258 mg/kg 325,956 mg/kg (duplicate)
20-Day:	445,674 mg/kg 438,632 mg/kg (duplicate)
28-Day:	601,610 mg/kg 317,907 mg/kg (duplicate)

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

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. 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 P2581, 1996.

OTHER

Last changed: 6/26/00

SECOND RUN

LR# P2581

Date 11-22-96

Analyst TKS

Modified CBOD Test 5,10,20 & 28 Day Analyses

Sample Description FC 603EF

Concentration of stock solution 278 mg 1 L

pH Stock Solution 6.6

Polyseed -NX Lot # A506

LR#

Date

Modified CBOD Test
5, 10, 20, & 28 Day Analyses

Sample Description

Bottle #	Day	Sample vol. (mg/L)	Sample conc. (mg/L)	Initial Dissolved Oxygen (mg/L)	Final Dissolved Oxygen (mg/L)	Date	Initials
33	0		4.97	8.45		11-22-96	BJS
34	0		9.94	8.46		11-22-96	BJS
35	0		24.8	8.46		11-22-96	BJS
36	0		49.7	8.46		11-22-96	BJS
37	5		4.97		6.16	11-27-96	TCS
38	5		9.94		4.95	11-27-96	TCS
39	5		24.8		2.55	11-27-96	TCS
40	5		49.7		0.13	11-27-96	TCS
41	10		4.97		5.09	12-2-96	BJS
42	10		9.94		2.80	12-2-96	BJS
43	10		24.8		0.12	12-2-96	BJS
44	10		49.7		0.09	12-2-96	BJS
45	20		4.97		4.41	12-12-96	TCS
46	20		9.94		1.79	12-12-96	TCS
47	20		24.8		0.12	12-12-96	TCS
48	20		9.94		0.09	12-12-96	TCS
49	28		4.97		2.22	12-20-96	TCS
50	28		9.94		0.15	12-20-96	TCS
51	28		24.8		0.12	12-20-96	TCS
52	28		49.7		0.09	12-20-96	TCS

LR#

Date

Modified CBOD Test
5, 10, 20, & 28 Day Analyses

Sample Description For - 10-2-11

Bottle #	Day	Sample vol. (mg/L)	Sample conc. (mg/L)	Initial Dissolved Oxygen (mg/L)	Final Dissolved Oxygen (mg/L)	Date	Initials
53	0		4.97	8.45		11-22-96	BSJ
54	0		9.94	8.44		11-22-96	BSJ
55	0		24.5	8.44		11-22-96	BSJ
56	0		49.7	8.40		11-22-96	BSJ
57	5		4.97		6.88	11-27-96	TCS
58	5		9.94		6.27	11-27-96	TCS
59	5		24.8		4.78	11-27-96	TCS
60	5		49.7		1.42	11-27-96	TCS
61	10		4.97		5.54	12-2-96	BSJ
62	10		9.94		3.34	12-2-96	BSJ
63	10		24.8		0.06	12-2-96	BSJ
64	10		49.7		0.07	12-2-96	BSJ
65	20		4.97		4.74	12-12-96	TCS
66	20		9.94		1.84	12-12-96	TCS
67	20		24.8		0.06	12-12-96	TCS
68	20		49.7		0.05	12-12-96	TCS
69	28		4.97		3.94	12-20-96	TCS
70	28		9.94		2.04	12-20-96	TCS
71	28		24.8		0.08	12-20-96	TCS
72	28		49.7		0.10	12-20-96	TCS

Product Testing
Modified CBOD Test
5, 10, 20 & 28 Day Analyses

P2581 FC-603EF

Mean CBOD mg/Kg	CBOD Results (mg/kg)	Day	Dil No.	Bottle No.	Seed Vol (mL)	Samp Vol (mL)	Samp Conc. (mg/L)	Seed Corr. Factor	Initial Dissolved Oxygen (mg/L)	Final Dissolved Oxygen (mg/L)	DO Drop Initial minus Final (mg/L)	Sample DO Drop
												Initial minus Final minus Seed Corr (mg/L)
		0	1	33	5	5	4.97		8.45			
		0	2	34	5	10	9.94		8.46			
		0	3	35	5	25	24.8		8.46			
		0	4	36	5	50	49.7		8.46			
216,189	235412	5	1	37	5	5	4.97	1.12		6.16	2.29	1.17
	240443	5	2	38	5	10	9.94	1.12		4.95	3.51	2.39
	191935	5	3	39	5	25	24.8	1.12		2.58	5.88	4.76
	145070	5	4	40	5	50	49.7	1.12		0.13	8.33	7.21
376,258	301811	10	1	41	5	5	4.97	1.86		5.09	3.36	1.50
	376258	10	2	42	5	10	9.94	1.86		2.86	5.60	3.74
	261290	10	3	43	5	25	24.8	1.86		0.12	8.34	6.48
	130986	10	4	44	5	50	49.7	1.86		0.09	8.37	6.51
445,674	362173	20	1	45	5	5	4.97	2.24		4.41	4.04	1.80
	445674	20	2	46	5	10	9.94	2.24		1.79	6.67	4.43
	245968	20	3	47	5	25	24.8	2.24		0.12	8.34	6.10
	123340	20	4	48	5	50	49.7	2.24		0.09	8.37	6.13
601,610	601610	28	1	49	5	5	4.97	3.24		2.22	6.23	2.99
	510060	28	2	50	5	10	9.94	3.24		0.15	8.31	5.07
	205645	28	3	51	5	25	24.8	3.24		0.12	8.34	5.10
	103219	28	4	52	5	50	49.7	3.24		0.09	8.37	5.13

$$\text{CBOD (mg/kg)} = (\text{Samp DO Drop (mg/L)} / \text{Samp Conc (mg/L)}) \times 1,000,000 \text{ mg/kg}$$

Greyed areas are data with unacceptable oxygen concentrations: Final D.O. must be ≥ 0.5 mg/L, and Sample D.O. drop (initial - final - seed correction) must be ≥ 2.0 mg/L for the data to be used to calculate CBOD.

Product Testing
Modified CBOD Test
5, 10, 20 & 28 Day Analyses

P2581 FC-603EF
Duplicate

Mean CBOD mg/Kg	CBOD Results (mg/kg)	Day	Dil No.	Bottle No.	Seed Vol (mL)	Samp Vol (mL)	Samp Conc. (mg/L)	Seed Corr. Factor	Initial Dissolved Oxygen (mg/L)	Final Dissolved Oxygen (mg/L)	Sample DO Drop	
											DO Drop Initial minus Final (mg/L)	Initial minus Final minus Seed Corr (mg/L)
		0	1	53	5	5	4.97		8.45			
		0	2	54	5	10	9.94		8.44			
		0	3	55	5	25	24.8		8.44			
		0	4	56	5	50	49.7		8.40			
110,163	90543	5	1	57	5	5	4.97	1.12		6.88	1.57	0.45
	105634	5	2	58	5	10	9.94	1.12		6.27	2.17	1.05
	102419	5	3	59	5	25	24.8	1.12		4.78	3.66	2.54
	117907	5	4	60	5	50	49.7	1.12		1.42	6.98	5.86
325,956	211268	10	1	61	5	5	4.97	1.86		5.54	2.91	1.05
	325956	10	2	62	5	10	9.94	1.86		3.34	5.10	3.24
	262903	10	3	63	5	25	24.8	1.86		0.06	8.38	6.52
	130181	10	4	64	5	50	49.7	1.86		0.07	8.33	6.47
438,632	295775	20	1	65	5	5	4.97	2.24		4.74	3.71	1.47
	438632	20	2	66	5	10	9.94	2.24		1.84	6.60	4.36
	247581	20	3	67	5	25	24.8	2.24		0.06	8.38	6.14
	122938	20	4	68	5	50	49.7	2.24		0.05	8.35	6.11
317,907	255533	28	1	69	5	5	4.97	3.24		3.94	4.51	1.27
	317907	28	2	70	5	10	9.94	3.24		2.04	6.40	3.16
	206452	28	3	71	5	25	24.8	3.24		0.08	8.36	5.12
	101811	28	4	72	5	50	49.7	3.24		0.10	8.30	5.06

CBOD (mg/kg) = (Samp DO Drop (mg/L) / Samp Conc (mg/L)) X 1,000,000 mg/kg

Greyed areas are data with unacceptable oxygen concentrations: Final D.O. must be ≥ 0.5 mg/L, and
Sample D.O. drop (initial - final - seed correction) must be > 2.0 mg/L for the data to be used to calculate CBOD.

Modified CBOD Test
5, 10, 20, & 28 Day Analyses
QC Data

LR# P2581, P2956, P2958
Date STARTED 11-22-96
Analyst BJS / TKS

Sample Description	Bottle #	Initial Dissolved Oxygen (mg/L)	Final Dissolved Oxygen (mg/L)	Date	Initials
Medium Blank	1	8.46		11-22-96	BJS
Medium Blank	2	8.47		11-22-96	BJS
Seeded Blank	3	8.47		11-22-96	BJS
Seeded Blank	4	8.45		11-22-96	BJS
Ref. Std. GGA	5	8.45		11-22-96	BJS
Ref. Std. GGA	6	8.47		11-22-96	BJS
Tox. Check LR# P2581	7	8.47		11-22-96	BJS
Tox. Check LR# P2956	8	8.44		11-22-96	BJS
Tox. Check LR# P2958	9	8.46		11-22-96	BJS
Tox. Check LR#	10	NOT RUN		11-22-96	BJS

Day 5

Medium Blank	11		8.04	11-27-96	TKS
Medium Blank	12		8.13	11-27-96	TKS
Seeded Blank	13		7.22	11-27-96	TKS
Seeded Blank	14		7.47	11-27-96	TKS
Ref. Std. GGA	15		5.84	11-27-96	TKS
Ref. Std. GGA	16		5.72	11-27-96	TKS
Tox. Check LR# P2581	17		0.17	11-27-96	TKS
Tox. Check LR# P2956	18		0.15	11-27-96	TKS
Tox. Check LR# P2958	19		0.13	11-27-96	TKS
Tox. Check LR#	20		NOT RUN	—	—

Day 10

Medium Blank	21		8.13	12-2-96	BJS
Medium Blank	22		8.12	12-2-96	BJS
Seeded Blank	23		6.05	12-2-96	BJS
Seeded Blank	24		6.56	12-2-96	BJS

Day 20

Medium Blank	25		8.08	12-12-96	TKS
Medium Blank	26		8.06	12-12-96	TKS
Seeded Blank	27		6.24	12-12-96	TKS
Seeded Blank	28		6.20	12-12-96	TKS

Day 28

Medium Blank	29		7.81	12-20-96	TKS
Medium Blank	30		7.94	12-20-96	TKS
Seeded Blank	31		5.30	12-20-96	TKS
Seeded Blank	32		5.15	12-20-96	TKS

Modified CBOD Test
5, 10, 20, & 28 Day Analyses
QC Results

LR#
Date
Analyst

P2581, 11-19-96 E P2958
+2-4-96 11-22-96 TJS
TV

Description	CBOD mg/kg	Bottle no.	Initial dissolved oxygen (mg/L)	Final dissolved oxygen (mg/L)	DO drop Initial- Final (mg/L)	DO drop Initial- Final- seed cor (mg/L)
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5 Day QC

Medium Blank		11	8.46	8.04	0.42		
Medium Blank		12	8.47	8.13	0.34		SCF*
Seeded Blank		13	8.47	7.22	1.25		1.25
Seeded Blank		14	8.45	7.47	0.98		0.98
							mean SCF= 1.12
Ref. Std. GGA	298	15	8.45	5.84	2.61	1.49	
Ref. Std. GGA	326	16	8.47	5.72	2.75	1.63	
Tox. Check LR#P2581	>1000	17	8.47	0.17	8.30	7.18	
Tox. Check LR# P2956	>1000	18	8.47	0.15	8.32	7.20	
Tox. Check LR# P2958	>1000	19	8.44	0.13	8.31	7.19	

10 Day QC

Medium Blank		20	8.46	8.13	0.33		
Medium Blank		21	8.47	8.12	0.35		SCF*
Seeded Blank		22	8.47	6.65	1.82		1.82
Seeded Blank		23	8.45	6.56	1.89		1.89
							mean SCF= 1.86

20 Day QC

Medium Blank		24	8.46	8.08	0.38		
Medium Blank		25	8.47	8.06	0.41		SCF*
Seeded Blank		26	8.47	6.24	2.23		2.23
Seeded Blank		27	8.45	6.20	2.25		2.25
							mean SCF= 2.24

28 Day QC

Medium Blank		28	8.46	7.81	0.65		
Medium Blank		29	8.47	7.84	0.63		SCF*
Seeded Blank		30	8.47	5.30	3.17		3.17
Seeded Blank		31	8.45	5.15	3.30		3.30
							mean SCF= 3.24

*(Seed Control Factor)

Tox. Checks contains sample at the highest conc. used for dilutions & 1.5 mLs of HACH GGA Std

Seed Correction Factor (mg/L)= Seeded Blank DO Drop

Ref. Std. BOD (mg/L)=(Ref. Std .DO drop-Seed Correction Factor) X (300mL/ Ref Std vol (ml))