MO-77-552-595

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TABLE I

PRIMARY AND ULTIMATE BIODEGRADABILITY OF DIELECTRIC FLUIDS AND COMPONENTS

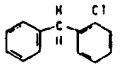
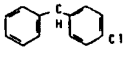
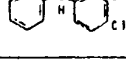
Test material	Structure/ composition	Ultimate Biodegradability (% of theoretical CO2 evolution) Inoculum source/Static Study temperature	Ultimate Biodegradability (% of theoretical CO2 evolution) Shake Flask procedure	Primary Biodegradability Addition rate (ppm or Bu per week)	Primary Biodegradability Reactor temperature (°F, C.)	Primary Biodegradability Remarks (Indicate moderate, weak, and variable inhibition of fungal growth with increasing concentration.)	Primary Biodegradability Initial pH Conditions	Primary Biodegradability Needed for 90% Primary Biodegradation	Toxicity to Aquatic Life % Recovery (Mixed Liquor Evaporation)	Toxicity to Aquatic Life Method Ref.
				7-Day	Cycle					
MO-77-552 MCS 1412 (o-chlorodiphenylmethane) FA 77538		86 (35-Day)		3 13	> 97 > 99	Volatility loss ≤ 4%. + For more detail see AC-73-55-18.			82.3 ± 3.9	AC-72-M-3
MO-77-553 MCS 1413 (p-chlorodiphenylmethane) FB 77538		80 (35-Day)		3 13	> 97 > 99	+ + For more detail see AC-73-55-18.			88.1 ± 5.4	AC-72-M-3
MO-77-554 MCS 1310 (3,4-Dichlorodiphenylmethane) FA77473				3 13	> 98 > 99	Volatility loss ≤ 1%. +For more detail see AC-73-55-18.			91.6 ± 3.7	AC-72-M-3
MO-77-555 MCS 1561 (2,4-Dichlorodiphenylmethane) FB77473		83 (35-Day)		3 13	> 97 > 99	Volatility loss ≤ 12. + For more detail see AC-73-55-18.			76.2 ± 5.5	AC-72-M-3

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TABLE I

PRIMARY AND ULTIMATE BIODEGRADABILITY OF DIELECTRIC FLUIDS AND COMPONENTS

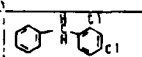
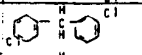
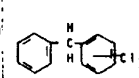
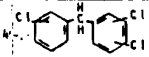
Test Material	Structure/ Composition	Ultimate Biodegradability (% of Theoretical CO_2 Evolution)[1]		Primary Biodegradability						
				Semi-Continuous Activated Sludge (SCAS)			Shake Flask Biodegradability			
		Thomson-Baier-Sturm procedure	Malaney-Gaden Flask procedure	Addition Rate (Application per cycle)	Primary Degradation (% of Theoretical CO_2)	Comments	Initial Concentration	Rate for 95% Primary Degradation	% Recovery (Mass Balance Corrected)	Method Ref.
				24-Hour Cycle		Ave. and +/- indicate moderate, strong, and variation in duration of sludge growth rate respectively.				
IMO-77-556 PCS 1560 (Mixture of 2,4- and 3,4-Dichlorodiphenyl methane) CP 77473				3	> 97	Volatility loss < 1%. + For more detail see AC-73-SS-18.			79.6 ± 1.6	AC-72-M-1
				13	> 99					
IMO-77-557 PCS 1559 (Mixture of 2,4'- and 4,4'-Dichlorodiphenyl methane) EC 77473				3	3 ± 6	Volatility loss < 1%. + For more detail see AC-73-SS-18.			89.7 ± 2.3	AC-72-M-3
IMO-77-558 PCS 1558 (Trichlorodiphenyl methane) CP 76793		26 (35-Day)		3	> 99	No detectable volatility loss (<0.1%) + + (13th-23rd week) + (24th-31st week) Slowly degrading trichlorophenylacetic acid metabolite formed.			71.3 ± 6.7	AC-75-M-15
				13	63 ± 10					
					27 ± 12					
IMO-77-559 PCS 1414 (Mixture of 2,3',4-, 3,3',4'-, and 4,3',4'-trichlorodiphenyl methane) FR 76793				3	10 ± 10	Volatility loss < 1%. ++ For more detail see AC-73-SS-18.			84.2 ± 5.1	AC-72-M-3

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TABLE I

PRIMARY AND ULTIMATE BIODEGRADABILITY OF DIELECTRIC FLUIDS AND COMPONENTS

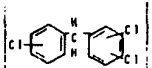
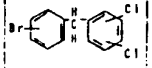
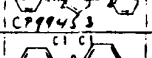
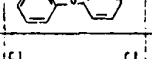
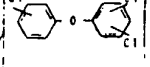
Test Material	Structure/ Composition	Ultimate Biodegradability (% of Theoretical CO2 Evolution)		Primary Biodegradability						
				Shake-Flask Studies		Activated Sludge Studies (SCAS)	Water Die-Away (WDA)		Gas Chromatographic Analytical Procedures	
		Soil Column - Static Procedure	Soil Column - Shake Flask procedure	Application Rate (ppm added per cycle)	Biodegradation Rate (mg/l/hr)	Comments	Initial Conditions	Days Required for 50% Primary Degradation	% Recovery (Mean Value Experiments)	Method No.
				24-Hour Cycle		+, ++, and +/- indicate moderate, strong, and variable destruction of fudge growth rate respectively.				
MO-77-560 NCS 1355 (Trichlorodiphenyl methane mixture) FB76793				3	6 ± 11	Volatility loss ≤ 1%. + For more detail see AC-73-SS-18.			77.5 ± 2.2	AC-72-M-3
MO-77-561 NCS 1356 (Bromodichlorodiphenyl methane mixture) CP94073				3	1 ± 10	Volatility loss ≤ 1%. + For more detail see AC-73-SS-18.			94.1 ± 4.8	AC-72-M-3
MO-77-562 NCS 1356 [Bis(trichlorobenzyl) benzene] CP99453		1 (35-Day)		3	7 ± 10	Volatility loss ≤ 1%. +			74.4 ± 4.5	AC-75-M-13
MO-77-563 2,2'-Dichlorodiphenyl Ether FA11692				3	10 ± 4	+			87.3 ± 4.2	AC-71-M-17
MO-77-564 NCS 1315 (Trichlorodiphenyl Ether) FA99450				48-Hour Cycle 3	24 ± 9	Volatility loss ~7%. ++ For more detail see AC-72-SS-13.			95.1 ± 6.3	AC-72-M-24

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TABLE 1

PRIMARY AND ULTIMATE BIODEGRADABILITY OF DIELECTRIC FLUIDS AND COMPONENTS

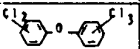
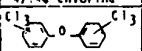
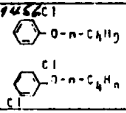
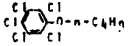
Test Material	Structure/ Composition	Ultimate Biodegradability (% of Theoretical CO_2 Evolution): Thomason -Buthie -Sturm procedure	Ultimate Biodegradability (% of Theoretical CO_2 Evolution): Monsanto Shake Flask procedure	Primary Biodegradability: Semi-Continuous Activated Sludge (SCAS): Addition Rate (ppm added per cycle)	Primary Biodegradability: Semi-Continuous Activated Sludge (SCAS): Primary Degradation Rate (% of Cycle)	Primary Biodegradability: Semi-Continuous Activated Sludge (SCAS): Comments	Primary Biodegradability: River Die-Away (RDA): Initial Conc (ppm)	Primary Biodegradability: River Die-Away (RDA): Days Req'd for 50% Primary Degradation	SCAS and Self Analytical Methods: % Recovery (Mixed Liquor Extraction)	SCAS and Self Analytical Methods: Method No.
				24-Hour Cycle		+, ++, and +/- indicate moderate, strong, and variable inhibition of sludge growth rate respectively.				
MO-77-565 Pentachlorodiphenyl ether mixture FB 99453	 47.4% Chlorine			1	1 ± 12	Volatility loss not significant.			72.8 ± 2.6	AC-74-M-24
MO-77-566 Hexachlorodiphenyl ether mixture FC 99453	 55% Chlorine			1	-4 ± 15	Volatility loss not significant.			78.9 ± 5.3	AC-74-M-24
MO-77-567 MCS 1311 (m-Trichloromethyl diphenyl ether) CP 99455				3 13	68 ± 15 35 ± 12	Volatility loss 8-10%. ++ ++ For more detail see AC-72-SS-13.			83.9 ± 3.7	AC-72-M-24
MO-77-568 FA 99456 MCS 1239 (Mixture of 2-chlorophenyl-n-butylether and 2,4-dichlorophenyl n-butyl ether)				3	45 ± 6	Volatility loss ~32%. ++ For more detail see AC-72-SS-13.			103.4 ± 11.2	AC-72-M-24
MO-77-569 MCS 1645 (n-Butylpentachlorophenyl) ether FB 99456				1	-1 ± 17	Volatility loss ≤ 1%. +			70.2 ± 2.8	AC-74-M-5

TABLE I

PRIMARY AND ULTIMATE BIODEGRADABILITY OF DIELECTRIC FLUIDS AND COMPONENTS

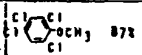
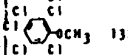
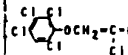
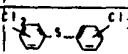
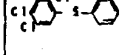
Test Material	Structure/ Composition	Ultimate Biodegradability (% of Theoretical CO2 Evolution)		Primary Biodegradability							
				Semi-Continuous Activated Sludge (SCAS)			River Die-Away (RDA)			Soil and Non-Activated Tests	
		Thomason -Dutcha -Sturm procedure	Monsanto Shake Flask procedure	Addition Rate (ppm added per cycle)	Primary Biodegradation Rate (95% C.L.)	Comments	Initial Conc(ppm)	Days Req'd for 50% Primary Degradation	% Recovery (Mixed Liquor Extraction)	Method No.
				24-Hour Cycle		+, ++, and +/- indicate moderate, strong, and variable inhibition of sludge growth rate respectively.				
MO-77-570 MCS 1646 (Mixture of 2,3,4,6-Tetrachloroanisole and pentachloroanisole) FA9447	 87%  13%	32 (28-Day)		1 3 13	> 95 > 99 > 99				78.9 ± 3.2	AC-74-M-6
MO-77-571 MCS 1647 [2,3,4,6-Tetrachlorophenyl-1 (2-Chloro-2-propenyl) ether] FB9446				1	9 ± 5	Volatility loss ≤ 1%.			69.4 ± 3.7	AC-74-M-7
MO-77-572 MCS 1648 (Pentachlorodiphenyl sulfide mixture) FA9445	 50% Chlorine			1	5 ± 11	Volatility loss ≤ 1%. ++			100.6 ± 13.1	AC-74-M-8
MO-77-573 MCS 1649 (2,4,5-Trichlorodiphenyl sulfide) FB9445				1	4 ± 6	Volatility loss ≤ 1%.			81.2 ± 1.3	AC-74-M-9

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TABLE I

PRIMARY AND ULTIMATE BIODEGRADABILITY OF DIELECTRIC FLUIDS AND COMPONENTS

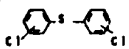
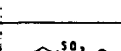
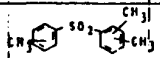
Test Material	Structure/ Composition	Ultimate Biodegradability (% of Theoretical CO2 Evolution)		Primary Biodegradability						
				Semi-Continuous Activated Sludge (SCAS)			River Die-Away (RDA)		[illegible]	
		Thompson-Duthie-Stuhm procedure	Pomeroy Shake Flask procedure	Addition Rate (ppm added per cycle)	Primary % Degradation Rate ±95% C.L.	Comments	Initial Conc (ppm)	Days Req'd for 50% Primary Degradation	% Recovery (Mixed Sludge Extraction)	[illegible]
				24-Hour Cycle		+, ++, and +/- indicate moderate, strong, and variable inhibition of sludge growth rate respectively.				
MO-77-574 MCS 1650 (Dichlorodiphenyl sulfide mixture) FC 99459				1	19 ± 5	Volatility loss ≤ 1%. ++			101.6 ± 9.2	AC-74-M-40
MO-77-575 MCS 1563 (Tetrachloro thiophene) CP 30487				1 3	Not detectable	Very high volatility losses.			71.6 ± 7.7	AC-74-M-11
MO-77-576 MCS 1664 (Hexachloro butadiene) CP 45942				1 3	Not detectable	Very high volatility losses.			68.[illegible] ± 0.6	AC-74-M-12
MO-77-577 Diphenyl Sulfone FA 99460				3	1 ± 6	Volatility loss ≤ 1%. For more detail see AC-72-SS-16			94.0 ± 3.4	AC-72-M-6
MO-77-578 MCS 1302 (Tolylxylyl sulfone) CP 16697				3 48-hour Cycle 3	23 ± 10 42 ± 12	+ Volatility loss ≤ 1%. + For more detail see AC-72-SS-16			98.9 ± 6.5	AC-71-M-2[illegible] AC-72-M-[illegible]

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TABLE I

PRIMARY AND ULTIMATE BIODEGRADABILITY OF DIELECTRIC FLUIDS AND COMPONENTS

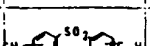
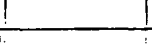
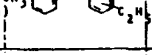
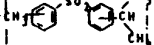
Test Material	Structure/ Composition	Ultimate Biodegradability (% of Theoretical CO_2 Evolution)		Primary Biodegradability						
				Semi-Continuous Activated Sludge (SCAS)			River Die-Away (RDA)			
		Thomson-Duthie-Stern procedure	Modified Sturm Flask procedure	Addition Rate (ppm added per cycle)	Primary Degradation Rate >95% C.L.	Comments	Initial Conc.(ppm)	Days Req'd for 50% Primary Degradation	% Recovery (Hexane Liquor Extraction)	Notes
				24-Hour Cycle		+, ++, and +/- indicate moderate, strong, and variable inhibition of sludge growth rate respectively.				
MO-77-579 HCS 1313 (Tolylethyl phenyl sulfone) FB99460				3	36 ± 6	Volatility loss < 1%. For more detail see AC-72-SS-16			105.6 ± 14.3	*C-72-M-6
MO-77-580 HCS 1312 (Tolyldiethyl phenyl sulfone) FC99460				3	13 ± 4	Volatility loss < 1%. For more detail see AC-72-SS-16			97.6 ± 3.8	AC-72-M-6
MO-77-581 HCS 1314 (Tolyl isopropyl phenyl sulfone) FD99460				3	27 ± 8	Volatility loss < 1%. For more detail see AC-72-SS-16			111.2 ± 10.0	AC-72-M-6
MO-77-582 HCS 1732 (Ethylphenyl xylyl sulfone) FE99460				3	17 ± 6	Volatility loss < 1%.			96.9 ± 1.6	AC-75-M-14

TABLE I

PRIMARY AND ULTIMATE BIODEGRADABILITY OF DIELECTRIC FLUIDS AND COMPONENTS

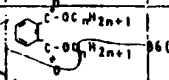
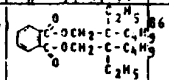
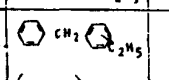
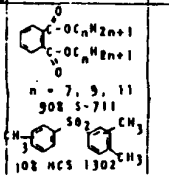
Test Material	Structure/ Composition	Ultimate Biodegradability (% of Theoretical CO_2 Evolution)		Primary Biodegradability						
				Semi-Continuous Activated Sludge (SCAS)			River Die-Away (RDA)		GLC and HPLC Analytical Method	
		Thomason -Duthie -Sturm procedure	Monsanto Shake Flask procedure	Addition Rate (ppm added per cycle)	Primary Degradation Rate ±95% C.L.	Comments	Initial Conc (ppm)	Days Req'd for 50% Primary Degradation	% Recovery (Mixed Liquor Extraction)	Method No.
				24-Hour Cycle		+, ++, and +/- indicate moderate, strong, and variable inhibition of sludge growth rate respectively.				
Santicizer 711 [Di(heptyl, nonyl, undecyl phthalate)] CP466/46	 n = 7, 9, 11	86 (27-Day)		3	52 ± 10			15	100.7 ± 3.1	AC-71-M-15 AC-72-M-4
				8	48 ± 9					
				13	54 ± 7	For more detail see AC-73-SS-20 and AC-75-SS-8.				
MO-77-583 Di-2-ethylhexyl phthalate (DEHP, DOP) CP467		86 (27-Day)		3	70 ± 11		1	10	74.1 ± 5.0	AC-72-M-4
				3	78 ± 3	For more detail see AC-73-SS-20 and AC-75-SS-8.				
MO-77-584 Santosol 100 (Mono and polybenzylethyl - benzene mixture) CP5661				8	61 ± 8	Volatility loss ~5%. Monobenzyl ethyl benzene degraded much more rapidly than polybenzyl components.			96.9 ± 2.4	AC-71-M-39 AC-72-M-7 AC-72-M-21
MO-77-585 HCS 1475 (Mixture of 90% S-711 and 10% HCS 1302) CP754/51	 n = 7, 9, 11 90% S-711 10% HCS 1302			3	38 ± 7	Volatility loss < 1%. For more detail see AC-73-SS-16.			92.8 ± 5.1	AC-73-M-11

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TABLE I

PRIMARY AND ULTIMATE BIODEGRADABILITY OF DIELECTRIC FLUIDS AND COMPONENTS

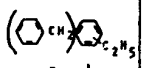
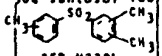
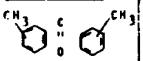
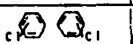
Test Material	Structure/ Composition	Ultimate Biodegradability (% of Theoretical CO_2 Evolution)		Primary Biodegradability						
				Semi-Continuous Activated Sludge (SCAS)			River Die-Away (RDA)		SCAS and RDA Analytical Method	
		Thompson -Duthie -Sturm procedure	Monsanto Shake Flask procedure	Addition Rate (ppm added per cycle)	Primary % Degradation Rate ±95% C.L.	Comments	Initial Conc(ppm)	Days Req'd for 50% Primary Degradation	% Recovery (Mixed Liquor Extraction)	Method No.
	 n ≥ 1			24-Hour Cycle		+, ++, and +/- indicate moderate, strong, and variable inhibition of sludge growth rate respectively.				
MO-77-586 MCS 1476 (Mixture of 50% Santosol 100, 25% MCS 1302, and 25% H230L) MB-99861 + 16687 + 54949	50% Santosol 100  25% H230L (Complex alkylbenzene mixture)			3	21 ± 12	Volatility loss ≤ 1%. +			81.8 ± 4.1	AC-73-H-11
MO-77-587 MCS 1342 (Dimethyl benzophenone) CP 6840				3 13	85 ± 9 93 ± 6 52 ± 21	Volatility loss ≤ 1%. + For more detail see AC-73-SS-16.			88.0 ± 4.4	AC-73-H-25
MO-77-588 Aroclor 1221 (Polychlorinated biphenyl) CP98361	 21% Cl 11% Biphenyl 51% Monochloro- 32% Dichloro- 3% Trichloro- 2% Tetrachloro-	45(28-Day)		24-Hour Cycle 1 3 48-Hour Cycle 1 8	 73 ± 21 82 ± 17 91 ± 6 87 ± 5	Volatility loss ≤ 6%. Lot AK-2 For more detail see AC-71-SS-6 and AC-72-SS-17.			95.8 ± 1.4	AC-71-H-17

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TABLE I

PRIMARY AND ULTIMATE BIODEGRADABILITY OF DIELECTRIC FLUIDS AND COMPONENTS

Test material	Structure/ Composition	Ultimate Biodegradability (% of Theoretical CO_2 Evolution): Thompson -Buchle -Sturm procedure	Ultimate Biodegradability (% of Theoretical CO_2 Evolution): Monsanto Shake Flask procedure	Primary Biodegradability: Self-Continuous Activated Sludge (SCAS): Addition Rate (ppm added per cycle)	Primary Biodegradability: Self-Continuous Activated Sludge (SCAS): Primary Degradation Rate ±95% C.L.	Primary Biodegradability: Self-Continuous Activated Sludge (SCAS): Comments	Primary Biodegradability: River Die-Away (RDA): Initial Conc (ppm)	Primary Biodegradability: River Die-Away (RDA): Days Req'd for 50% Primary Degradation	[illegible]: % Recovery (Mixed Liquor Extraction)	[illegible]
						[illegible], and +/- indicate moderate, strong, and variable inhibition of sludge growth rate respectively.				
				24-Hour Cycle						
MO-77-589 MCS 1043 (Polychlorinated biphenyl) CP98397	Cl Cl 30% Cl 0.1% Biphenyl 22% Monochloro 72% Dichloro 6% Trichloro	43(35-Day) Lot QA47		1	74 ± 7	+ Lot QA47			94.7 ± 1.0	AC-71-M-17
				48-Hour Cycle						
				1	56 ± 16	Sample OR15891 Volatility loss ~6%.				
MO-77-590 Arobronclor 1232 (Poly Bromochloro-biphenyl) FA 98361	(Bromonated Aroclor 1221) Cl,Br Cl,Br 21% Cl, 11% Br			48-Hour Cycle						
				1	54 ± 19	Sample OR16882 For more detail see AC-71-SS-6.			92.4 ± 1.7	AC-71-M-17
MO-77-597 Aroclor 1016 (Polychlorinated biphenyl) CP95360	Cl Cl 42% Cl 1% Monochloro- 20% Dichloro- 57% Trichloro- 21% Tetra- 1% Penta-	4(28-Day) 12(35-Day)		48-Hour Cycle		Volatility loss ~ 4%. Sample OR158591 For more detail see AC-71-SS-2, AC-71-SS-6 and AC-72-SS-19.			91.6 ± 1.2	AC-71-M-17
				1	33 ± 14					







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TABLE I

PRIMARY AND ULTIMATE BIODEGRADABILITY OF DIELECTRIC FLUIDS AND COMPONENTS

Test Material	Structure/ Composition	Ultimate Biodegradability (% of Theoretical CO_2 Evolution)		Primary Biodegradability						
				Semi-Continuous Activated Sludge (SCAS)			River Die-Away (FDA)		[illegible]	
		Thomson -Dunnie -Sturm procedure	Monsanto Shake Flask procedure	Addition Rate (ppm added per cycle)	Primary Degradation Rate (%) C.L.	Comments	Initial Conc(ppm)	Days Req'd for 50% Primary Degradation	[illegible]	[illegible]
						*, **, and +/- indicate moderate, strong, and variable inhibition of sludge growth rate respectively.				
MO-77-592 Aroclor 1242 (Polychlorinated Biphenyl) CP98363	 42% Cl 1% Monochloro- 16% Dichloro- 49% Trichloro- 25% Tetrachloro- 8% Pentachloro- 1% Hexachloro-	11(35-Day)		48-Hour Cycle 1	26 ± 15	Volatility loss ~4%. Lot AK-255 For more detail see AC-71-SS-6 and AC-72-SS-19.			83.8 ± 1.3	AC-71-M
MO-77-593 Aroclor 1254 (Polychlorinated Biphenyl) CP98365	 54% Cl 1% Trichloro- 21% Tetrachloro- 48% Pentachloro- 23% Hexachloro- 6% Heptachloro-			48-Hour Cycle 1	15 ± 38	Volatility loss ≤ 1%. Lot AK-38 For more detail see AC-71-SS-6.			75.5 ± 2.4	AC-71-M

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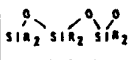
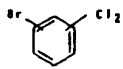
TABLE I

PRIMARY AND ULTIMATE BIODEGRADABILITY OF DIELECTRIC FLUIDS AND COMPONENTS

Test Material	Structure/ Composition	Ultimate Biodegradability (% of Theoretical CO_2 Evolution)		Primary Biodegradability						
				Semi-Continuous Activated Sludge (SCAS)			River Die-Away (RDA)		SCAS and RDA Analytical Method	
		Thompson -Buthie -Sturm procedure	Monsanto Shake Flask procedure	Addition Rate (ppm added per cycle)	Primary Degradation Rate ±95% C.L.	Comments	Initial Conc(com)	Days Req'd for 50% Primary Degradation	% Recovery (Mixed Liquor Extraction)	Method No.
				24-Hour Cycle		+, ++, and +/- indicate moderate, strong, and variable inhibition of sludge growth rate respectively.				
MO-77-594 Dow-Corning 705 (Methylphenyl polysiloxane) CP99021	 R=Methyl,phenyl			3	16 ± 13	No detectable volatility loss. For more detail see AC-73-SS-23.			75.6 ± 8.2	AC-73-M-31
MO-77-595 MCS 1288 (Bromodichloro benzene) CP99120				1	14 ± 8	Volatility loss ~9%. +/- For more detail see AC-72-SS-15.			77.3 ± 2.4	AC-72-M-19