File
PCB Contaminating Plans MC

7/24/75
WRR

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CAPACITOR REPLACEMENTS

BIODEGRADATION (SCAS)

	5 mg/24 hrs.	5 mg/48 hrs.	
MIPB	71 ± 3 (10 mg)		
MCS 1302 (TXS)	23 ± 10	42 ± 12	
Santosol 100	61 ± 8		
Aroclor 1016	3.6 ± 1.9	23 ± 14	
Aroclor 1043	4.7 ± 2.2	56 ± 15.5	
Aroclor 1221		64 ± 14	
Aroclor 1254	≈0	≈0	
Blends:			
MCS 1475 (S-711/TXS)	38 ± 7		
MCS 1476 (S-100/TXS/H2SOL)	21 ± 1.2		
MCS 1238 (MIPB/TXS)	60 ± 8 (calc)		To be run
MCS 1588 (S-100/TXS)	52 ± 10 (calc)		To be run

BIODEGRADATION (RIVER DIE AWAY)

TXS (MCS 1302)	Will degrade
MIPB	Will degrade
Santosol 100	Will degrade

MONS 082877

RAT FEEDING STUDIES

Fat Tissue Residue Analysis

	Feeding 25 ppm	10 Day Recovery	Feeding 100 ppm	10 Day Recovery
MCS 1302 (TXS)*	<0.5	<0.25	<0.1	<0.25
MCS 1623 (TXS/S-100*)	0.7	0.4	2.7	1.6
MCS 1238 (MIPB*/TXS)	1.2	0.5	2.5	<0.5
MCS 1475 (S-711/TXS)	Not detected		<0.25	
(Sulfone component in blends all <0.25 ppm)				
*Component evaluated				
Monochlorobiphenyl	1	0	7-8	1
MCS 1043	2	1	10-12	1
Aroclor 1016	23	15		
Aroclor 1242	35-40	30		

Conclude OK

Residues of TXS sulfone are 0.5 ppm, of hydrocarbon <3 ppm at feeding of 100 ppm

CARCINOGENICITY

Tests have been contracted with Industrial Bio-Test - Materials Sent - Tests not started

MCS 1475
MCS 1238
MCS 1558
Aroclor 1016
Aroclor 1043

a) 1 Feeding level
b) Tests to run for 2 years
c) Small samples of animals to be sacrificed at 6 months and 1 year
d) Pathological tissue examinations

TOXICITY

	Acute	Skin	Human Patch Test	Tissue Rat Feeding	Fish	Vapor Inhalation
TXS (MCS 1302)	✓	✓	0	✓	0	(not scheduled) 0
MIPB (Santosol 200)	✓	✓	✓	✓	✓	(not scheduled) 0
Santosol 100 (MCS 1175)	✓	✓	✓	✓	✓	(Being run)
MCS 1475	✓	✓	0	✓	✓	Rely on components ?
MCS 1238	✓	✓	0	✓	✓	
MCS 1588	✓	✓	✓	✓	✓	

0 = Need to be run

FUNCTIONALITY

A.C. LIFE TESTING CAPACITORS

	Max. Test Conditions		Customer Trials
	Paper	Film	
MCS 1475	Standard to -		Mallory (recycle problems)
MCS 1588	Standard to -		E.U.C. (field tests)
MCS 1238	Standard to -		G.E. (preliminary look only)
Aroclor 1016	Standard		All capacitor manufacturers
Aroclor 1043	Standard +		G.E. (evaluation through drum stage)

"Market" not ready to convert immediately to MCS 1238 or MCS 1588. Estimate conversion might take 2 years.

"Market" might convert to MCS 1043 - less technical risk - take 1 year.

SAFETY

	Fire Properties			Underwriters Laboratory
	Flash, °F	Fire, °F	AIT, °F	
MCS 1475	432	495	730	Not approved
MCS 1588	325	350	870	Not approved
MCS 1238	303	328	835	Not approved
Aroclor 1043	318	>515*	1155	Not approved
Aroclor 1016	358	>620*	1185	Approved

*None to B.P.

Conclude - Some sacrifice in fire safety. No standard covers capacitors other than present U.L. specification. Aroclor 1043 comes closest to fire resistance of Aroclor 1016.

PROPERTIES OF DIELECTRIC FLUIDS AND SYSTEMS

Properties	Aroclor 1016	MCS 1043	MCS 1489	MCS 1448	DOP	MCS 1475	MCS 1238	MCS 1588	MCS 1633
	Data on Fluids								
Sp. G. 25/25°C	1.368	1.246	1.348	0.969	0.983	0.988	1.018	1.030	1.0507
DK 25°C.	5.9	6.0	8.1	4.7	5.3	6.2	6.0	6.1	6.2
100°C.	4.85	5.0	5.5	4.0	4.3	5.0	5.1	5.1	5.1
Tan δ 60 Hz 100°C.	0.0025	0.0006	0.05	0.018	0.075	0.1	0.046	0.1	0.1
P_s 100°C x 10^4 Ω cm	150,000	10,000	2,000	3,075	211	500	1,000	620	1500
Viscosity, cs.									
@ 100°F.	14.3	5.6	21.5	23.0	29.0	26.4	9.1	7.14	9.58
@ 210°F.	2.12	1.47	2.54	4.2	4.3	4.33	1.98	1.96	2.08
Flash Point °F.	358°	318°	358°	425°	440°	432°	303°	325°	310°
Fire Point °F	None to BP (620)	None to BP (515)	610°	480°	-	495°	328°	350°	318°
AIT °F.	1185°	1155°	1125°	-	-	730°	835°	870°	770°
Hydrolysis***	0.00	0.00	0.00	0.18	0.11	0.17	0.00	0.00	0.00
	Data on 2 μF Capacitors* Impregnated with Above Fluids								
Capacitance @ 25°C.	1.95	1.99**	2.20	1.78	1.85	1.95	1.97	1.98	1.97
Dissipation Factor @ 25°C.	0.0034	0.0037	0.0040	0.0032	0.0033	0.0034	0.0037	0.00361	0.0038
Capacitance @ 90°C.	1.83	1.89**	2.07	1.67	-	1.84	1.87	1.87	1.87
Dissipation Factor @ 90°C.	0.0032	0.0037	0.0033	0.0028	-	0.0032	0.0039	0.0035	0.0034
Terminal to Case Resist.	$240x10^9$		$89x10^9$	$11x10^9$	$1x10^9$	$2.6x10^9$		$51x10^9$	-

* Standard 2 μF, 585 VAC Capacitors, 2 layers 0.00066, 0.90 density paper, 0.3% Unox 221 added.

** Standard 2 μF, 585 VAC Capacitors, 2 layers 0.00066, 0.90 density paper, without 0.3% Unox 221 added.

*** Neutralization number of sample with 0.5% water added heated for 168 hrs. at 210°F. in a stainless steel bomb along with an aluminum and a mild steel coupon.

MANUFACTURING PROCESS

TXS/MCS 1302

TSCl Route - Process Outline P-1728, LP&EC

Process for Interim Quantities, P-1755

Have made interim quantities, 50,000 lbs. 00-Bldg.

High transfer price TSCl, 40¢/lb.

TSCl process is a polluter

TSA Route - Process Outline P-1777, LP&EC

In pilot plant demonstration -- emulsion problem in quench and washing steps. Can undoubtedly be solved with some work.

Manufacturing cost should be ≈40-45¢/lb.

MIPB/Santosol 200

Tentative Process P-718 + Amendments A-F, LP&EC

Manufacture at Dixie, 37.5¢/lb.

Have made interim quantities W-Bldg., Queeny Plant

Desirable to raise flash point by dialkylation or substitution of C_4-C_6 or C_7 olefin for propylene

Manufacturing cost should be ≈26¢/lb.

Santosol 100/MCS 1175

Tentative Process P-1674 + Amendments A-D

Manufacture at Delaware River

Manufacturing cost 35 ¢/lb.

MCS 1238:	76% Hydrocarbon	X 26¢	= 19.8
	24% TXS	X 45¢	= 10.8
	Blending & purification		= 1.0
			31.6 - Call 32¢/lb.