Monsanto

FROM (NAME & LOCATION) J. H. Orem - B3ND

DATE September 15, 1972

SUBJECT 3M Company
St. Louis Visit September 7&8

REFERENCE 1972 - Dr. Richard F. Heine,
Mr. Gary Olson

TO :
C. W. Cook - 1180
E. Muschick

cc D. H. Bechtold - 1180
J. A. Cannon - 1760
A. W. M. Coaker
W. S. Clark
J. R. Darby - 1760
D. J. Denby
P. R. Graham
E. L. Kaiser
R. E. Lamkin
A. W. Morgan - 1760
W. W. Touchette - 1760

Extruded Product:

Low temperature is not important. Hardness is a Shore "A" 80 max. Oil and grease (axle grease and light weight oil) resistance are needed. Thickness is 10-60 mils and for the oily environment product it is ca 20 mils. Current plasticizer system is DIDP and DIDA.

Plasticizer system presented and discussed:

40 mil sheet 65 PHR+0.5PHR DS-207	T_f °C	Volatility 24 hr/6 day	Shore Hardness	Extraction Kerosene	% PL Soapy Water
DIDP/DIDA (56/9)	-42	2.5/9.0	72	85	4.0
S-711	-49	1.7/7.8	73	73	3.5
S-315	-39	3.9/18/7	70	12	17.0
S-711/S-148 (3:1)	-45	1.8/8.5	73	46	20.0
S-711/S-429 (1:1)	-30	- /6.2	71	15	7.9
S-411 (67 PHR)	-9	- /1.8	83	0.6*	7.0
S-429	-18	- /2.0	76	1.0*	6.0
S-711/S-97A (1:1)	-61	6.0/24.6	67	78	13.0
S-412 (67 PHR)	-29.5	- /5.9	71	4.2*	10.4
S-278 (67 PHR)	-0.9	1.0/3.4	79	0.8*	-
S-160	-24	8.0/ -	70	7.9	21

*hexane, 4 hours/RT

Volatility = 87°C/24 hours in activated carbon
Shore Hardness = 10 second hold down
Kerosene = 24 hours/RT
Soapy Water = 50°C/4 days

Discussed styrene and ABS mar in relation to their question on laminating PVC film to other polymers. Polymerics are okay with styrene, marginal with some ABS types, and not good on nitrocellulose migration resistance.

Melt flow properties of polymerics are higher than monomerics.

DSW 587358

STLCOPCB4092694

On weatherability, in general polymerics are good, phthalates are good, and adipates are not as good. Filled systems need an opacifying agent - such as TiO_2 rutile - when used outdoors. Many of our Florida and Arizona weathering results were shown and discussed. 3M Co. has some films being exposed in Florida.

Fungicides - Vancide 89, R.T. Vanderbilt, is the most commonly used in PVC. 3M feel it may be deactivated by sunlight. Vinyzene B-2-5 (arsenic containing) is deactivated by sunlight according to 3M. We have recently prepared films using some 20 commercially available fungicides and sent them to Florida for outdoor exposure evaluation.

Plastisols

Their plasticizer system is not DIDP/DIDA as we had assumed; it is BBP. Requirements are:

Viscosity, Brookfield, 50 rpm	2000 cps
Viscosity stability, 48 hours	2500 cps
Fusion temperature	ca 310°F.
Tear strength	170 lbs.
Elongation	400%
Tensile strength	1500 psi
Oil & Grease resistance	

Formulations discussed:	1	2	3	4	5
Opalon 400 (med. MW homopolymer)	100	100	100		
Opalon R-7611 (low MW homopolymer)				100	
Opalon 400 (low MW copolymer)					100
DIDP	56				
DIDA	9				
S-711		65	58.5	65	65
S-160			6.5		
G-62 (ESO)	3	3	3	3	3
Mark 462 (Ba/Cd/Zn)	2	2	2	2	2
After fusion 310°F/5 minutes					
Tear strength, lbs.	90	115	140	150	188
% Elongation	150	188	230	230	410
Tensile strength, psi	1170	1280	1490	1400	2050
Fusion °C	172	165	-	160	148

To achieve low viscosity and viscosity stability blending resins (MC 85 from Goodyear and VC 260S from Borden should be considered.

We are to develop an organisol or plastisol recipe, using their requirements, that will have good oil and grease resistance. WR has been written.

DSW 587359

STLCOPCB4092695

Flammability

3M wants to achieve a 25 flame spread rating in the Stiner tunnel, smoke generation is not a concern at this time. We discussed our Alumina Trihydrate evaluations and explained it works best with phosphate plasticizers. KH-36, formerly KH-45 (Kaiser) is 4.5¢/lb; Hydral 710 (Alcoa) is 9¢/lb. The latter is a fine particle size and twice as efficient as KH-36.

Flame retardance is more of a concern in the extruded product than it is in the plastisol.

In theory, S-148 is only 65% as efficient as S-140; in practice in PVC, S-148 is 85-90% as efficient, S-148 is lower in smoke.
(with alumina trihydrate) of S-140 with [illegible]

When phosphates are used, Drapex 10.4 (epoxidized linseed oil) should be used rather than ESO. The 10.4 has a higher oxirane oxygen content than ESO.

Formulations presented and discussed and approximate flame spread and smoke ratings:

Opalon 650	100	100	100	100	100
S-711	19	35	35	35	
S-429	25				
S-148		30			
S-145			30		
S-140	21			30	
S-355					65
Stabilizer Ba/Cd	1.5	1-2	1-2	1-2	1-2
Drapex 10.4	3	3	3	3	3
Atomite		20	20	20	20
Hydral 710		30	30	30	30
KH-45	30		20	20	20
ca Flame Spread	-	20	20	20	10
ca Smoke Rating	-	30	50-60	50-60	20

In the tunnel test, where the specimen is attached to the roof, the 3M Company Green Refractory Cement should be used to insure good adhesion and prevent the specimen's separation from the roof and hanging vertically into the flame.

Starting point guide line ratios for varying degrees of FR severity are:

	Phosphate:Al. Trihydrate
Maximum FR	
Steiner = 25 FS or Cal. Fire Marshall	1 : 1
CCC 5903-1818 (Army vertical burn)	3 : 2
Moderate FR	
Steiner = 75 FS	1 : 3
DOT (MVSS - 302)	1 : 4
MVSS	1 : 5

Stabilizer systems

Normally 3 PHR of ESO or Drapex 10.4 is used for processing heat stability. When the PVC is used outdoors Epi Rez 810 or Epon 828 @ 2 PHR should be considered to replace the 3 PHR of ESO. 10% replacement of the primary with S-141 improves outdoor stability. Mark LL (liquid Ba/Cd) @ 2 PHR & Mark PL (Zn/phosphite) @ 0.1 PHR with stearic and as needed provides a good stabilizer system. Mark WS (solid Ba/Cd) @ 2 PHR & Mark C (Cjelator) @ 0.5 PHR gives good heat stability but is not good on outdoor exposure.

Filler

Up to 25-50 PHR does not have too much affect upon extraction resistance or T_f. Above 50 PHR there is a decline in properties. Low temperature brittleness is adversely affected by any filler addition.

Outdoors, even low levels (5-10 PHR) of calcium carbonate can be detrimental - produces a translucent effect.

Oil absorption number of fillers can affect yield in plastisols.

Clay is used in electrical compounds for its good electricals.

Comment

With all this discussion they would not indicate the applications. Believe they have test marketed some products. 1973 potential may be 200 M pounds of plasticizer.

John Orem

/cs

DSW 587361