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EVALUATION ~~OF QSOM-7,~~ BLEND 6, RESIN AT NEW ENGLAND PLASTICS CORPORATION, WOBURN, MASS.

Customer Personnel:

John Gibbons, Vice-president
Bob Alexander, Plant Engineer

UCC Personnel Present:

W. H. Hunscher
L. G. Krauskopf
S. Krumm

Date of Visit:

April 26 & 27, 1967

SUMMARY

QSOM-7, Blend 6 resin was evaluated at New England Plastics Corporation in one rigid and two plasticized (85 and 65 Shore "A" durometer) formulations. The two plasticized formulations based on "O" resin when compared at equivalent durometers did not reach the equivalent preblend dryness of similar formulations based on Escambia 2225 pearls, nor did they extrude into equivalent product quality. Escambia 2225 is considered by NEP to be the very best resin in their plasticized formulations from the standpoints of preblend and extrusion characteristics. QSOM-7 characteristics were judged equivalent to their alternate resin -- Tenneco 250-1. Powderblend performance of the "O" resin in a rigid formulation was judged equivalent to powderblend based on Tenneco 12-R resin except for higher power consumption in the preparation of the powderblend. Slightly higher extruder die temperatures were required for the "O" resin formulations in all cases to approach standard product quality and gloss. Because of the higher die temperatures, increased susceptibility to product decomposition was encountered. In general, physical properties were equivalent except in two cases where slightly poorer brittle temperatures were measured for the "O" resin based products.

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DISCUSSION

Messrs. W. H. Hunscher, L. G. Krauskopf and the writer visited New England Plastics for the purpose of evaluating QSOM-7 resin in the contour extrusion of a variety of products. The following three were selected:

(1) #87 chair tubing (unfilled 85 durometer)
(2) #2 channel (filled 65 durometer)
(3) #RV-115 Rigid (chlorinated polyethylene modified)

The competitive resins being used in the products which were run during the trials were:

Resin	Products
Escambia 2225 Pearls	#87, #2
Tenneco 250-1	#87, #2
Tenneco 12-R	#RV-115

The following plasticizers were used:

Blended DOP/Drapex 4.4 in a ratio of 3/1
Blended DOP/DOA/Drapex 4.4 in a ratio of 68/11/21
Drapex 4.4

The dryblend and powderblend techniques were used to prepare feedstocks for the extruders.

The feedstock preparation area contained the following mixers:

500# - 60 rpm, jacketed ribbon blender
500# - 120 rpm, jacketed Littletown blender
100# - 2 vessel, jacketed Diosna intensive mixer

The fabrication area contained eight extrusion lines, including two sheet lines.

Plasticizer reductions of 15 and 20% respectively were made in #87 and #2 formulations to achieve equivalent durometers to the standard products. A straight substitution of QSOM-7 for Tenneco 12-R was made in RV-115. The resultant formulations are shown in Table I.

QSOM-7, blend 6, was selected for the trial since it was considered a good resin, low in fisheyes. A recheck by Texas City of a sample taken from one of the bags at NEP showed it to have over twice the fisheye count reported on the original quality control sample (10 mil Respro, normal count: 40 versus 83). The blend data sheet is attached for informational purposes.

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Shown in Table II are the time-temperature relationships achieved in the preparation of the preblends. The standard procedure involved 40 minutes of heating to 220°F, followed by 40 minutes of cooling to 130°F. Actual material temperatures in these trials were recorded by stopping the ribbon blender, then immersing a needle pyrometer into the preblend. A recording micromax usually records temperature throughout the entire cycle, but it was inoperative at the time. The #87 chair tubing preblend based on the "O" resin appeared initially to dry faster during the first five to ten minutes of the heating cycle, but no further improvement appeared obvious to the end of the heating cycle. On the other hand, Escambia 2225 based preblend appeared "wet" during the first five to ten minutes, but thereafter a significant improvement in dryness occurred which continued to the end of the heating cycle. In checking the dryness of the cooled preblend by the hand squeeze test, it was clearly obvious that Escambia 2225 preblend was significantly drier. The two NEP preblend operators stated that the "O" resin preblend was equivalent to preblend based on Tenneco 250-1 resin. Escambia 2225 preblend can be fed immediately after cooling to the extruders without encountering feed stoppage. On the other hand, Tenneco 250-1 preblend must be dried overnight. An extrusion trial of unaged "O" resin preblend was attempted to further measure its dryness. Soon after filling the hopper of #1 (small throat) extruder, stoppage of feed occurred. Several unsuccessful attempts were made to restore feed to the screw, but when the two hopper vibrators failed to operate consistently, the run was terminated. Overnight aging of the preblend significantly improved its dryness to the point where no caking occurred in the hand squeeze test, and no feed problems were encountered in the No. 5 extruder, which has a larger throat.

The #2 channel preblend was prepared under conditions similar to the #87 chair tubing. Here again Escambia 2225 preblend dried faster and reached better ultimate dryness than "O" resin preblend.

A Diosna intensive mixer was used to prepare the #RV-115 rigid powderblend. Tabulated in Table III are amperage versus temperature of the batches. At certain temperatures, power consumption when mixing "O" resin preblend approximated 50% more than that required to mix Tenneco 12-R powderblend. After discharge from the cooling vessel, however, no apparent differences in degree of dryness were discernible.

Extrusion conditions for the three formulations are shown in Table IV. Starting conditions were the so-called "standard" which NEP had established as optimum for each particular formulation. In general, "O" resin based product lacked gloss at the standard conditions. Higher die temperatures of 10 to 20°F improved gloss somewhat, but product quality suffered from inadequate dispersion and/or high level of hard particles. Product output and power consumption were equivalent in the extrusion of both #87 chair tubing and #2 channel preblends. In the extrusion of RV-115 rigid, a drop in power consumption resulted in a drop in product output from a 10 to 20°F increase in die temperature.

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No evidences of product decomposition were apparent in the two plasticized extrusions. However, in the white rigid extrusion, two yellow streaks were clearly visible on product based on "O" resin, and to a lesser extent on product based on Tenneco 12-R resin. Thermal decomposition occurred faster than normal in the head and die sections on all four of the extruders after "O" resin formulations had been extruded. This was particularly disturbing since it was felt the inherent lubricity of the "O" resin had adversely influenced product quality and that these deficiencies could be overcome by more water on the screw and higher die temperatures. Improvement in heat stability probably could result through the use of certain stabilizers which are not necessarily critical for conventional PVC homopolymers.

Limited physical properties are shown in Table V. These properties were determined on compression molded plaques pressed from roll milled sheets of the extruded products. In general, properties of the standard and "O" resin based products are equivalent, except for a tendency of the "O" products in two cases to have poorer brittle temperatures.

S. Krumm

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VINYL RESIN BLEND DATA REPORT
QUALITY CONTROL LABORATORY, PLANT 515

QXOM-7
Type

LABORATORY DISPOSITION	QXOM-7 none (no specs)
PLANT DISPOSITION	
BLEND NUMBER	B-6
BATCH STATUS	/ 2
EXCEPTIONS	— —
BLEND WEIGHT	34,320
PRODUCT AIM	QXOM-7
DATE SAMPLED	9-15-66

Screen Analysis USBS Sieve % thru	20 mesh	—
	40 mesh	100
	60 mesh	99
	80 mesh	67
	100 mesh	30
	140 mesh	7
	200 mesh	3
	270 mesh	—
Median Particle Size, microns		164
Heating Loss, %		0.2
Polyvinyl Chloride Content, %		—
Viscosities	Inherent Visc., ASTM D-1243	0.99
	Melt Viscosity	
	Brookfield Viscosity, cps	
	Falling Ball Viscosity, sec.	
Slurry Contamination Rating		1
Apparent Density, lb/cu ft		29
Haze (Plaque), %		
Catanac, %		
Water, %		
Lead, ppm		
Insoluble Matter, %		
Plasticizer Absorption, PPHR		95
Dry Blend Time, min/temp °C		3.3/82
Resin Flow, sec/400 cc		3.5
Co-monomer ( ), %		

Color	Solution Color, % trans.		
	Solution Turbidity, % trans.		
	Oil Bath Heat Stability, min.		
	ICMT Rating		110.
	HTMT	Initial, % trans.	
		Intermediate, % trans.	
		Ultimate, minutes	
	Columbia Heat Stability, min.		
	Whiteness Index, % reflectance		
	Ken-tile Color	Brightness, % trans.	
		Yellowness	
Hard Particles	Pigmented Film	17.5 mils	nil
		10 mils	40
	Clear Hard Resin Particles		1
Solvent Composition	% Toluene		
	% Methyl Ethyl Ketone		
	% Acetone		
	% Vinyl Acetate		
	% Solids		
Maleic Acid, %			
Reactivity, cps			
ASTM Conductance			0.50
Melt Viscosity/Temperature °C			
% Ethylene			1.33
Melt Viscosity (WC-327-B)			1730

By J. C. Akins Date 9/23/66

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TABLE I

PRODUCT FORMULATIONS

#87 Chair Tubing - Green

	Parts By Weight	
	Standard	"O"
Escambia 2225 Resin	100	-
QSOM-7, Blend 6	-	100
DOP/DOA/Drapex 4.4 (ratio of 68/11/21)	40	34
Vanstay HTA (Solid Ba-Cd Stab.)	2.5	2.5
Vanstay RR (liquid Ba-Cd Stab.)	0.8	0.8

#2 Channel - Gray

Escambia 2225 Resin	100	-
QSOM-7, Blend 6	-	100
DOP/Drapex 4.4, ratio of 3/1	80	64
Atomite	33.3	33.3
Vanstay HTA	1.0	1.0

#RV-115 Rigid - White

	Parts by Weight
*Tenneco 12-R	100
Chlorinated Polyethylene	12.5
Acryloid K-120 N	3.0
0-292 (Tin stabilizer)	3.0
Drapex 4.4	3.0
Stearic Acid	0.75
Mg. Stearate	0.25
Unitane 450	8.0

*QSOM-7 directly substituted for 12-R.

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#87 Chair Tubing

With neutral ribbon blender, resin and dry ingredients added; liquids then pumped in (plasticizers and Vanstay RR which have been preheated to 120°F prior to addition to blender) - takes approximately 2-1/2 minutes to pump in liquids. 15# steam turned on blender. Forty minutes of mixing with heat to reach 210-220°F, followed by 40 minutes of cooling to 130°F. Batch discharged into fiber drums.

TABLE II

PREBLEND PREPARATION

Cycle, Minutes	Standard, °F	"O", °F
23	189	185
28	200	191
33	210	200
40	215	210
--	Cold Water On Blender	
80	130	130

#2 Channel

Same equipment and procedure as #87 chair tubing.

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TABLE III

POWDERBLEND PREPARATION

#RV-115 Rigid

Add all solids, except lubricants, to mixing vessel of Diosna intensive mixer. When mix reaches 150°F, add liquids and continue mixing to 175°F. Add lubricants and drop mix into cooling vessel. Cool five minutes, then discharge into Gaylord container.

Cycle Time	Standard		"O"	
(minutes)	Amperage	°F	Amperage	°F
0.25	75	170	85	130
0.50	75	170	-	-
-	Liquids Added		-	-
0.75	100	170	90	140
1.00	90	180	95	150
-	-	-	Liquids Added	
1.5	85	180	105	150
2.0	83	180	125	170
2.5	85	190	135	190
3.0	95	200	135	200
3.5	100	210	155	200
-	Lubricants Added		Lubricants Added	
4.0	130	230	155	230

Discharge mix to cooling vessel.

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TABLE IV

EXTRUSION CONDITIONS

#87 Chair Tubing

Unaged Preblend

No. 1 Davis - Standard Extruder - 2-1/2 inch, 20/1 L/D
3:1 Compression Ratio

	"O"
Head-Die 1	330°F
Zone 1	325
2	320
3	320
4	325
Stock Temp.	350
Load, amps	34 amps
RPM	106
Cold Water on Screw	80°F
Line Rate, ft./min.	146

Remarks: Feed problems - screw starved - vibrators stopped - run terminated.

#87 Chair Tubing

Aged Overnight Preblend

No. 5 Davis - Standard Extruder - 3-1/2 inch, 20/1 L/D
4:1 Comp. Ratio

	Standard	"O"
Die 1	Off	Off
2	325	330
Zonel Front	350	345
2	340	335
3	320	320
4 Rear	315	325
Amperage	60-70	60-70
RPM	77	77
Line Rate, ft./min.	175	175
Cold Water on Screw	- - - One Turn - - -	

Remarks - see page 10.

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TABLE IV

(Continued)

Remarks

Run started with "O" based product at "standard" conditions. Die temperature raised 20°F to improve gloss, but still not as good as standard product. Conditions shown above are equilibrium conditions and actual instrument readings - - not settings.

#2 Channel

No. 2 Davis - Standard Extruder - 3-1/4 inch, 16/1 L/D
2:1 Comp. Ratio

	Standard	"O"
Head	355°F	355-375
Zone 1 (Front)	350	350
2	355	355
3	345	345
Amperage	55 amps	55 amps
RPM	106	106
Stock Temp.	350°F	350°F
Line Rate, ft./min.	184	184
Cold Water on Screw	- - - - One Turn - - - -	

Remarks

Die temperature raised 20°F to improve gloss, but still not as good as standard product.

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TABLE IV

(Continued)

#RV-115 Rigid

No. 4 Davis - Standard Extruder - 3-1/2 inch, 20/1 L/D
2:1 Comp. Ratio

	Standard	"O"
Head 1	320°F	330-340°F
2	-	-
Zone 1 (Feed)	320	310
2	320	330
3	320	340
4 (Front)	330	340
Amperage	125 amps	100-110 amps
RPM	7	7
Line Rate, ft./min.	12	10

No Water Cooling Provision for Screw

Remarks:

Gloss and dispersion were relatively poor at standard conditions. Raised die and lowered feed to improve somewhat both properties, but still not as good as standard.

TABLE V

PHYSICAL PROPERTIES

(Measured on 8 x 8x.125" Compression Molded Plaque)

	RV-115 Rigid White		#87 Tubing Green		#2 Channel Gray	
	STD	"O"	STD	"O"	STD	"O"
Specific Gravity	1.403	1.399	1.262	1.268	1.329	1.329
Durometer, Shore A	-	-	85	85	65	67
Tensile Strength,psi	6620	6740	3120	3020	1550	1670
Tensile Elong., %	20	17	246	260	336	332
Brittle Temp.,°C	+ 4	+14	-12	-12	-34	-26

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