STATUS REPORT

VINYL CHLORIDE - ETHYLENE COPOLYMER RESIN

EVALUATION OF EXPERIMENTALLY PREPARED LOW MOLECULAR WEIGHT POLYMER

Author: A.W. Conkling
P.T. McCoy

Supervisor: W.H. Bauer

Date: December 21, 1966

Project No.: 224A90

File No.:

SUMMARY

The comparative evaluation of a small sample of an experimentally prepared vinyl chloride ethylene (0.8 percent) copolymer indicates unique processing characteristics not currently available in conventional Union Carbide homopolymers. The resin, as produced by the suspension process, and at the molecular weight level of QYSA processes easier than QYSA and QXOH-7, is in the range of VSKK, and is a competitive counterpart of Cumberland's 420 and 470 (propylene modified vinyl resins). The resin exhibits excellent dry blending and preblend flow characteristics not generally shown for homopolymer resins at this low molecular weight.

A QXOE-7 type of polymer should find industry acceptance in the following application areas:

Flooring

Rigid and non-rigid calendered film and sheeting

Rigid and non-rigid extruded film and sheeting

Injection molding

Blow molding

Processing aid for calendering, extrusion and molding

The resin exhibits unique and novel properties that should command a premium of a few cents over conventional homopolymer counterparts. Manufacturing specifications for this type of a product are suggested.

Union Carbide Corporation - Chemicals Division
Research and Development Department
Tarrytown, New York

DISCUSSION

A small sample of experimentally prepared vinyl chloride - ethylene copolymer resin, QXOE-7 (QEX-1259), has been evaluated. The fusion and dry blend properties were the primary properties assessed. The test results are reported in Table I and Figure I.

The QXOE-7 resin exhibits a satisfactory dry blending performance not generally exhibited by homopolymer counterparts at this low molecular weight. This performance is consistent with the rapid drying characteristics of the higher molecular weight "O" resins and is fully equivalent to the good dry blending characteristics of the Cumberland 400 vinyl chloride - propylene resin series. The dry blend flow of QXOE-7 is excellent. The combination of low fusion and excellent pre-blend flow are characteristics that several flooring customers have expressed as most desirable for "grouting" applications.

The fusion characteristics are the lowest of any UCC "O" resin examined to date. The average melt characteristics as compared to VSKK, QYSA, QXOH-7 and the Cumberland 400 series are summarized in the following table:

	Comparative Average Melt Characteristics of QXOE-7	
RESIN	Unplasticized	Plasticized (30 PHR DOP)
VSKK	6 % lower	20 % higher
QYSA	16 % lower	7 % lower
QXOH-7		25 % lower
CUMBERLAND		
401	47% lower	31% lower
405	16% lower	15% lower
420	Same	8% higher
470	12% higher	21% higher

The average melt characteristics in plasticized compounds of QXOE-7 are between those of Cumberland 420 and 470 and in terms of compositional factor (vinyl chloride times inherent viscosity) is closer to 470 than 420. The average melt characteristics of VSKK similiarly approach those of 420.

The apparent melt viscosity of QXOE in a rigid formulation is equivalent to that of Cumberland 420.

Conclusions - QXOE-7 vinyl chloride-ethylene copolymer resin is a near competitive counterpart of Cumberland 470 and 420 propylene-modified vinyl chloride resins and offers near comparative melt characteristics in both rigid and non-rigid end-use applications.

The following property levels and limits are suggested as targets for the manufacturing specifications of this potential product:

Vinyl chloride, %	99
Ethylene, %	1.0 ± 0.2
Inherent viscosity, ASTMA	0.61 to 0.65
Heating loss, %	0.5 max
Apparent density, lbs/ft^3	28 to 32
Dry blend trial, minutes	4.0 max
Sieve analysis thru 40 mesh	100
thru 200 mesh	5 max
median, microns	150 to 200

AWConkling

A.W. Conkling

PTMcCoy/lw

P.T. McCoy

Attachments
1 Table
1 Figure

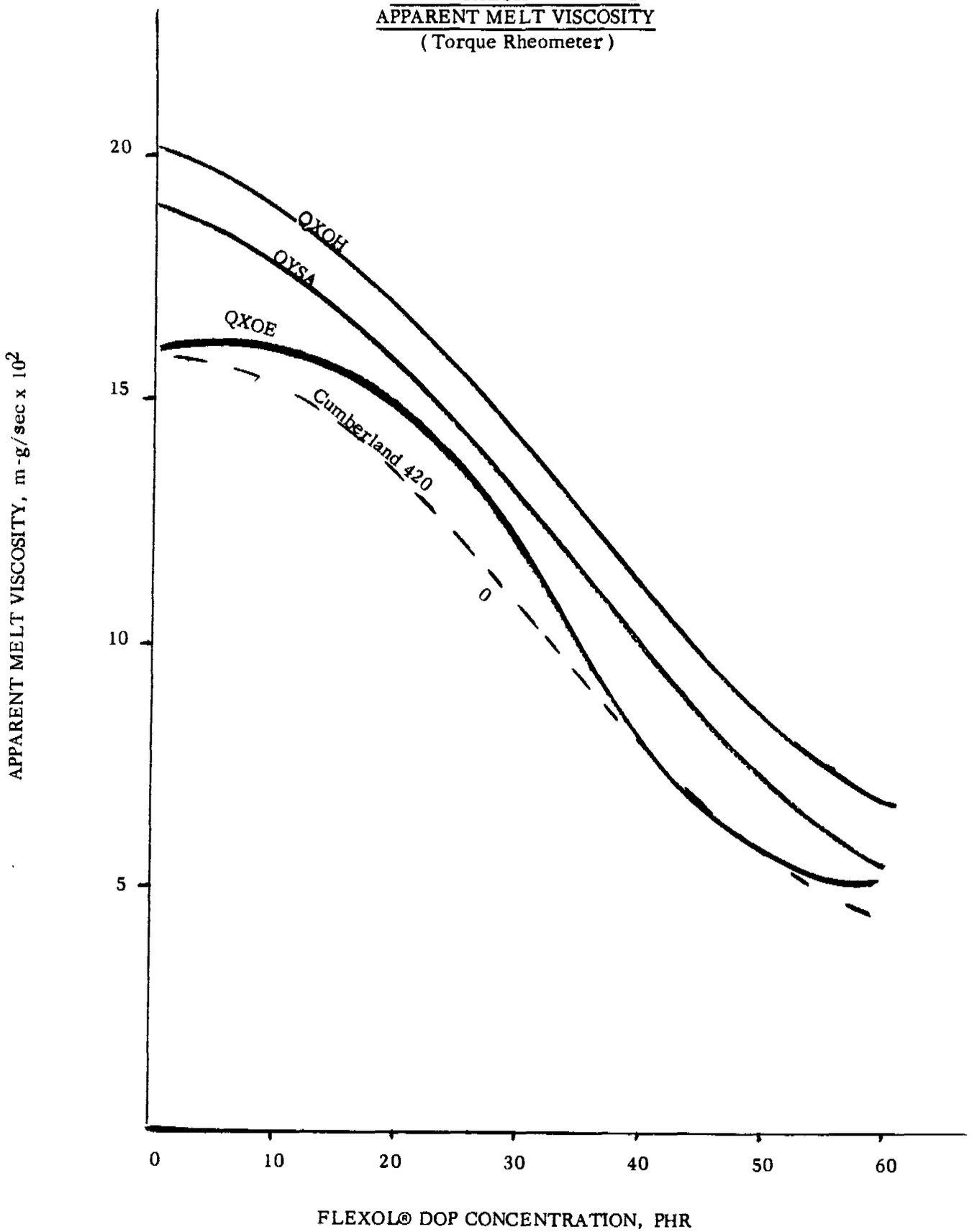
TABLE I

EXPERIMENTAL VINYL CHLORIDE - ETHYLENE COPOLYMER RESIN
CHEMICAL AND PHYSICAL PROPERTIES

	QXOE-7 QEX1259	Typical QYSA 5	QXOH-7 Blend 1	Typical VSKK
Vinyl Chloride, %	99	100	99	89
Inherent viscosity, ASTM A	0.64	0.62	0.78	0.72
Ethylene, %	0.84	0	1.0	0
Apparent density, lbs/ft^3	31	32	32.5	39
Resin flow, sec/400 cc	3.3	5.9	4.8	3.5
Plasticizer sorption, phr	90	80	95	50
Initial color mill test	93	85	102	
Hard resin particles, ft^2 17.5 mil	80	100	40	
10	2240	1500	1150	
Clear fisheye test	10+	8	8	
Torque rheometer				
Dryblend trial, time				
Time (min)/temp. °C	3.4/79	does not dry	4.8/81	
Apparent melt viscosity, m-g/sec/°C				
0 PHR FLEXOL DOP	1600/174	1900/178	2025/179	1700/175
20 " " "	1510/148	1605/149	1720/151	1295/144
30 " " "	1150/144	1150/146	1480/148	905/141
40 " " "	815/140	980/142	1090/144	640/139
60 " " "	505/137	560/138	690/140	325/135
Fusion temperature, °C				
O PHR FLEXOL DOP	110	108	106	94
30 " " "	90	---	109	90
Sieve analysis, thru 100 mesh %	16	85	--	70
" 200 " %	1	25	7	8
median, microns	177	110	160	120

FIGURE I

VINYL CHLORIDE RESINS
APPARENT MELT VISCOSITY
(Torque Rheometer)



UCC
039447

Distribution

Mr. J. Anthony
Dr. F. E. Bailey
Mr. W. H. Bauer
Mr. A. J. Costantin
Mr. F. D. Dexter
Mr. D. L. Engle
Mr. J. F. Erdmann
Mr. C. R. Field
Mr. N. R. Gimler
Mr. G. G. Himmler
Mr. S. Krumm
Mr. D. E. Richardson
Mr. H. J. Rutherford
Mr. J. R. Wilkinson
Mr. E. R. Weidlein, Jr.
Mr. N. R. Wheeler
Dr. N. L. Zutty