BUSINESS CONFIDENTIAL

PROJECT REPORT

SUSPENSION VINYL RESINS-
SCALEUP STATUS OF ETHYLENE-MODIFIED
DRYBLEND RESINS

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DATE: November 29, 1967

PROJECT NO.: 347 B 10

FILE NO.: 8402

SUMMARY R. and D. studies showed that the addition of a small amount of ethylene to dryblend PVC resins for calendering and extrusion resulted in a substantial improvement in dryblend time without apparent effect on melt properties. Since this technique yielded dryblend times at least as good as, and in most cases better than any competitive dryblend PVC resin, it was agreed with operating personnel that scaleup runs of ~ 50,000 lb. would be made, adding ethylene to four dryblend PVC types: QYTQ-7, QYSC-7, QYSL-7 and QSAN-7. The first three mentioned were for calendering use, while the fourth was intended primarily for wire and cable coating. The ethylene concentration required was approximately 0.5% by the old standard, or 0.9-1.3% by Dr. Geo. Potter's new Parr bomb standards.

The above-mentioned scaleup runs are now complete. Resin properties in all cases were approximately as predicted, and the resins so produced are considered suitable for sampling to selected customers except for the modified QYSC-7, in which case the amount of ethylene added was insufficient. Analyses are shown, along with typical unmodified PVC analyses for comparison.

Bearing in mind recent quality control analyses of leading competitive resins, the data in the tables show that for the first time UCC has proved manufacturing capability to produce a line of dryblend-type resins with dryblend times second to none in the industry. Exploitation of this advantage awaits marketing decisions as to pricing and initial potential customers.

INTRODUCTION Earlier R. and D. studies on the so-called "O" resins (vinyl chloride/ethylene copolymers) showed that dryblend times were improved substantially by the ethylene, but that melt viscosities were also affected. Marketing personnel in the Calendering, Flooring and Records Market Area felt that a significant improvement in dryblend times for UCC standard dryblend-type PVC resins must be made to maintain or improve competitive position. R. and D. studies showed that this could be accomplished by the addition of ~0.5% ethylene (0.9-1.3% by Dr. Potter's new standards) without significantly affecting melt properties.

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DISCUSSION The 50,000 lb. scaleup runs for the four ethylene-modified resins mentioned above are discussed in the chronological order in which the scaleups were carried out.

QYSL-7 This high-viscosity PVC, sold only to Ford, was scaled up first in ethylene-modified form because of an immediate need to counter a competitive resin threat at Ford. Ford has evaluated a sample of Blend B-78, and was so favorably impressed that they have requested that all future QYSL-7 deliveries be equal to Blend B-78. Marketing and Operating personnel plan to comply. Properties are shown in Table I. Ethylene content could be increased slightly without harming melt properties if further incremental dryblend improvement is needed.

QYSC-7 The ethylene-modified QYSC-7 was scaled up in late August, 1967, the resin being collected and packaged as Blend B-83. Unfortunately, the amount of ethylene introduced was not enough to significantly affect the dryblend times, so while Blend B-83 dryblends faster than typical QYSC-7, it is no better than selected blends of top-quality QYSC-7. Properties of the resin are shown in Table II. No further scaleup efforts are planned for ethylene-modified QYSC-7 unless Marketing can document a specific customer need.

QYTQ-7 Ethylene-modified QYTQ-7 was scaled up early in November, 1967. Resin properties are shown in Table III, and were as predicted. It was originally planned to offer this resin for Ford's general purpose business, but price weakness caused a change in these plans. Marketing personnel are considering the best application for offering this improved resin.

QSAN-7 The ethylene-modified QSAN-7 was scaled up in mid-November, 1967, and was double-washed in the same manner as normal QSAN-7, in order to obtain good electricals. Properties were as predicted, and Wire and Cable personnel are considering the possibility of offering this resin to the two wire coating firms selected as initial marketing targets. Properties are shown in Table IV. Electrical resistivity can be improved by reducing the sodium bicarbonate in the recipe.

CONCLUSIONS 1. The use of small amounts of ethylene in the recipe for dryblend vinyl resins provides UCC a line of products with dryblend performance second to none in the field. Furthermore, melt properties are not significantly affected at this ethylene level.

2. Maximum autoclave pressures generated at the levels mentioned above are low enough that the resins can be made in any of the existing suspension autoclaves at Texas City.

3. Autoclave productivities, in terms of lbs. of resin per reaction hour for the ethylene-modified resins are essentially the same as for their unmodified counterparts.

4. Inasmuch as manufacturing capability for the ethylene-modified resins has been conclusively demonstrated, the burden of the further effort to capitalize on this breakthrough now rests with marketing personnel.

BIBLIOGRAPHY

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2. Memorandum "Initial Production Run QYSL-7 with Ethylene", W. D. Bush to N. A. Gimber, November 20, 1967.

3. Memorandum "Scale-Up Run of QYSL-7 With Ethylene", J. C. Schlichter to N. A. Gimber, September 8, 1967.

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TABLE I

ETHYLENE-MODIFIED QYSL-7

	Blend B-78	Typical QYSL-7*
Screen Analysis, % through		
40 mesh	100	100
60 "	99	-
80 "	76	-
100 "	29	-
140 "	5	-
200 "	1	1
Median particle size, microns	161	178
Heating loss, %	0.4	0.4
Inherent Viscosity	1.37	1.35-1.37
Contamination Rating	2	2
Apparent Density, lb/cf	29	31
ASTM Plasticizer Sorption, pphr	114	-
Dryblend time, min./°C	7.6/85	9.8/85
FORD dryblend time, min./°C	15.0/82.5	-
Dry resin flow, sec.	3.1	2.8
ICMT	90	96
Fisheyes, 17.5 mil at 4 min.	0	0
10 " " " "	111	100
10 " " 6 "	1	5
Clear HRP	2	2
Ethylene, % ***	0.41 (0.95)	-
Brabender melt viscosity, ** m-gm./°C	1820/173	1750-1800/172

* Taken from last 10 blends
** Ford formulation
*** Value in parentheses is taken from new Parr bomb standards determined by Dr. George Potter.

TABLE II

ETHYLENE-MODIFIED QYSC-7

	Blend B-83	Typical QYSC-7*
Screen, % through		
40-mesh	100	100
60 "	99	-
80 "	92	-
100 "	60	-
140 "	17	-
200 "	9	8
Median particle size, microns	138	146
Heating loss, %	0.2	0.3
Inherent Viscosity	1.19	1.15
Contamination rating	1	2
Apparent density, lb/cf	30	31
Dryblend time, min./°C	7.8/85	8.2/85
Dry resin flow, sec.	3.3	3.4
ICMT	103	99
Fisheyes, 17.5 mil/10 mil	0/5	0/45
Clear HRP	2	2
Ethylene, % ***	0.26 (0.60)	-
Brabender melt viscosity, *** m-gm./°C	1550/167	1500/166

* Taken from last 10 blends
** Ford formulation
*** Figure in parentheses is approximation of Parr bomb determinations by Dr. George Potter.

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TABLE III

ETHYLENE-MODIFIED QYTQ-7

	Blend B-330	Typical QYTQ-7*
Screen, % through		
40 mesh	100	100
60 "	100	-
80 "	94	-
100 "	62	-
140 "	13	-
200 "	2	3
Median particle size, microns	138	137
Heating loss, %	0.1	0.2-0.3
Inherent Viscosity	0.96	0.96-0.99
Contamination rating	1	1-2
Apparent density, lb/cf	32	33-34
Dryblend time, min/°C	4.8/85	6.4/85
Dry resin flow, seconds	3.0	3.4
ICMT	110	102
Respro fisheyes, 17.5 mil/10 mil	0/19	0/20
Clear HRP	2	2
Ethylene, % ***	0.52 (1.25)	-
Brabender melt viscosity, m-gm/°C **	1940/155	2000-2100/155

*Values taken from last 10 production blends
** UCC Method WC-327A
*** Figure in parentheses is an approximation by Dr. George Potter's Parr bomb technique.

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TABLE IV

ETHYLENE-MODIFIED QSAN-7

	Blend B-111	Typical QSAN-7*
Screen, % through		
40 mesh	100	100
60 "	96	-
80 "	78	-
100 "	49	-
140 "	10	-
200 "	2	2-3
Median particle size, microns	151	148
Heating loss, %	0.5	0.2
Inherent Viscosity	1.06	1.01-1.05
Contamination rating	2	2
Apparent density, lb/cf	33	33
Dryblend time, min/°C	5.2/82	6.4/84
Dry resin flow, seconds	3.8	3.1
ICMT	111	106
Respro fisheyes, 17.5 mil/10 mil	0/3	0/35
Ethylene, % ***	0.7 (1.4)	-
Resistivity, % of std.	65	70
Brabender melt viscosity, m-gm/°C **	1300/161	1310/161

* Taken from last 10 blends
** Ford formulation
*** Figure in parentheses is an approximation of results by Dr. George Potter's Parr bomb technique.

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