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Marshall Laboratory
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MEMORANDUM REPORT NO. 459:

DRYING OF HOUSE PAINTS WITH MALEIC MODIFIED LINSEED OIL

It had been found in previous work during 1951 that Archer-Daniels-Midland's Zymol, a maleic modified linseed oil, made a marked improvement in the drying time of house paint when it was used as the total vehicle in place of linseed oil in 301-885 #40 Outside White. This oil was not considered for immediate use as the total vehicle because of the danger of poor durability which might result from the extremely low solids of the paint. More complete exposure coverage has been made in Series #12560.

The purpose of this work was to determine what improvement in drying might be made by using maleic modified linseed oils in place of the bodied oil portion of the house paint vehicle. The oil blends used in these experiments are shown in Table I along with the physical properties of the individual oils. The experiments were designed to determine the effects on drying of the following variables:

(a) Maleic modified linseed oil versus bodied linseed oil at equal vehicle viscosity and at approximately equal paint solids.

(b) Total vehicle viscosity; 2 poises versus 5 poises.

(c) Viscosity of bodied oil portion of the vehicle; S-T body versus Z2-Z3 body.

Results of these tests are shown in Table II.

Summary and Conclusions:

a. A significant and substantial improvement in drying to the "tack free" stage is obtained under all test conditions of temperature and humidity by using maleic modified linseed oil in place of

linseed oil as the bodied oil portion of the paint vehicle. There is no improvement in drying to the "firm" stage by using maleic modified linseed oil.

b. A significant improvement in tack free time at C.T.R. and 100°F, 80% R.H. conditions is obtained by using Z-2 bodied oil rather than "S" bodied oil, at equal total vehicle viscosity. There was, however, an interaction in this determination between the viscosity of the bodied oil and the type of bodied oil. Table III shows that this difference in drying time is significant only when bodied linseed oil is used. When maleic treated oil is used as the bodied oil portion, there is no significant difference between the high and low viscosity maleic treated oil.

In drying to the "firm" stage the interactions are again predominant. Small but significant difference between high and low viscosity bodied linseed oil show the high viscosity oil drying faster at CTR and 100°F; 80R.H. conditions. At 43°F; 80% R.H., the low viscosity maleic modified linseed oil dries significantly faster than the high viscosity Zymol.

c. There is generally faster drying to the "tack free" stage with the higher viscosity total vehicle than with the lower viscosity vehicle. There is a small but significant difference in favor of the high viscosity vehicle in drying to the firm stage only at CTR conditions.

If it is desired to use maleic modified linseed oil to improve the drying of house paint, either the low viscosity Trimol V-14 or the high viscosity Zymol could be used equally well. The determining factor in choosing between the two would probably be raw material costs and handling charges. This might be in favor of the Zymol because of the smaller quantity required to obtain a desired overall viscosity.

Action:

Because of the failure of maleic modified linseed oil to improve drying to the "firm" stage there is no need for further action at this time. Sales Department is now testing a product, 301-894, with improved "firm" time and improved color. The vehicle in 301-894 is 100% H-613, maleic modified soya oil. It is considered that a reduction in "tack free" time is of less importance than improvement in "overall" drying.

Experimental:

The drying tests, whose results are given in Tables II and III, were conducted according to W. F. Singleton's memorandum dated December 27, 1951 entitled "Tests to Characterize Initial

Properties of White House Paint". Four determinations were obtained in each test for each of the paints shown in Table I. Therefore, each of the results in Table II is the mean of sixteen determinations for each variable shown.

All of the paints in these tests had the pigmentation and drier concentration of 301-892, high gloss #40 Outside White. No attempt was made to determine the optimum drier concentration for each vehicle. The vehicle in P-301-U-21441 is the closest in composition to the vehicle in 301-892 which has a 70/30 blend of H-19/VO-5372.

Subsequent to the above tests three samples of low viscosity maleic modified oil were received from Archer-Daniels-Midlands. These are listed as the last three oils on Table I. The first two of these oils have somewhat lower maleic anhydride content compared to their Zymol while the third has about the same level of maleic content. These oils were used as 100% of the vehicle in 301-892 and tested for drying under Constant Temperature Room conditions only. These oils showed no advantage over the above blends with standard maleic treated oils, so tests under other conditions of temperature and humidity were not made.

Reference:

Details of compositions and drying tests are located in Notebook #3843.

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ATTACH:

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TABLE I
EXPERIMENTAL DESIGN

	2 Poise Vehicle		5 Poise Vehicle	
	S-T Bodied Oil	Z-2 Bodied Oil	S-T Bodied Oil	Z-2 Bodied Oil
Bodied	P-301-U-21147 83.2% solids vol. G. Wt. 13.60	P-301-U-21441 82.8% solids vol. G. Wt. 13.60	P-301-U-21445 83.2% solids vol. G. wt. 13.70	P-301-U-21449 74.0% solids vol. G. Wt. 12.90
L. O.	H-19/VO-8000 35.0/65.0	H-19/VO-5372 60.0/40.0	100% VO-8000	H-19/VO-5372 40.0/60.0
Maleic Treated	P-301-U-21445 83.2% solids vol. G. Wt. 13.70	P-301-U-21443 79.0% solids vol. G. Wt. 13.40	P-301-U-21453 75.0% solids vol. G. Wt. 13.10	P-301-U-21451 71.5% solids vol. G. Wt. 71.50
L. O.	H-19/Trimol V-14 40.0/60.0	H-19/Zymol 60.0/40.0	100% Trimol V-14	H-19/Zymol 40.0/60.0

	Acid No.	G-H Vis.	G-H Color	Gal. Wt.
H-19 Alkali Refined Linseed Oil	1.5	A-1	6	7.71
VO-8000 Bodied Linseed Oil	7±?	S	4	7.87
VO-5372 Vacuum Bodied Linseed Oil	3	Z-2	2.5	8.00
DS-23147 Trimol V-14, Maleic Treated L.O.	5	U	6-8	8.08
DS-23148 Zymol, Maleic Treated L.O.	8.5	Z-1+1/3	6	8.13
DS-23549 ADM Lot 2596-1 Maleic Treated L.O.	6.0	G-H	4-5	7.88
DS-23550 ADM Lot 2596-2 " " "	7.5	H-	9-10	7.90
DS-23551 ADM Lot 2228-11 " " "	8.7	K	4-5	7.82

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TABLE II
MAIN VARIABLE

DRYING TIME HRS.

	Tack Free Time			Firm Time		
	78°F. 50% R.H.	43°F. 80% R.H.	100°F. 80% R.H.	78°F. 50% R.H.	43°F. 80% R.H.	100°F. 80% R.H.
Untreated L.O.	13.04	40.0	10.1	13.9	50.3	6.5
Vs.						
Maleic Treated L.O.	6.8	23.0	3.6	15.9	46.8	7.2
"S" Body Oil(VO-8000 (Trimol V-14	10.6	32.0	8.2	15.3	45.3	7.3
VS.						
"Z-2" Body Oil(VO-5372 (Zymol)	9.2	32.0	5.5	14.5	51.8	6.4
2 Poise Vehicle	10.3	34.0	8.1	15.5	51.5	6.9
VS.						
5 Poise Vehicle	9.5	30.0	5.6	14.3	45.7	6.7
Standard Deviation	0.920	5.38	3.00	1.58	11.85	0.76
Significant Difference between means of 16 determinations each	0.65	3.78	2.12	1.11	8.35	0.54

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TABLE III
INTERACTION OF TYPE OF OIL WITH BODIED OIL VISCOSITY

DRYING TIME HRS.

		Tack Free Time			Firm Time		
	N	78°F. 50% R.H.	43°F. 80% R.H.	100°F. 80% R.H.	78°F. 50% R.H.	43°F. 80% R.H.	100°F. 80% R.H.
"S" Body Oil	16	10.6	31.8	8.2	15.3	45.0	7.3
"Z-2" Body Oil	16	9.1	32.0	5.5	14.5	51.8	5.9
VO-8000	8	14.5	41.5	12.8	14.9	49.5	7.0
VO-5372	8	11.3	39.5	7.5	12.8	50.5	5.9
Trimol V-14	8	6.7	22.0	3.6	15.7	40.5	7.6
Zymol	8	6.9	24.5	3.5	16.1	53.0	6.7
Significant Difference	16 8	0.65 0.92	3.78 5.35	2.12 2.99	1.11 1.57	8.35 11.84	0.54 0.76

N = Number of determinations in mean value.