

ALLIED RESEARCH LABORATORIES

Report of Investigations
For the Month of April, 1946

M. VAN LOO

#162 - Studies in Flat Wall Paint Formulation

Flat Wall Paints

Work was continued during the month to improve the brushing properties and reduce the after-bodying tendencies of the lithopone formulation for Flat-Tone White. In addition to certain difficulties experienced with the vehicle CV 7014, high initial bodies and definite after-body pointed toward reactivity in the 461 L lithopone used. Albalith #14 produces a much lower initial body than 461 L and shows only a moderate increase in body when used in the lithopone formulation. The pigment division has been informed of our results and an investigation is under way to determine the cause for the increased reactivity of our 461 L. Work will be continued on this problem.

Samples of the new Paintercraft Paste Paint - OJ 810 J and Reducing Varnish CVR 452-2 have been sent to Cleveland for test. The paste has been formulated so that it can be reduced with thinner or varnish to produce a satisfactory flat, semi-gloss or gloss wall paint as well as an enamel undercoater and wall primer and sealer.

Samples of #100 and #140 Soltrols were submitted by the Phillips Petroleum Company for our inspection. These materials represent the best development of low odor thinners that have been tested in Cleveland. The samples were compared with Shell's 8296 Special Mineral Spirits and Regular Base #1, which represent Shell's deodorized types of thinners, in the Flat-Tone White formula of 8-28-45. The special flats were checked for odor by making laboratory paint-outs and by painting rooms with each material.

The Phillips material was rated very good with respect to lack of odor but considerable difficulty was encountered in the application of the flat wall paint made with this material, due to its low solvent power (Kauri Butanol number 25.6). The flat wall paint made with the Phillips thinner was very sticky in brushing. When the flat was reduced with 5 to 10% more of Phillips Soltrol 140, a definite break was evident.

The thinners obtained from the Shell Oil Company were rated second with respect to odor but were much more typical of our regular (348) and (3020) thinner combination for brushing and body characteristics. The slightly higher Kauri-Butanol values of the Shell thinners appear to be quite essential when used with highly polymerized oils and varnishes common to flat wall paint liquids. The brushing properties were not quite equal to standard. Therefore some reformulation will be necessary to improve the brushing if deodorized types of thinners are to be used.

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The following break points were run on the varnishes used in making the flat wall paints referred to above:

<u>Varnish Used</u>	<u>Thinner Content of Varnish</u>	<u>Varnish Reduced With</u>	<u>Break Point</u>
(3880)E - CVR 487	Phillips Soltrol 140	Phillips Soltrol 140	50%
Regular (3880)E - CVR 372	(348) and (3020)	Phillips Soltrol 140	300%
(3880)E - CVR 373	Shell's 8230 Regular Base #1 8296 Sp. M. S.	Shell's 8296 Special M. S.	250%
Regular (3880)E - CVR 372	(348) and (3020)	Shell's 8296 Special M. S.	No break at 5000%
Regular (3880)E - CVR 372	(348) and (3020)	(348)	No break at 5000%

Enamels

Storage samples of Enameloid White - Rex 710 made with a variety of varnishes were examined for seeding. Most of the samples had seeded badly over a period of two months, with (4100) and (2945)EA showing little or no seeding. No correlation could be observed between the composition of the varnishes and the extent of seeding. These enamels were all made with 2229 dry and 547 dry. Samples made with Acto 450 showed the same amount of seeding as those made without this agent.

A study was also made of the effect of the pigment on the seeding of Rex 710. These enamels were all made with (3109) and 547 dry, and have been in storage about a month. All showed very little seeding when fresh.

<u>Pigment</u>	<u>Seeding</u> (1 - very slight) (5 - moderate)
Anatase	
1403 Titanox A	5
1901 " A LO	5
1901 RT " A 168 LO	6
2030 " AA	3
2147 " A 24	5

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<u>Pigment</u>	<u>Seeding</u> (1 - very slight) (5 - moderate)
Rutile	
2173 Ti Pure R 200	5
2174 " R 610	3
2228 " R 110	1
2229 " R 510	3
2273 Unitane OR 250	6

We have examined a series of Rex 710 samples containing various basic pigments which were introduced to check the drier absorption.

<u>Formula</u>	<u>Set-to-touch Time</u>	
	<u>Fresh</u>	<u>2 Months</u>
Regular	1 hr. 50 min.	2 hr. 23 min.
10 lbs. 108 dry	2 " 5 "	2 " 50 "
20 lbs. 18 dry	1 " 45 "	1 " 48 "
6 lbs. 1128 dry	1 " 10 "	1 " 15 "

These batches have all seeded slightly and will be repeated using Calcium Stearate 1826 for Aluminum Stearate 547 dry. Over night through dry was hard in all cases.

A sample of Lead Naphthenate RB 1127 B submitted by the Resin Research Laboratory has been compared with (4230) in the Enameloid White formula for drying characteristics after two months of storage. It was also compared with (4230) regular lead naphthenate drier - outside purchase, for drying and stability in linseed oil, and in conjunction with (4231) manganese naphthenate and (4230) cobalt naphthenate driers. Two batches of Enameloid White - Rex 710 were made, one with the regular naphthenates and one with CRB 1127 B replacing (4230) at equal metal content.

The initial drying and stability tests were referred to in the monthly report for February, 1946.

Drying Time on Enameloid White
After 2 Months Storage

	<u>Driers</u>	<u>Set-to-touch Time</u>	
		<u>When Fresh</u>	<u>After 2 Mo.</u>
Batch OJ 701 J	Using regular driers (4230), (4231), (4232).	2 hr. 5 min.	2 hr. 30 min.
Batch OJ 703 J	CRB 1127 B (4231), (4232)	1 hr. 30 min.	2 hr. 15 min.

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Samples of Ferro Lead, Manganese and Cobalt obtained from the Ferro Drier and Chemical Company were compared with regular (4090), (4091) and (4092) obtained from Advance Solvents and Chemical Corporation. The driers were checked for color characteristics as well as drying properties in the Enameloid White formula of 9-19-45 and the SWP Gloss White formula of 9-14-45. In general, no noticeable difference in color or drying properties was evident between the Ferro or Advance driers except for a slightly longer tack period for the Ferro drier in the case of the Enameloid White.

The drying times are reported below:

	Driers Under Test	Drying Characteristics		
		Set-to-touch	Over Night	Color
SWP Gloss White Batch OJ 853 J	(543) - (4230) made from Advance (4090)	5 hr. 10 min.	Good	
SWP Gloss White Batch OJ 854 J	(4231) - (4232) Advance Driers	5 hr. 5 min.	Good	Colors appear equal.
SWP Gloss White Batch OJ 855 J	Using Ferro Drier, metal content as above.	5 hr. 15 min.	Good	
Enameloid White Batch OJ 858 J	(4230, (4231), (4232) - Advance driers.	1 hr. 5 min.	Good	Colors appear equal.
Enameloid White Batch OJ 859 J	Using Ferro Drier, metal content as above.	1 hr. 30 min.	Good	

Semi-Lustre

The Varnish Research Division suggested CV 7013 (20 gallon tall oil P.E. maleic-resin-linseed varnish) as a vehicle for Semi-Lustre White. A number of batches have been made which have been too thin in body or too low in viscosity. However, it now appears that by increasing the (48) and decreasing the inert content we may be able to obtain a satisfactory sheen and body for this rex. Work will be continued on this problem.

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#177 - Pigment Studies

Work continues on the study of white pigment opacity factors.

Paint Type I - House Paint

In this first group of tests it should be recalled that "House Paints" were made using in each test a single opacity pigment plus extender. The test paints were formulated to 18,000 Holley units. The p.v.c. was held at 36% by the addition of 20 F magnesium silicate.

From the above study opacity values were obtained for each opaque pigment tested, in terms of square feet per pound at given contrast ratios. If the values obtained are accurate and practical it should be possible to substitute various opaque pigments for each other without shifting the actual opacity. A test using Rex 471 SWP Gloss White was run to check this point. The standard paint was identified as RB 1428. Two paints were then formulated to give equal theoretical hiding, using (a) the Holley index (Paint RB 1429) and (b) the Allied index of opacity in square feet per pound at a contrast ratio of 93%. These paints used Zinc Oxide XX-503 2059 dry, basic carbonate white lead 18 dry, and zinc sulfide 1538 dry as the opaque pigments. A second pair of check paints (RB 1431 and RB 1432) were made in the same manner, pigmenting with basic sulfate white lead 9 dry, 2059 dry, and Titanox RC HT 2132 dry. In this pair it was found that based on Allied units it was not possible to pigment RB 1432 to equal hiding, due to the 36% p.v.c. limitation, holding lead and zinc in balance. Therefore, by calculation RB 1432 is approximately 6% deficient in hiding.

Test data:

Paint No.	Pigmentation	Holley	Theoretical Opacity		Sq.Ft./Gal.			
			Allied at 93% CR	Sq.ft./gal.	91% CR	93% CR	95% CR	97% CR
RB 1428	2173 1403, 412, 18	17,995		577.3	-	500	430	377
RB 1429	1538, 2059, 18	17,990		452	534	454	398	337
RB 1430	1538, 2059, 18	21,640		577.5	577	488	419	360
RB 1431	2132, 2059, 9	17,990		384	488	423	372	300
RB 1432	2132, 2059, 9	24,690		543	560	470	410	-

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Comparing paints 1428, 1429 and 1431 as against 1428, 1430 and 1432 it is apparent that the Allied values have made it possible to formulate paints with hiding substantially equal to the standard whereas the Holley index paints are considerably deficient in hiding. On the other hand, further refinement of the index is indicated by the rather wide variation between the theoretical opacity figure and that actually developed, e.g., RB 1428, theoretical = 577 sq.ft./gal. at 93% CR, whereas the actual hiding is 500 sq.ft./gal. at 93% CR.

Work on the extender pigment relationships will be continued on house paint type opacities.

Paint Type IV - Interior Gloss Enamels

In this series of tests enamels were made using single opacity pigments up to 18,000 Holley units per 100 gallons so long as the total pigment volume did not exceed 14 gallons. Vehicle relationships were held constant, i.e., the vehicle solids were maintained at 38 gallons per 100 gallon formula. In every case the total yield was held at 104 gallons by adjustment with (348). (3109) was used as the vehicle solids throughout.

Type IV Opacity Values

		<u>Opacity Sq.Ft./Lb.</u>					
<u>Dry No.</u>		<u>% Br.</u>	<u>91% CR</u>	<u>93% CR</u>	<u>95% CR</u>	<u>97% CR</u>	<u>98% CR</u>
108	XX 592 Zinc Oxide	82.7	46.9	40.8	(34.8)	(28.4)	(25.3)
461 L	Lithopone	84.1	59.4	50.9	42.2	(33.1)	(29.0)
1271	Anatase Titanium Calc.	85.0	102.6	89.9	76.8	(64.1)	57.8
1403	TiO ₂ Anatase	88.4	209.1	178.2	147.0	115.4	100.3
1538	Zinc Sulfide	86.7	137.7	118.9	99.8	(80.7)	(71.1)
1897	Ti Bar HH	85.6	95.4	82.8	70.6	58.0	51.7
1901	TiO ₂ Anatase LO	88.7	204.5	176.8	148.4	120.2	106.0
2030 T	Titanox AA	88.7	190.9	165.2	139.3	113.0	100.3
2132	Titanium Calcium RCHT	85.6	116.1	100.2	84.4	68.3	60.4
2229	TiO ₂ Rutile	89.9	319.4	266.9	213.2	160.3	133.8

These values have not been re-checked but do compare logically with those under Type I in previous Investigation Reports.

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Lithopone Texture Test

For this study New Jersey, du Pont and Coffeyville were asked to ship us representative bags of each of their various grades, indicating which ones they consider enamel grade. These samples were received - two from du Pont, three from New Jersey, and four from Coffeyville.

An initial texture evaluation was made using the Hoover muller, 100 rubs, minimum weight. Following this, paint batches were made on the Rex 711 formula, card 15, alternate E, with the alternate pigmentation which calls for 360 pounds of lithopone and 105 pounds Ti Pure R 510. In the mixing operation paste consistencies were adjusted to a somewhat similar range by adjusting the quantity of varnish used. Stomper measurements were made on the mill pastes. All of the batches were then milled over a 13" Lehmann 3-roll mill at a fixed setting.

A tabulation of the data is attached. In considering the milling trials it should be borne in mind that the tests were run in consecutive order over the mill at a fixed setting. The texture of the lithopone is evidenced by the fineness obtained as well as the mill production rate.

It is noted that Albaliths 14 and 806 are superior to the other lithopones on test. Ponolith EL 133 is similar except for a lower mill production rate. None of the Coffeyville lithopones tested can be designated as enamel grade under these conditions of test.

See chart on next page.

Hoover Miller Texture	Gallons Varnish	Consistency	Rate	Enameloid Test		Grind		Viscosity		Fine-Fresh - #3 S-W Cup		4-Day Viscosity		Finished Paint		Wt./Gal. T A
				Mix												

0 2560	5	26-1/2	107"/100 rev.	4.50 gals./hr.	6	19"	20"	10.85	11.00	"	5-1/2	18.4"	20.2"	"	10.98	"
K 4496	4	27-1/2	"	5.03	"	5-1/2	21.2"	21.0"	10.92	"	5	21.2"	20.4"	"	10.90	"
Lot		4-3/4	50-1/2	5.08	"	5-1/4	17.0"	20.4"	10.90	"	5	21.2"	20.4"	"	10.92	"
4498		4-1/2	28-1/2	5.25	"	5	21.2"	21.0"	10.92	"	5	21.2"	20.4"	"	10.90	"
		4-3/4	50-1/2	5.08	"	5-1/4	17.0"	20.4"	10.90	"	5	21.2"	20.4"	"	10.92	"
		4-1/4	28-1/2	4.79	"	5	25.0"	25.0"	10.88	"	5	25.0"	25.0"	"	10.88	"
1 *		5-3/4	26-1/2	6.76	"	6	15.0"	20.0"	10.93	"	6	15.0"	20.0"	"	10.93	"
06 *	5	26-1/2	"	6.08	"	5-3/4	16.0"	19.0"	10.75	"	5-3/4	16.0"	19.0"	"	10.75	"
112	5-1/4	26-1/2	"	4.86	"	5-3/4	17.0"	20.0"	10.83	"	5-3/4	17.0"	20.0"	"	10.83	"
133	5-1/2	28-1/2	"	5.04	"	5-3/4	17.0"	20.2"	10.77	"	5-3/4	17.0"	20.2"	"	10.77	"
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the enamel grade lithopones.

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TiO₂ Chalking

Mr. L. Melscheimer, of the United Color Company, reported that they use an ultraviolet lamp made by Hanovia Lamp Company for a quick estimation of chalking rates of titanium oxides, as dispersed in refrigerator finishes. We have simulated his tests using a G.E. Uviarc lamp without arriving at any classification between three anatase samples and two rutile titanium pigment samples.

#182 - Study of Improved Mixing and Grinding Practices

Nuomix has been found to have little effect on the mixing of Rex 42558 - Kem Lustral Medium Yellow, Rex 67558 - Lustral 67 Medium Yellow, or Rex 710 - Enameloid White.

A factory test of Nuade X-401 and Acto 450 was made on the alternate Rex 710 formula, using 2147 dry and (4103). 300 gallon batches were ground on a 5-roll Lehmann mill.

	#1	#2	#3
Paste	290 pounds 2147	290 pounds 2147	290 pounds 2147
Formula	5 " 1826	5 " 1826	5 " 1826
	17 gals. (4103)	5 " Acto 450	5 " Nuade
	4 " (4230)	22 gals. (4103)	22 gals. (4103)
Gals./Hr.	78 gallons	86 gallons	112 gallons
Grind	6 H	6 H	6 H

Batch #1 is the regular formula as used at Kensington and ground at the standard rate of 30 pounds paste per five minutes. The Acto 450 in batch #2 was added at the beginning of the mix to take advantage of its wetting action. The Nuade in batch #3 was added at the end of the mix in order to preserve its tacky effect. All batches required about 20 minutes to mix and were near the capacity of the paste mixer as far as power and consistency were concerned. All pastes were soft on the mill apron and reduced easily.

300 gallon factory batches were also run on the alternate Rex 701 formula using 2147 and (4103).

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	#1	#2	#3
Paste	20 gallons (4103)	20 gallons (4103)	20 gallons (4103)
Vehicle	1 " (4230)	1 " Acto 450	1 " (348)
			6 lbs. Nunde
Gals./Hr.	58 gallons	95 gallons	76 gallons
Grind	6 H	6 H	5-3/4 H

The rate on the regular formula is lower than average. In a second test, run on a slightly faster mill, 100 gals./hr. was obtained on the regular, 180 gals./hr. on the Acto batch, and 153 gallons on the Nunde batch. However, the grind on all three of these batches was below standard.

At present we feel that with the present usage of 2147 dry Nunde is the most effective in Rex 710, and Acto 450 the most effective in Rex 701.

Attempts were made to correct the flooding of Porch and Floor - Rex 157. Additions of various agents to the finished paint had little effect. Acto 450 apparently has little wetting action on lamp black - 104 dry. When 104 was ground separately with Acto 450 there was only a slight decrease in the flooding.

#163 - One Coat House Paint

In preparation for the 1946 house painting program, we have arranged with the factory to make two 50 gallon batches of One Coat House Paint - CH 4697 and one 50 gallon batch of SWP Gloss White based on the latest revision.

The two 50 gallon batches of CH 4697 will be similar in formulation except for the type of TiO_2 . Formula 828 J will be based on all 1403 dry and formula 829 J on one-half 1403 and one-half 2030 dry. Both formulas have a p.v.c. of 34.2% and ZnO content of 29.5%.

In connection with our house painting program, 8 gallons of CH 4697 - C 1495 were shipped to Cleveland for test on Mr. L. W. Dasbach's house.