RC-103 File

cc: Dr. F. Robinson, Lab.
Mr. R. B. Davis, Lab.

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RC-395

Introduction

Pentaerythritol resins were found to have good air drying properties and excellent blister resistance as compared to glycerol resins. It is the purpose of this memorandum to record the results of the study which led to the selection of RC-395, 51.2% Linseed - P.E. Resin.

Summary and Conclusions

1. The shorter oil resins (less than 50% Oil) do not dry satisfactorily. Longer oil resins dry quite well with some sacrifice to hardness as the oil length increases.

2. Improved air-dry characteristics result with increased P.E. content. A 3/1 P.E/glycerol ratio appears to be the minimum P.E. content desirable. A 100% P.E. resin at the optimum oil length would be too high in viscosity and produce poor enamel viscosity stability.

3. Since some glycerol is desirable, resins made from the oil result in a satisfactory P.E./glycerol ratio.

4. Unlike our experience with glycerol resins, soya P.E. Resins produce better air drying characteristics and better overnight hardness than Linseed P.E. Resins of comparable composition.

5. While Soya P.E. Resins are better for air dry enamels, the Linseed P.E. Resins are better for baking products as judged by gloss and hardness measurements.

6. An evaluation of many resins has shown that an oil length of about 50% is optimum.

7. The solvent composition used to cut the resin has a considerable effect on the build and apparent gloss of the enamels.

8. Enamels containing P.E. Resins improve in drying characteristics on aging. The period for reaching equilibrium varies from 48 hours to 14 or more days.

9. Attempts to improve the air drying characteristics and hardness of P.E. Resins resulted in the following observations:

a. Modifying gums speed up the initial set up but slow down the ultimate dry.

b. Use of Cellosolve Acetate in the mill base produces no significant improvement.

c. Increases in drier content such as increase in manganese drier up to 100% appears to be of no value except very slight improvement in overnight hardness

d. Activated tetralin produces no significant improvements.

e. DPG reduces the time to Tack Free but at a slight sacrifice in gloss.

f. Small amounts of melamine (3 to 5% on the vehicle) produce a very slight improvement in Tack Free time but at a sacrifice in gloss and overnight hardness.

g. Treating P.E. resin with Benzoyl peroxide improves the initial Tack Free time but at a considerable sacrifice in gloss.

Discussion

A rather wide range of P.E. resin compositions were evaluated. Those having less than 50% oil showed inferior air drying qualities whereas those P.E. resins having 50% or more oil produced enamels drying within eight hours. The use of longer oil resins in the range of 55 to 65% oil resulted in some sacrifice in initial and overnight hardness.

In studying the resin compositions, it was found that 100% P.E. resins are relatively high in viscosity and produce enamels with questionable viscosity stability. A ratio of about 3/1 P.E./glycerol appears to give the best balance of properties. At the optimum oil length, a resin made from the oil results in a satisfactory P.E./glycerol ratio.

Contrary to our experience with glycerol alkyds, Soya P.E. Resins produce enamels with better air drying characteristics and overnight hardness than Linseed P.E. Resins. This observation has been generally reported by other investigators so that it can be accepted as an inherent property of P.E. Resins especially since the study covers a wide range of resin composition and products.

While Soya P.E. Resins show an unusual air drying behavior, they act similar to glycerol alkyds in so far as gloss and hardness are concerned when used in baking products. In 94 Line Baking "DULUX", the Linseed P.E. Resins give better hardness and gloss than the Soya P.E. Resins.

On basis of these findings, two P.E. Resins were recommended. Both containing 51.2% Oil, 31 to 35 acid number and Y to Z-1 viscosity. The only difference being that the resin to be

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used in air dry enamels must contain soya oil, whereas the resin for use in baking products contains linseed oil. When the resins are used in the recommended lines, they are generally comparable to RC-103 in all properties. The soya resin did not get beyond the experimental stage due to the bad shortage of soya oil. However, the experimental code PRC-P-36968 was assigned to this resin. In the meantime, glycerol also became short hence the use of P.E. assumed added importance. Although the linseed P.E. resin produced air dry enamels which were on the lower end of the tolerance limits for RC-103, expediency predicated its use as widely as possible. The linseed resin was given the permanent code RC-395.

A study of the air dry film characteristics revealed unusual surface patterns and considerable gloss variations which appeared to be influenced by the substrate. Further study showed that solvent variations in the resin solution could minimize the effect of the substrate. It was found that solvents such as H-287 Mineral Spirits, and H-202, High Solvency Petroleum Naptha 135-185°, were somewhat slow in evaporation rate. This resulted in an excessive amount of flow which caused the film to assume a detailed contour of the substrate which was reflected in the surface as apparent poor build and low gloss. The use of more rapid evaporating solvents such as H-257, VM and P Naphtha, and H-15, Xylene, eliminated the surface phenomena hence the films were smooth and exhibited good gloss. The baking resin (LO-P.E. Resin) did not show this sensitivity to solvent composition.

There were some indications that air dry enamels containing P.E. resins improved in dry on aging. Other investigators have made similar observations. Apparently P.E enamels take 48 hours to 14 or more days to come to equilibrium. This characteristic indicates the possibility that since P.E. enamels are slow to come to equilibrium, they will be slower to show loss of air drying potential on aging. Limited available data would seem to confirm this point.

A number of attempts were made to improve the initial air drying characteristics and overnight hardness of enamels containing P.E. resins. Several agents such as benzoyl peroxide, activated tetralin and cellosolve acetate all of which contained available oxygen had a limited effect on the drying time. Where there was an improvement, there was a proportionate sacrifice in gloss. The use of increased amount of drier or use of DPG resulted in a slight improvement in overnight hardness and initial dry, but again a slight sacrifice in gloss was obtained. The addition of varying amounts of modifying resins or gums such as melamine and Pentalyn A did not produce any satisfactory results. Melamine (3 to 5% based on the vehicle) improved the tack-free time but at sacrifice in gloss and overnight hardness. Similiar amounts of gums improved the initial set up time but prolonged the ultimate dry. Adding enough gum to reduce the oil length of the vehicle to 37.5% resulted in a better balance of properties, but the RC-395 and PRC-P-36968 were definitely more satisfactory.

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Plant Alignment

The first two batches of RC-395 made in the Toledo Plant were tested by the Philadelphia Laboratory and found to be comparable to the Philadelphia Plant production in working properties. This established a satisfactory alignment by the Toledo Plant.

Stability

A series of enamels including single pigment and blended colors have been examined after eight weeks and found to have satisfactory viscosity and settling stability. The RC-395 (P.E. Resin) containing enamels were comparable to the corresponding control enamels made with RC-103.

References

Note books 2939 and 2996
Exposure Series #9013.

PHILADELPHIA LABORATORY

W. P. Colio

W. P. COLIO

WPC/mhl

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