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LAC-LINSEED OIL VARNISHES

PART III — LAC-LINSEED OIL-LIME

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Lac-linseed Oil Varnishes Part III—Lac-linseed Oil-lime

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THE possibility of preparing lac-linseed oil varnishes using lead oxide and glycerine respectively as incorporating agents has been studied and reported in two previous papers[1,2]. It has been pointed out that about 15 per cent of litharge on the weight of lac is necessary to ensure complete dissolution of lac in the oil. It has also been pointed out that whereas baked films of the lac-linseed oil-lead oxide compositions are quite smooth and homogeneous, air-dried films are not so smooth and present an uneven surface. This was interpreted as being possibly due to the large amount of the " drying " metal necessarily present in the composition. It was hoped, therefore, that if the lead oxide could be partially or totally replaced by the oxide of another metal of the non-drying or at least less drying type, the defect might be eliminated. With this end in view, lime (calcium hydroxide) was investigated as a possible substitute for lead oxide.

The possibility of using lime as an incorporating agent for the preparation of lac-linseed oil combinations has been reported by Aldis[3] and by Fain[4]. The former, beyond reporting one particular proportion, does not appear to have studied the problem in all its aspects such as the film properties of the resulting compositions, while the latter has used the product only in conjunction with other synthetic resins. The problem has, therefore, been investigated anew in detail. As stated already, about 15 per cent of litharge on the weight of lac is necessary to bring about proper incorporation of lac in linseed oil. This, in terms of calcium hydroxide, will be equivalent to about 5 per cent on the weight of lac. Thus, to dissolve 50 gm. of lac in 100 gm. linseed oil, 7·5 gm. of litharge or its equivalent 2·5 gm. of calcium hydroxide are required, which was actually found to be the case. For the proportions given above, the temperature of incorporation is 240°-250°C. in the case of litharge, but when lime is used, a higher temperature (280°-290°C.) is necessary. If less than 2·5 gm. of lime are used, a portion of the lac is left behind in granular form. Increasing the amount of lime lowers the temperature of incorporation but not to the same extent as in the case of litharge. Again, when 100 parts of lac are dissolved in 100 parts of linseed oil using 15 parts litharge, the temperature of incorporation is 220°C. But with these same proportions of lac and oil and the equivalent quantity of lime (i.e. 5 parts) in place of litharge, the product obtained as a result of reaction at the same temperature, namely 220°C., does not become clear immediately as in the case of litharge but only after 20-25 min. If, however, the temperature is raised to 290°C. the product becomes clear immediately. From the above data it may be inferred that as an incorporating agent lime is not so efficient as litharge.

It was observed in the course of our experiments that precipitated calcium linoleate may be used in place of lime for incorporating lac in linseed oil (cf. lead linoleate), and it was of interest to investigate whether any other soap of calcium would serve the same purpose or it should only be the linoleate. Accordingly, calcium stearate was tried, and was found to effect the dissolution quite well. Other metallic soaps, e.g. the stearates of zinc, aluminium and potassium as well as linoleates of manganese, sodium and potassium were tried, and it was found that all of them were more or less similar in bringing about the compatibility.

Among other compounds tried were sodium acetate and sodium oleate which, however, did not induce solubility, though the " life " of lac in the oil was prolonged considerably. The chemical reactions involved in these incorporations are being examined and will be reported later.

Properties of Lac-linseed Oil-lime Compositions — Though lime is not quite so efficient as litharge as incorporating agent, the

products obtained by using either are very similar. Thus, lac-linseed oil-lime compositions are all soluble in the usual varnish solvents like white spirit or turpentine, and require, in addition, small proportions of alcohol to eliminate false body when the proportion of lac to oil exceeds 70-75 per cent. These varnishes are naturally slow-drying owing to the absence of lead, but when suitable driers are incorporated, the drying property can be considerably improved. The air-dried films are smooth and homogeneous. Even in the absence of a drier, the films dry when baked at 90°-95°C. in the course of 3-4 hr. and in shorter time at higher temperatures. The varnishes are non-skinning and the baked films are considerably more resistant to the effect of heat than the lead oxide compositions with regard to their ageing characteristics.

Lac-linseed Oil-litharge-lime — It was noted that though the lac-linseed oil-lime compositions could be made to air-dry in less than 24 hr. by using excess of lead and cobalt driers, the product could not be made to "surface-dry" in less than 6 hr. as required in some of the specifications. It was hoped that by substituting a portion of the lime with litharge, a composition might be obtained which would surface-dry in less than 6 hr. and retain all the other properties unaffected. Such a product could actually be made by using 3 parts of litharge and 1·5 parts of lime for incorporating 50 parts of lac in 100 parts of linseed oil.

A varnish based on the combined use of lime and litharge in the above proportions may be made under the usual conditions at a temperature of 270°-280°C. (as described for litharge). With the addition of 0·04 per cent cobalt in this varnish the surface-drying time is less than 6 hr. and the hard-drying time less than 18 hr. The resulting film in this case also was smooth. The acid value of the product is low and the colour satisfactory. Incidentally, this composition without the cobalt drier was found to be superior for use as a clear baking, insulating varnish to the one using only lime as the incorporating agent, as the drying was faster. This was also perfectly non-skinning in spite of the presence of lead. A sample of "empire cloth" prepared on a 5-mil cotton support by the application of 4 coats of this varnish (by dipping), each coat being baked in a tower at 125°C. for 1 hr. gave a product with the following characteristics :

Thickness	10 mil
B.D.V. at laboratory temperature after drying in a vacuum desiccator for 24 hr.	980 volts/mil
B.D.V. at 90°C.	700-750 volts/mil

Summary

1. Lac can be incorporated in linseed oil into which 5 per cent of lime on the weight of lac has been dissolved.
2. In place of lime the equivalent quantity of precipitated calcium linoleate or stearate may be used.
3. Other metallic soaps like zinc stearate, potassium linoleate, etc., also assist in the incorporation of lac in linseed oil.
4. Lime may be partially replaced by litharge to improve the drying characteristics of the composition.
5. The products obtained in either case are practically similar to those obtained using litharge alone except for the drying characteristics. They have, however, better ageing properties.
6. Cobalt or manganese together with lead may be used to improve the drying properties.

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REFERENCES

1. Sankaranarayanan, Y. : *J. Sci. Ind. Res.*, 1946, **6B**, 117.
2. Idem., ibid., 1947, **7B**, 117.
3. Aldis : *Paint Manufacture*, 1933, 105.
4. Fain, Jacob M. : *U.S. Patent* 2,368,126 (1945); *C.A.*, 1945, **39**, 3948.

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