Water thinned shellac finish for wooden furniture

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A SATISFACTORY *composition of water thinned shellac polish for wooden furniture has been developed by modifying aqueous (ammoniated) lac varnish with 20 per cent, Urea resin (partially methylated) and 10 per cent maleic resin on the weight of lac. This Varnish on application by French polishing produces a non-tacky, hard and blossy finish on wood. Addition of 15 per cent alcohol to the varnish further improves the levelling characteristics and gloss. In performance this composition compares favourably with conventional spirit based French polish except that its gloss is slightly inferior and its drying time a little longer.*

ONE of the major uses for lac in this country is for the French polishing of the furniture. As a wood finishing material, it not only decorates the surface but also protects it from the various deteriorating effects.

Shellac finishes are particularly noted for their toughness, transparency and brilliance. This natural resin has been enjoying a monopoly in wood finishing industry but because of certain shortcomings such as its poor resistance to heat, water and chemicals, it could not keep pace with the rapidly developing synthetic resins and had to yield ground in their favour.

As a result of systematic investigations, a semi-synthetic shellac lacquer was developed at this Institute[1] which compared favourably with synthetic wood lacquers in performance. This development had given great hope to shellac in wood finishing industry but with the sudden acute shortage of alcohol, at the moment, in the country the position which appeared to improve again became quite adverse.

In view of the present state of affairs further investigations were made to develop a French polish with water as the principal if not the sole solvent.

Shellac, as is well known, dissolves in water in the presence of volatile bases or other alkaline materials. The resulting varnishes produce films which show much inferior performance in respect of adhesion, water resistance and gloss and as such do not serve satisfactorily for wood finishing.

In the present study, efforts have made to develop a satisfactory water thinned shellac varnish which may produce, on air drying, hard, adherent and glossy finish on wood with adequate resistance to heat, water and chemicals. With a view to achieve this object, modification of aqueous lac was studied with urea and maleic resins.

Urea resins are amongst the most efficient curing resins. It has been found by a systematic study[2] that in alcoholic solution this resin reacts with COOH and OH groups of lac to produce a cross-linked molecule with much improved performance.

Maleic resins, on the other hand, are noted for their excellent gloss and high melting point. It was, therefore, thought that by suitable modification, the desirable properties of the two resins may be superimposed on lac.

EXPERIMENTAL

Preparation of aqueous shellac varnishes

Aqueous shellac varnishes (20 per cent solids) were prepared by dissolving dewaxed lac in water containing adequate quantity of alkali at 70°C under efficient stirring. The exact quantity of alkali and water used for preparing different varnishes are given in Table I. The varnishes so prepared were filtered over cotton to remove any suspended impurities.

Maleic resin varnish

Maleic resins are the condensation products of rosin and maleic anhydride. These resins are noted for their excellent gloss and high melting point and due to their high acid value they dissolve freely in alkali. Maleic resin (Alresat 4000c) obtained from Chowgule and Company) was powdered to 50 mesh and then dissolved in 300 ml warm water containing 20 gm. ammonia (sp. gr. 0.88) under stirring. A clear solution was obtained which was filtered through No. 1 filter paper.

Urea resin

Partially methylated urea resin is one which dissolves freely in water and acts as an efficient curing resin in aqueous medium.

This resin was prepared by refluxing the following ingredients in a three necked flask fitted with a reflux condenser, stirrer and thermometer for 2 hours.

Urea	—	15 g.
Formalin	—	80 g.
Methanol	—	110 ml.

At the end of the reaction period, water and excess of methanol was recovered under vacuum. A syrupy liquid was obtained in the flask which could be diluted freely with water.

RESULTS AND DISCUSSIONS

Shellac varnishes in different alkalies

Aqueous dewaxed shellac varnishes prepared in different alkalies were invariably clear and transparent. Film properties of these were studied with a view to find out as to which alkali gives the best film performance. The data are brought out in Table I. It may be seen that all the varnishes produced hard, smooth and glossy films but with poor adhesion on metals and glass. In some cases films prepared from ammoniated shellac varnishes flaked off from the metal on air drying.

As regards scratch hardness and flexibility all the varnishes showed poor performance and behaved almost alike except the varnish composition containing excess of ammonia.

In regard to heat and water re-resistance, the varnishes prepared from ammonia showed better performance than the varnishes prepared from other alkalies.

Varnishes 1 and 2 showed the best performance and behaved almost alike but since in varnish 1 lesser amount of ammonia was used, it was selected for further studies.

Modification with urea resin

Shellac varnish containing 16 per cent of ammonia on the weight of lac was found to serve the best in the previous experiments. This varnish was modified with different percentages of urea resin. It was observed that with urea resin upto 20 per cent on the weight of lac, clear varnishes were obtained but when the percentage of urea resin was higher, the varnishes gelled and therefore, they could not be studied for the film properties. The clear varnishes gave non-tacky, hard and smooth films with good adhesion to metals, glass, wood, etc. Properties of these films are brought out in Table II.

It may be seen that heat and water resistance of the air dried films improved with the increasing amount of urea resin in the compo-

TABLE I

PERFORMANCE OF SHELLAC VARNISH PREPARED IN DIFFERENT ALKALIES

Composition of varnish				*Properties of the Varnish*		*Properties of the films (Films tested after seven days of air drying)*				
Dewaxed Gms.	*Water Gms.*	*Alkali used*	*Quantity of alkali Gms.*	*Appearence*	*Viscosity by NO_4 Ford cup at 30°C seconds*	*Appearence*	*Scratch hardness Load on 1 mm ball Gms.*	*(Heat resistance) Initial sticken Tem. °C.*	*Flexibility Film bent round 1/8" mandrel*	*Water resistance tested on wooden panels (initial time of blushing) Minutes*
50	196	Ammonia	4	Clear and	14.8	Hard non-tacky film	300	61	FC	80
50	192	—do—	8	—do—	17.3	—do—	300	61	FC	80
50	184	—do—	16	—do—	14.5	—do—	300	62	C	24
50	195	Morpholine	5	—do—	14.7	—do—	400	52	FC	Softens and washes out in 4 minutes
50	191.5	Triethanolamine	9.5	—do—	15.0	—do—	400	41	FC	Softens and washes out in 3 minutes.
50	197.5	Sodium hydroxide	2.5	—do—	13.5	—do—	400	52	FC	Softens and washes out in 4 minutes

FC=Fine cracks
C=Cracks

sition while the gloss decreased. Hardness and fexibility did not xary to any appreciable extent. Varnish composition containing 20 per cent urea resin was found to be the best and was selected for further studies.

Modification with maleic resin

Varnish composition containing 20 per cent urea resin was further modified with different proportions of maleic resin to improve the gloss of the films. The resultant varnishes were studied for their film properties.

It was found that addition of up to 10 per cent maleic resin improved the gloss to an appreciable extent without adversely effecting any other property. But when greater percentages of maleic resin was, used there was no further improvement in gloss but the water resistance of the films deteriorated. The data are presented in Table III.

Effect of alcohol

Addition of alcohol to aqueous varnishes usually improves the levelling characteristic and shortens the flash off period of the films. With a view to further improve upon the film properties of the shellac, varnish containing 20 per cent urea resin and 10 per cent maleic resin, incorporation of different proportions of alcohol was studied. Varnishes containing 5, 10, 15 and 20 per cent alcohol were studied. The results are brought out in Table IV.

It may be seen that, as expected, addition of alcohol upto 15 per cent sufficiently improved the gloss and other properties of the varnish. The best performance was obtained

TABLE II

PERFORMANCE OF SHELLAC VARNISHES MODIFIED WITH WATER SOLUBLE UREA RESIN

*Composition**		*Film properties (films tested after 7 days of air drying)*				
Aqueous shellac varnish Gms.	*% urea resin added on (solid basis) weight of lac.*	*Gloss % of standard black glass*	*Flexibility film bent round a 0.125 mandrel.*	*Water†resistance initial time of blushing of film failure. Min.*	*Heat resistance initial temperature at which sticking starts °C*	*Scratch hardness load on 1 mm steel ball Gms.*
100	0	65	C	80	62	400
100	5	56	FC	85	70	400
100	10	48	FC	95	76	500
100	20	46	FC	105	76	400
100	30	—	These varnishes gelled and therefore no film properties could be studied.			
100	40	—				

* 25 gms of dewaxed shellac dissolved in 4 gms. ammonia and 96 gms of water.
† Tested on wooden panels.

TABLE III

Composition		*Film properties (films tested after 7 days of air drying)*				
Shellac varnish containing 20% urea resin*	*% of maleic resin on the wt. of solids.*	*Gloss % of standard black glass*	*Flexibility film bent round a 0.125 mandrel*	*Scratch hardness load on 1 mm steel ball gms.*	*Water†resistance initial time of blushing or film failure minutes*	*Heat resistance$ initial temperature of sticking °C.*
100	5	63	FC	500	105	74
100	10	70	FC	500	100	75
100	20	68	FC	400	85	75
100	30	65	FC	400	60	76
100	40	66	FC	500	40	75

FC=Fine cracks, *=25 g. of dewaxed shellac dissolved in 4 gms. of ammonia and 96 gms. water. †= Tested on wooden panels. $=Applied by French polishing.

TABLE IV

PERFORMANCE OF MODIFIED SHELLAC VARNISHES CONTAINING DIFFERENT PROPERTIES OF ALCOHOL.

Composition		*Film properties (films tested after 7 days of air drying)*				
Shellac varnishes containing 20% urea and 10% maleic resin gms.*	*% alcohol on weight of varnish*	*Gloss % of standard black glass*	*Flexibility film bent round a 0.125 mandrel*	*Scratch hardness load on 1 mm steel ball gms.*	*Water† resistance initial time of blushing or film failure min.*	*Heat resistance initial temperature at which sticking starts °C.*
100	0	70	FC	500	100	75
100	5	71	FC	500	105	78
100	10	74	FC	400	120	80
100	15	80	FC	600	140	79
100	20	78	FC	400	130	78

FC=Fine cracks. *=25 g of dewaxed shellac dissolved in 4 gms. of ammonia and 96 gms. water.
†=Water resistance was tested on wooden panels.

when 15 per cent alcohol on the volume of varnish was added.

The improved performance in gloss, heat and water resistance may be attributed to the proper levelling and efficient removal of solvent from the film due to the presence of alcohol.

Conclusions

Aqueous shellac varnish modified with 20 per cent urea resin and 10 per cent maleic resin on the weight of lac and containing 15 per cent alcohol produced non-tacky hard and glossy films on wood and other substrates and served satisfactorily as an aqueous French polish.

In performance, it compared favourably with the conventional French polish in spirit except that its gloss was slightly inferior and the drying time a little longer. But in regard to heat resistance this aqueous finish was better.

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