Quick drying water proof shellac paints

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SHELLAC finds its biggest outlet in the field of surface coatings. In this field it is used in the form of clear varnishes and lacquers. Pigmented coatings are not very popular. A few paint compositions [1,2] were developed by pigmenting ordinary shellac varnish in spirit with different coloured pigments and plasticizers but the paints so produced suffered from the inherent shortcomings of shellac such as poor resistance to heat, water and solvents and could not fit well in the current trend which is fast changing over towards the use of paints which when applied, dryout quickly and produce hard and durable films with good resistance to heat, water and spilled liquids of all kinds.

These types of paints are in great demand in western countries. They are mostly used for painting kitchen furniture, shop windows display panels etc.

Acid catalysed paints are becoming more and more popular as they combine a short dust free drying period with surface hardness and a good degree of resistance to solvents and chemicals.

Recently a semisynthetic shellac lacquer[3] has been developed at the Indian Lac Research Institute, by modifying lac with 40 percent melamine resin, which, on air drying, produces hard, smooth, durable and highly glossy films with excellent resistance to heat, water and spirituous liquors. Further experiments on the catalysation of this lacquer has shown that in the presence of catalyst such as *p*-toluene sulphonic acid and hydrochloric acid addition of only 20 per cent melamine resin serves the purpose. This lacquer also served as a satisfactory vehicle for the preparation of coloured paints.

Systematic experiments were therefore made to develop multicoloured decorative paints which could be applied by spray or brush to produce hard, smooth, glossy and attractive finishes on various substrates such as wood, metal etc.

Experimental

The vehicle was prepared of the following formula

1.	Dewaxed decolourised lac	700 g
2.	Alcohol (methylated spirit)	1,050 ml
3.	Toluene	200 ml
4.	Butanol	120 ml
5.	Melamine resin* (syrup 40% solids)	350 g.

Dewaxed decolourised lac was dissolved in a mixture of the alcohol and toluene and the other ingredients then added. The resultant blend was thoroughly stirred and filtered to remove any suspended impurities. A clear transparent varnish was obtained.

Preparation of paints

200 g. of the above vehicle was ground with the appropriate pigments (given in Table I) for 20 to 24 hours in a ball mill till thoroughly dispersed. Paints of six colours were prepared namely black, red, green, blue, white and yellow. After straining through muslin, these compositions were divided into two parts. To one part 5 per cent. *p*-toluene sulphonic acid on the weight of resin content was added and the other portion was examined as such. Films were prepared on wood (6" X 6"), glass (3" X 2") and tin plate (5" X 3") panels by spraying. These films became dust dry within 10 minutes and tackfree in 30 minutes. They were tested after seven days of air drying. Standard methods of testing as prescribed in ISS, 101/1961[4] were followed.

* *Commercial melamine resin diluted with methylated spirit to 40 percent solids.*

Film properties

All the paints produced, on air drying, hard, smooth and highly glossy films on various substrates. They showed excellent adhesion to wood, glass and metals.

Scratch hardness and flexibility

Scratch hardness was tested on an automatic scratch hardness tester and flexibility on a conical mandrel.

The results obtained are brought out in Table No. 2 and 3. It may be seen that as regards scratch hardness, addition of *p*-toluene sulphonic acid as catalyst did not cause any appreciable improvement in white, black and blue paints, but in the case of red, green and yellow paints there was some increase in the value. As regards flexibility, practically no difference in the performance was noticed. Both catalysed as well as uncatalysed films passed specification laid down by I.S.I.

Heat resistance

Heat resistance was tested by placing a 600 ml beaker containing water kept boiling by an immersion heater over the coated panel for 2 minutes and noting the extent of marking and sticking if any. It was observed (Table 2 and 3) that in the case of uncatalysed paints, some sticking took place and in some cases a slight marking and blistering was also seen.

Addition of the acid improved the heat resistance somewhat but

TABLE NO. 1
COMPOSITION OF PAINTS

Sd. Sl.	*Colour of the paint*	*Quantity of the vehicle used*	*Hiding pigment (Titanium dioxide)*	*Tinting pigment*	*Solvent and diluents added**
1.	White	200 g	15.4 g	—	100 g
2.	Black	200 g	15.4 g	Lamp black 3 g	100 g
3.	Red	200 g	15.4 g	Perma red 2B 2 g	100 g
4.	Yellow	200 g	15.4 g	Lemonchrome 2 g	100 g
5.	Blue	200 g	15.4 g	Brunswick blue 5 g	100 g
6.	Green	200 g	15.4 g	Brunswick green 5 g	100 g

c A mixture of 2 pts of alcohol and one pt. of toluene.*

when the painted surfaces were exposed to sunlight for 6—8 hours, complete heat resistance was achieved. These panels when tested as above did not show any sticking or marking.

Water resistance

Water resistance was tested by immersing the film in water at room temperature for 48 hours and noting the extent of damage such as blushing and film failure at different intervals of time.

It was noted that both catalysed as well as uncatalysed films did not show any blushing or change in colour. Percentage of water absorption was also determined to find out the variation if any between the different pigmented coatings. In this property black paint proved to be the best while in yellow the absorption of water was the maximum. Data are brought out in Table No. 2 and 3. In general no peeling or film failure was noticed in any of the panel.

Alcohol and acetone resistance

Alcohol and acetone resistance was determined by hard rubbing of the film fifty times with a cotton wool soacked in the respective solvent and noting the extent of damage in the fiilm at each rub. Initial number of rub that removed the film was noted. The data are brought out in Tables No. 2 and 3. It may be seen that except in the case of blue, all paints stood the test satisfactorily.

Acid and alkali resistance

Acid and alkali resistance of the films was determined by immersing the coated glass plates in the respective solutions for 24 hours and noting the extent of film failure and fading of the colour at different intervals of time.

In the case of alkali resistance (1% KOH) peeling of the film was noticed both in catalysed as well as uncatalysed varnishes within an hour or so of immersion. After 24 hours complete bleaching of colour took place in red, blue, yellow and green paints. In the black paint also slight fainting of colour was observed.

In case of acid, no lifting of the film or fading of colour was noticed upto 24 hours continuous immersion in uncatalysed films. In the case of catalysed films red, yellow, black and white stood satisfactory but blue and green showed lifting within 16 minutes, and fading of colour in 2—2½ hours. The data within 16 minutes. and fading of are summerised in Table No. 4.

Storage stabllity of paints

All the compositions, with and without *p*-toluene sulphonic acid as catalyst stored satisfactorily upto 3 months, so far studied. During this course no thickening of gelling could be noticed however some settling of the pigments occured but it could be redispersed by stirring.

Conclusions

Shellac varnish modified with butylated melamine formaldehyde resin serves as a satisfactory vehicle for the preparation of quick drying water proof shellac paints.

These acid catalysed paints can be sprayed to produce a hard, smooth and highly glossy finish which acquires good heat and water resistance in seven days air drying or in 8—10 hours if the painted surface is exposed to sunlight.

As the vehicle used in these paints is a chemically drying type the painted surface gradually becomes more and more resistant to heat, water, liquors etc. as the time passes.

These paints are highly suitable for application on kitchen furnitures, shop windows and display panels etc.

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Reference:

1. Venugopalan, M. *Paint Manuf.* Vol. 4. (1934), p. 124.
2. Murty, N. N. *Paint Technol.* Vol. 10, No. 117, (1945), p. 211—212.
3. Shravan Kumar, *Paint Technology.* Vol. 30, No. 2, (1966), 6. 16.
4. Standard methods of testing ready mixed paints, ISS, 101/1961.

TABLE NO. II

FILM PROPERTIES OF PIGMENTED MELFOLAC (FILMS TESTED AFTER 7 DAYS)

							Water Resistance		
Sl. No.	*Colour oif the paint*	*Scratch hardness load on 1 mm. steel ball gms.*	*Heat resistance Effect of keeping beaker containing water at 100°C*	*Flexibility at $\frac{1}{4}$" mandrel*	*Acetone resistance -hard rubs*	*Alcohol resistance -hard rubs*	*Condition of the film after 48 hrs. continuous immersion*	*Percentage of water absorption in 48 hrs.*	*Recovery in 2 hrs.*
1.	White	900	FS & B	Passes	50 nE	50 nE	nB & nL	1.38	No lifting of the film
2.	Black	1400	FS & B	Passes	50 nE	-do-	nB & nL	0.08	-do-
3.	Red	600	NS & B, Change in colour	Passes	50 nE	-do-	nB & nL	0.97	-do-
4.	Yellow	1000	VFS & B	Passes	50 nE		nB & nL	1.54	Complete lifting of the film
5.	Blue	900	VFS	Passes	37	-do-	nB & nL	1.26	-do-
6.	Green	800	FS & B	Passes	50 nE	-do-	nB & nL	1.31	Partial lifting of the film.
7.	NC paint (Nitrocellulose Paint)	1000	—	Passes	one rub	four	nB & nL	...	

VFS = Very faint sticking, NS = No sticking, FS = Faint sticking
B = Fine blistering, nB & nL = No blushing and no lifting
nE = *No effect.*

TABLE NO. III

FILM PERFORMANCE OF QUICKDRYING PAINTS CATALYSED WITH 5 PER CENT P-TOLUENE SULPHONIC ACID. FILMS PREPARED BY SPRAYING AND TESTED AFTER 7 DAYS AIR DRYING. APPROX. FILM THICKNESS. 1 TO 1.2 ML.

Sl. No.	Colour of the Paint	Scratch hardness load on 1 mm steel balls—g.	Heat resistance at 100°C: Before exposure to sunlight	Heat resistance at 100°C: After exposure to sunlight for 8 hours.	Flexibility on 1/4" mandrel	Acetone resistance -number of -hard rubs	Alcohol resistance -number of -hard rubs	Water resistance condition of the film after 48 hrs. immersion.
1.	White	900	FS, M & B	50 E	Passes	50 nE	50 nE	nB & nL
2.	Black	1400	-do-	nE	Passes	50 nE	50 nE	nB & nL
3.	Aed	700	NS, FM, NB, but change in colour	nE	Passes	50 nE	50 nE	nB & nL
4.	Yellow	1300	S,M & B	nE	Passes	50 nE	50 nE	nB & nL
5.	Blue	800	S,V.F.M., N.B.	nE	Passes	37	50 nE	nB & nL
6.	Green	1100	NS, NM, NB	nE	Passes	50 nE	50 nE	nB & nL

F.S.=Faint sticking, M= Marking, S = Sticking, VFM = Very faint marking, N.S. = No sticking, B = Blistering F.M. = Faint marking, NB = No blistering, NM = No marking, nE = No effect, nB = No blushing, L = Lifting nL = No Lifting

TABLE NO. IV

ACID AND ALKALI RESISTANCE OF THE AIR DRIED FILMS

		Acid Resistance 5 per cent HCL				Alkali Resistance 1 per cent KOH			
		Initial time of blushing or lifting of the film		Condition of the film after 24 hours.		Initial time of blushing lifting of the film		Condition of the film after 24 hours	
Sl. No.	Colour of the paint	Without Catalyst.	With Catalyst	Without Catalyst	With Catalyst	Without Catalyst	With Catalyst	Without catalyst	With Catalyst
1.	Red	nE	nP or L	nE	nP or L	P.O. in 13 mts.	P.O. in 1 hr.	PL & CF	PL & CB
2.	Blue	nE	nL, but P in 13 mts & Bleaching of colour after 2 hrs	nE	nL but P	P.O. in 11 mts.	P.O. in 1 hr. 10 mts.	PL & CF	PL & CB
3.	Yellow	nE	nL or P	nE	nL or P	P.O.9 mts.	P.O. in 1 hr 15 mts.	PL & CB	PL & CB
4.	Black	nE	nL or P	nE	nL or P	P.O. in 10 mts.	P.O. in 1 hr. 7 mts.	PL & CF	PL & CF
5.	Green	nE	nL but SP in 16 mts & bleaching of colour in 2 hrs 50 mts.	nE	nL but SP	P.O. in 12 mts.	P.O. in 1 hr. 20 mts.	PL & CB	PL & CB
6.	White	nE	nL or P	P.O. in 6 mts.	nE	nL or P	P.O. in 1 hr. 25 mts.	PL & CB	PL & CF

nE = no effect, nP = no peeling, L = Lifting, nL = no lifting, P = Peeling, SP = slight peeling P.O. = peeled off, PL & CF = partial lifting & colour fainting, CB = Colour Bleaching.