Lacquered tins for packaging and storage of shellac varnishes

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PACKAGING of shellac spirit varnishes has been a problem since the very beginning. These shellac varnishes when packed in thin containers darken with time and the performance also deteriorates. This darkening of shellac varnishes takes place due to slow reaction of the carboxyl group of lac with the metal of the container and formation of coloured compounds.

Packaging of shellac varnishes in glass bottles also involved the risk of damage during transportation and therefore, the chemists and technologists were all the time looking for a better solution to the above problem.

In early days, Ford[1] discovered that shellac varnishes when packed in copper vessels do not discolour. He, therefore, suggested the use of copper lined vessels but these too could not become popular due to their prohibitive cost.

In 1936, Verman and Bhattacharya[2] observed that if 0.02-0.025% of oxalic acid is added into shellac varnish, it stays in iron and tin containers for a longer life. Later on, Brown[3] noticed that addition of 0.5% organic phosphates such as ethyl aniline phosphate also retards darkening of shellac varnishes in tin containers. But these chemicals acted only as retarders to the darkening process and none completely check the deterioration in the film performance.

Lacquered tins have to a very great extent solved the long standing packaging problem of shellac varnishes.

These containers are made by tin sheets which are first coated with epoxy-phenolic lacquer and baked at 120°C for 20-30 minutes. These sheets are then made into containers. The epoxy lining acts as a barrier between the varnish and the metal of the container and thus checks the darkening process.

Since epoxy resins are very costly and also not manufactured indigenously, efforts were made to find out a suitable substitute to epoxy. lacquer.

During modification of lac with urea resin[4], it was observed that the resultant product in addition to possessing good flexibility and chemical resistance also showed remarkable inertness towards alcohol.

Further experiments were, therefore, made to develop a satisfactory lacquer based on the above composition. Keeping in view that such lacquers are applied by rollers and as such should be thick and slow drying.

Experimental

A 40% solution of dewaxed lemon shellac was prepared in butanol and xylol mixture and to this 20% urea resin on the weight of lac was added. The resultant varnish was then applied on tin panels by flood spinners to obtain a uniform film. After a flash-off period of 5 minutes these panels were baked under different schedules normally practised in the industry.

	Temperature °C	Time mts
(1)	100	60
(2)	150	30
(3)	175	20
(4)	200	15

Invariably uniform and glossy films were obtained. These films were then subjected to different specific tests used for evaluating a metal lacquer. Special attention was given to the hardness, acetone resistance and flexibility of the films. All these properties were studied by the standard methods[5,6]. Acetone resistance was determined by hard rubbing the film with a cotton swab dipped in acetone. For comparison purposes, epoxy phenolic lacquer was also tested side by side and the data so obtained are given in table I.

Results and discussion

Shellac lacquer when applied properly produced hard, smooth, flexible and highly glossy films with excellent adhesion on tin and other metals. After stoving at 150°C for 30 mts., these films acquired excellent resistance to water, solvents including alcohol and chemicals.

Baked films also satisfactorily passed the specific tests such as acetone resistance, wedge bend test, etc., normally done for the evaluation of a metal lacquer.

This lacquer conforms to IS 344/1952 for stoving type clear varnish and in general, performance compares favourably with epoxy phenolic lacquers normally used for tin plate lacquering.

TABLE I

Comparative film performance of lac urea resin and epoxy phenolic resin lacquers

Sl. no.	Properties	Lac-urea resin llms baked at 150°C for 30 mts.	Epoxy phenolic resin films baked at 170°C for 20 mts.
1.	Appearance of the film	Golden, highly, smooth & glossy	Golden, highly, smooth & glossy
2.	Flexibility and adhesion		
	a) Bend round 1/8 mandrel	No cracking or detachment of film	No cracking or detachment & film
	b) Wedge bend test	70% Unfractured portion	80% unfractured portion
3.	Scratch hardness-gms	800	1,000
4.	Heat resistance at 100°C		
5.	Water resistance (7 days continuous immersion)	No effect No blushing, swelling or detachment of film	No effect No blushing, swelling or detachment of film
6.	Resistance to acid (immersed in H_2SO_4 6 N for 24 hrs.)	No effect	No effect
7.	Resistance to 0.5% soap solution	No effect	No effect
8.	Resistance to acetone — 50 hard-rubs		Stands satisfactorily
9.	Resistance to alcohol immersed in methylated spirit for one month	Stands satisfactorily No softening or dissolution of film	No softening or dissolution of film
10.	Resistance to lubricating oil at 60°C for 80 mts.	No sign of permanent injury or removal	
11.	Stripping test	Scratch free form jagged edges	Scratches free from jagged edges.

Trials made by a commercial firm on this lacquer have shown very encouraging results. Baked films of this lacquer stand stamping, turning and punching operations during fabrication of tin containers.

In view of its excellent film performance, this lacquer can satisfactorily be used for lacquering of tin plate containers to be used for packaging of shellac varnishes.

In addition, these lacquered tins can also be used for packaging of other consumer goods including food products.

Development of shellac urea lacquer has not only solved the long standing packaging problem of shellac varnishes but has also opened a newer field for the utilisation of lac.

References

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