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Shellac Emulsion Paint for Interior Decoration

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Shellac emulsion paints of different shades have been prepared by emulsifying the mixed glycerides of linseed oil with aqueous ammoniacal solution of lac. These paints can be applied both by brush and spray to produce hard, smooth and characteristic egg shell finish having excellent adhesion on concrete, cement and limed surfaces. These paints air dry rapidly and show good resistance to water and abrasion. Keeping quality of these paints is also very good. No caking or gelling takes place up to one year storage. The special attraction in these paints is that they are based on purely indigenous raw materials.

Plastic emulsion paints used for the interior decoration of public and residential buildings are increasingly becoming popular because of their easy application, quick drying qualities, lack of odour and washability. These paints also eliminate the use of solvents for thinning. The first interior wall finish[1] based on styrene-butadiene emulsion appeared in the market in 1948. Thereafter emulsion paints based on polyvinyl acetate, acrylics, etc. entered the market and slowly gained popularity. These emulsion paints are quite costly and are beyond the reach of common man. As a result in most of the places distempers are preferred due to their relatively low cost. But it has been found that these distempers are not economical in the long run as they chalk out and are soiled after some time and require frequent painting. This situation necessitated the development of suitable water thinned paints for interior decoration which may, in addition to possessing the desirable properties of plastic emulsion paints, be cheaper.

Structurally, shellac shows a close resemblance with the present day water soluble resins[2]. Owing to the presence of one free carboxyl group in the molecule, it dissolves freely in aqueous alkalies to form clear varnishes[3]. These aqueous varnishes do not adhere well on metals and some other substrates. To improve upon its adhesion and other properties such as weather resistance, flexibility, etc. it was modified with water soluble drying oils such as linseed[4] and Tung oils[5] and self dispersible alkyds[6]. These modified varnishes gave highly adherent, hard, smooth and glossy films on various substrates. Of these, lac-linseed oil varnish was used as a vehicle for decorative paints[7]. The resultant paints produced hard, uniform and egg shell finish characteristic of plastic emulsion paints.

In view of the added advantages of emulsion paints over water-soluble type of paints a shellac emulsion paint based on shellac-rosin-castor oil[8] was also formulated by Shellac Export Promotion Council. This paint composition due to its lower cost entered commercial production but it could not gain much popularity due to presence of high proportion of rosin in the composition which impaired its performance.

The present study was, therefore, undertaken to develop a satisfactory composition of shellac

emulsion paint which may meet the specifications laid down by ISI for plastic emulsion paints.

Experimental procedure

It the first set of experiments emulsification of linseed oil with aqueous ammoniacal solution of lac was tried under different conditions but unfortunately stable emulsion could not be obtained and, therefore, in the second set of experiments linseed oil was partially hydrolysed and then emulsified with aqueous ammoniacal solution of lac when a stable emulsion was obtained. This emulsion could satisfactorily be pigmented without breaking or gelling to produce emulsion paints of different shades comparable to plastic emulsion paints in appearance and performance.

Composition

Vehicle

(i) Mixed glycerides	150 g
(ii) Aqueous shellac solution	500 ml
(iii) Cobalt naphthenate	12.5 g
(iv) SARCOL - P - 313	5 g
(v) Sodium carboxymethyl cellulose	0.5 g
(vi) Pentachlorophenol	1.25 g

Pigments

(i) Titanium dioxide	250 g
(ii) Calcium carbonate	50 g

The various steps involved in the preparation of shellac emulsion paint are described below.

Preparation of mixed glycerides of linseed oil—Linseed oil (200 g) was heated to 170°C in a three-necked flask fitted with a thermometer, reflux condenser and an efficient stirrer, and to it litharge (6 g) and lime (3 g) were added under efficient stirring. The temperature was then raised to 250°C and maintained for 10 minutes when a clear transparent product was obtained. This was then thinned with white spirit and strained through muslin cloth to obtain a clear solution.

Preparation of aqueous shellac solution—Shellac powder (100 g) was treated with water (400 ml) containing liquor ammonia (30 ml) and triethanolamine (2.5 ml) at 80°C till a clear solution was obtained. This solution was then cooled to room temperature and filtered through muslin cloth to remove suspended impurities, if any.

Emulsification—Mixed glycerides (150 g) obtained as above were taken in a stainless steel vessel and to it SARCOL P-313 (non-ionic emulsifier) (5 g) and cobalt naphthenate (12.5 g) as drier were added under brisk stirring. This mass was then emulsified by slowly adding aqueous shellac solution. During addition of shellac solution the whole mass was kept stirred by a high speed mechanical stirrer till oil in water emulsion was formed which could be diluted with large amount of water without breaking. At this stage a further quantity of water (70 ml) was added to obtain the desired consistency of shellac emulsion.

Preparation of emulsion paint—The emulsified material as obtained earlier was transferred to a dispersing vessel and then sodium carboxymethyl cellulose (0.5 g) and pentachlorophenol (1.25 g) were added to it as protective colloid and antifungal agent respectively. Thereafter titanium dioxide (250 g) and calcium carbonate (50 g) previously ground in the form of a paste were dispersed in the resultant emulsion to obtain white emulsion paint.

This white emulsion paint was tinted with commercially available homopastes of different colours to obtain shellac emulsion paints of

Table 1—Comparative Film Performance of Shellac and Plastic Emulsion Paints

Characteristics	Shellac emulsion paint	Comercial emulsion paint-I	Commercial emulsion paint-II	I.S. specifications
Consistency	Smooth & uniform	Smooth & uniform	Smooth & uniform	Smooth & uniform
Drying time				
(a) Surface dry	20 min	12 min	15 min	15 min
(b) Hard dry	8.10 hr	5 hr	6 hr	4 hr
Flexibility and adhesion (375 mm mandrel)	No visible damage or detachment of film	No visible damage or detachment of film	No visible damage or detachment of film	Shall not show any visible damage or detachment of film.
Finish	Smooth & matt finish	Smooth & matt finish	Smooth & matt finish	Smooth & matt finish
Resistance to wet abrasion and washing	995 rubs	200 rubs	210 rubs	4,000 rubs
Temperature stability				
(a) at 5° + 1° for 48 hr	No change	became like a soft solid mass	No change	No change
(b) at 60°C ± 1° for 48 hr	No change	gelled	No change	No change
Resistance to water spotting	Good	Good	Good	—
Scratch hardness (load in grams on 1 mm steel ball)	900	1100	1000	—
Keeping properties	Over one year	Over one year	Over one year	Not less than one year
Fastness to light	Good	Good	Good	to pas test
Coverage (per litre of paint)	11-11.5 m^2	11.6 m^2	12.2 m^2	9-14 m^2

different shades. After 24 hr the viscosity of these emulsion paints was determined. The films were prepared both by brushing and by spraying on tin, glass and asbestos cement panels for testing the performance of these paints. The film properties were studied by the standard methods and compared with IS:5411 (Part I)-1969 for plastic emulsion paints. For comparative study performance of two commercial plastic emulsion paints was also tested side by side. The data so obtained are summarised in Table 1.

Results and discussion

Shellac emulsion paints possessed the required viscosity and could be diluted with water to any desired consistency without breaking. These paints on application by brush or spraying produced hard, smooth and egg shell finish on various substrates. The air-dried films showed good adhesion on metals, wood, concrete and primed surfaces. The coated surface showed very good resistance to water and abrasion. The coverage of shellac paints was determined to be 11.2 m^2/l.

From the data presented in Table 1 it may be seen that shellac emulsion paints compare favourably with plastic emulsion paints in performance. These shellac paints also conform to IS:5411 (Part I)-1969 for plastic emulsion paints excepting that these paints take comparatively longer time for drying due to the presence of drying oil in the composition.

The process for the preparation of shellac emulsion paint on a semi-pilot scale (2 gallons) was translated without any appreciable difficulty. The paints so obtained compared well in performance with the paints obtained in the laboratory.

Suitability of different varieties of lac for the preparation of shellac emulsion paint was also studied, but it was found that only dewaxed variety of shellac gave the desired film performance. Wax-containing shellac gave inferior performance. Experiments were also carried out to prepare shellac emulsion paint by using ordinary linseed oil but satisfactory performance could not be obtained.

Storage stability of shellac emulsion paints was studied and it was noted that these emulsion paints thinned down to some extent and the pigments also settled at the bottom on storage for one year. But, after stirring, these pigments could be redispersed and a uniform paint could be obtained which was found to give the same film performance as the fresh one.

Conclusion

This study has resulted in the development of satisfactory composition of shellac emulsion paint which compares favourably with plastic emulsion paints in performance. The special attraction in this paint is that it is based purely on indigenous raw materials and its present cost works out to be Rs 31-36 per litre. This paint is suitable for application on asbestos, cement, plaster, concrete, masonry and limed surfaces, etc. for interior decoration. This is equally suitable for painting partition walls, display panels and other such items which are normally not exposed to out door conditions.

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