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Studies on Bleaching of Lac: Part II—Bleaching with Hydrogen Peroxide Alone or in Combination with Sodium Hypochlorite

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In earlier studies on bleaching of lac with sodium hypochlorite, it was observed that entry of chlorine during bleaching adversely affects the desirable properties of lac, such as life under heat, flow and keeping quality. A combination of bleaching treatments making use of sodium hypochlorite and hydrogen peroxide has been tried. The products obtained have satisfactory colour and good storage stability and their flow behaviour is similar to that of commercial dewaxed shellacs. The chlorine content of the bleached lac is much lower than that of the hypochlorite bleached lac (0.4% against 1.5%).

BLEACHED lac obtained using sodium hypochlorite as the bleaching agent has poor life under heat, flow behaviour and storage stability. These detrimental effects have been shown to be due to the entry of chlorine into the resin during bleaching[1]. It is also believed that during storage, chlorine gradually splits off in the form of hydrochloric acid and renders lac insoluble[2]. Various steps have been taken to increase the storage stability; these include the use of antichlors like hydrogen peroxide[3], stabilizers, such as thiosulphates of sodium and lead[4], and certain epoxy resins like Epikote 1001, 1004 (ref. 5). However, very insignificant improvement in storage stability has been noticed with all these treatments. An ideal bleached lac is the one which has no colour, but is identical in all respects with the parent lac, particularly in respect of storage stability and flow behaviour.

Obviously, the first step in this regard should be to avoid chlorine and chlorine-containing oxidizing agents and to remove chlorine as completely as possible later on. Extensive use of hydrogen peroxide and sodium perborate as effective bleaching agents in fibre industry in place of chlorine bleaching agents suggested exhaustive study of their bleaching action on lac. Also from the methyl tetrahydroxyanthraquinone structure of erythrolaccin, the colouring matter present in seedlac, it appears that the oxidative action of hydrogen peroxide should destroy the colour due to it[6].

Experimental procedure

The procedure for preparing solution of lac, bleaching and reclaiming the bleached lac was the same as reported earlier[1]. Hydrogen peroxide diluted to a

Table 1 — Properties of bleached lac obtained

Amount of bleach liquor (3%) added to 100 g seedlac ml	Amount of hydrogen peroxide (10% wt/vol.) added ml	Temp. of bleaching °C	Period of bleaching hr	Yield %	Colour index	Chlorine content %	Acid value	Life at 150°C min	Flow by Victor's method mm	Remarks
Rangeeni SEEDLAC (BLEACH INDEX 100) USED IN SODIUM CARBONATE SOLUTION										
Nil (Precipitated lac unbleached)	Nil	—	—	95.0	20.0	Nil	67.7	14.0	59.0	Unbleached precipitated lac
Nil	150.0	22±2	24.0	91.0	7.0	Nil	74.8	66.0	51.0	Hydrogen peroxide bleached lac
(In sodium bicarbonate solution)										
Nil	150.0	22±2	24.0	91.0	4.5	Nil	75.5	61.0	38.0	do
333.0 (full)	Nil	26±2	24.0	91.0	0.26	1.5	69.0	5.0	19.0	Hypochlorite bleached lac
250.0 (three-fourth)	150.0	26±2	30.0	92.0	0.31	0.61	76.2	23.0	32.0	Hypochlorite-hydrogen peroxide bleached lac
167.0 (half)	150.0	26±2	30.0	90.0	0.5	0.47	74.5	36.0	38.0	do
83.5 (one-fourth)	150.0	26±2	30.0	90.5	1.33	0.42	76.8	38.0	44.0	do
Rangeeni SEEDLAC (BLEACH INDEX 84) USED IN SODIUM BICARBONATE SOLUTION										
140.0 (half)	100.0	24±2	30.0	89.0	0.35	—	68.0	45.0	44.0	do
140.0 (half)	150.0	24±2	30.0	91.0	0.21	—	70.3	46.0	48.0	do
140.0 (half)	200.0	24±2	30.0	91.0	0.24	—	71.3	46.0	48.0	do

strength of 10% (wt/vol.) was used. The methods of analysis were also the same as described earlier.

Results and discussion

When bleached at temperatures below 40°, the products obtained were free flowing. At higher temperatures, the reaction was fast and appreciable bleaching resulted, but there was reversion of colour in the resultant product and the product was sticky in nature. Increase in the amount of hydrogen peroxide beyond 150 ml for 100 g of seedlac had no significant effect on bleaching. Reaction periods beyond 24 hr brought about reversion in colour and also made the product sticky, probably due to some type of breakdown of the resin molecule.

An interesting observation made was that change of alkali from sodium carbonate to sodium bicarbonate (15% on the wt of lac) caused considerable improvement in the bleaching action of hydrogen peroxide (Table 1). The colour index of *Rangeeni* seedlac could be reduced to 4.5 as against 7 and that of *Kusmi* to 2 as against 6 under the same conditions.

Although life under heat and flow of the products obtained by bleaching with hydrogen peroxide showed considerable improvement over that obtained by bleaching with sodium hypochlorite, the colour indices of the bleached products could not be brought below 4.5 in the case of *Rangeeni* or 2 in the case of *Kusmi* seedlac by bleaching with hydrogen peroxide alone. As such, a combination of bleaching treatments making use of both sodium hypochlorite and hydrogen peroxide was attempted.

The solution of seedlac in sodium bicarbonate was first bleached partially with sodium hypochlorite and the bleaching was then completed with hydrogen peroxide. The characteristics of the products obtained using varying amounts of sodium hypochlorite and hydrogen peroxide are listed in Table 1. It is evident from Table 1 that the products, besides having good colour (minimum colour index 0.24 compared to 0.26 for hypochlorite bleached lac), have life and flow almost similar to those of commercial dewaxed shellacs. Further, the chlorine content of the bleached lac is much lower than that of the hypochlorite bleached lac (0.4% against 1.5%).

All the samples thus produced were found to be freely soluble in alcohol at the end of up to 9 months' storage at room temperature.

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