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Specific Heat of Bleached Lac

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The specific heats of wax-containing and wax-free bleached lacs have been determined in the temperature range 10-100°C using a modified calorimeter. The values obtained show significant differences from those of shellac or seedlac reported earlier [Rahman, A. *et al.*, *Indian J. Technol.*, 8 (1970), 231; and Bhattacharya, G. N., *Indian J. Phys.*, 16 (1940), 415].

IN an earlier communication[1], specific heat values of seedlac within the temperature range 10-180°C were reported. The present paper presents specific heat data for bleached lac.

Design of calorimeter — As shellac is a resin of poor thermal conductivity, Bhattacharya[2] used a specially designed cylindrical calorimeter for measuring the specific heat of shellac. This was later modified by Srivastava[3] into one of rectangular cross-section. Although this was an improvement, the authors met with other practical difficulties in using this calorimeter for the determination of specific heat of bleached lac. In both the earlier designs no lid had been provided. A lid was considered necessary, because in its absence conduction

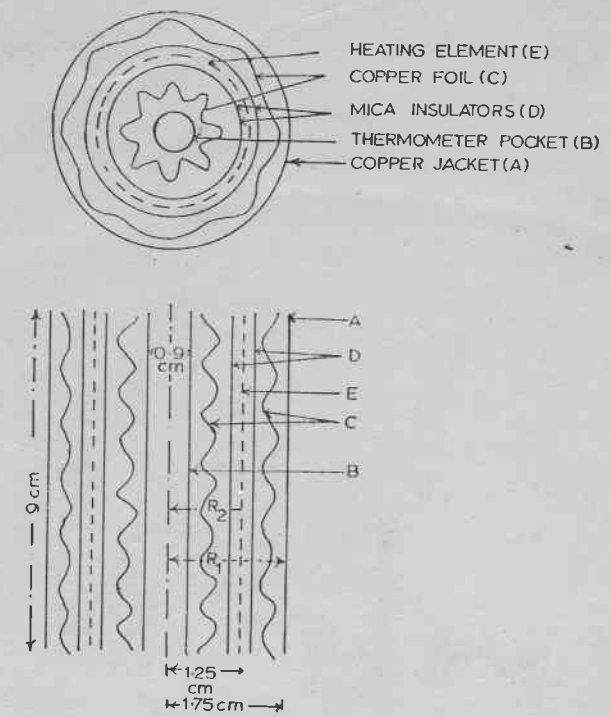

Fig. 1 — Schematic diagram of the calorimeter

of heat from all the sides of the assembly may not be uniform, as all the sides and the bottom will be of copper, while the top will be of lac, a bad conductor. Besides, being of rectangular cross-section, the distance from the heating element varies from point to point of the materials packed inside the calorimeter and, therefore, the conduction of heat may not be uniform.

Bleached lac, which is usually in the form of a very fine powder, flies off under high vacuum, thereby resulting in loss in mass during the experiment unless prevented by a tight fitting lid. Therefore, for the present study, a lid closely fitting the calorimeter was provided.

As the specific heats of seedlac or shellac are determined at temperatures higher than their melting points, cleaning of the calorimeter becomes a difficult operation and often the heating element gets damaged. Keeping this in view, the new calorimeter has been designed in such a way that all the components can be opened and separated immediately after the determination.

The calorimeter used in the present investigation was made cylindrical in order to allow uniform radial heat conduction and its heating element was located in such a way that the masses of the material on either side of the element were equal. For this purpose, the appropriate position of the heating element was calculated. A schematic diagram of the calorimeter is given in Fig. 1 where A is the calorimeter and B, the heating element inside it, R_1 and R_2 being the radius of the calorimeter and cylinder of heating element respectively. To maintain weight and volume of material on either side of the cylinder and the heating element equal, the value of R_1 is taken as $1{\cdot}414\ R_2$.

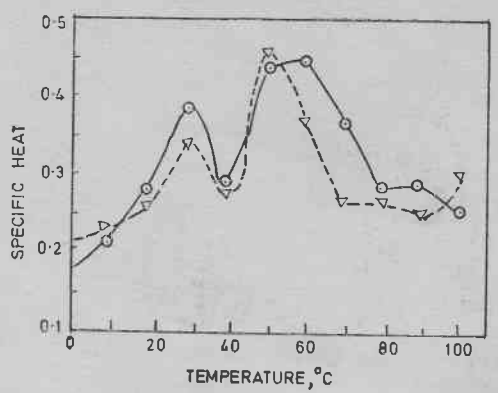

Fig. 2 — Variation of specific heat of bleached lacs with temperature [⊙—⊙, wax containing lac; and △—△, wax-free lac]

In the new assembly (Fig. 1), for the sake of uniformity of heat conduction, corrugated copper foils are placed in the material on either side of the cylinder and the heating element.

Results — For standardizing the calorimeter, the specific heat of shellac was determined according to the procedure described earlier[1,3]. The values obtained compared fairly well with the specific heat values reported by Srivastava[3]. Specific heats of both varieties of bleached lac, namely the 'regular' or wax-containing material (BR) (acid value 7·93; life under heat 3 min) and the 'refined' or wax-free variety (BRF) (acid value 76·3; life under heat 9 min) were then determined within the temperature range 10-100°C. The values are plotted in Fig. 2. The accuracy of the measurement was $\pm 0{\cdot}003$.

From the results (Fig. 2) it is seen that the trend of variation in specific heat with temperature is the same for both types of bleached lac. The specific heat values increase with temperature up to 30°C, beyond which they decrease, reaching a minimum at 40°C. The specific heat increases again thereafter up to the softening range (50-60°C) and then gradually registers a fall again to another minimum, after which there is no appreciable change. The specific heats of dewaxed bleached lac are generally lower than those of the regular variety bleached lac. It is noteworthy that the specific heats of both the varieties of bleached lac are lower than those of seedlac or shellac. This is understandable, because whereas the latter two readily fuse at moderate temperatures, thereby requiring heat of fusion, bleached lacs do not fuse appreciably in the temperature range studied and consequently they require less heat for the same rise in temperature. This is corroborated by the observations of Srivastava[3] who also noted that (heat) polymerized lacs (which do not fuse at these temperatures) have lower specific heats than those of more fusible fresh lacs.

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References

1. Rahman, A., Banerjee, R. & Bhattacharya, P. R., *Indian J. Technol.*, **8** (1970), 231.
2. Bhattacharya, G. N., *Indian J. Phys.*, **14** (1940), 415.
3. Srivastava, S. N., *Indian J. Phys.*, **32** (1958), 443.