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Specific Heat of Seedlac at Different Temperatures

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The specific heats of seedlac have been determined at different temperatures in the range 10-100°C at 10° intervals. As with shellac, a gradual increase has been observed in the specific heat values of seedlac also with increase in temperature. The maximum value (0·66) is attained at 70°C. The value drops suddenly to 0·51 at 80°C and thereafter remains steady; this behaviour is different from that of shellac which shows a smooth fall in the value of specific heat with increase in temperature beyond 73°C, the temperature for maximum value.

THE specific heats of shellac at different temperatures in the range 20-110°C were reported by Srivastava[1,2]. He found that the specific heat of fresh shellac at any temperature differed substantially from that of heat-polymerized shellac and that this difference was widest at 73°C. This observation is of considerable practical importance, as a possible means of determining the state of polymerization of any lac. The study was, therefore, extended to seedlac, which is also of equal commercial importance. The trends in the variation of specific heat of seedlac in the temperature ranges above and below 70°C are reported in this communication.

The seedlac sample used was from 1964 *Bysakhi Ber* lac obtained from Balarampur (West Bengal) and processed by washing with water only in June 1964. It contained non-volatile matter insoluble in hot alcohol, i.e. impurities, to the extent of 3·78%. The apparatus used and the procedure adopted were similar to the ones described by Srivastava[2]. The only change was that the calorimeter was kept inside a 1 litre short ring neck round-bottomed pyrex flask instead of the bottle. This was done to reduce the heat loss due to conduction, convection and radiation to the minimum. The flask was kept in a glycerine bath whose temperature was maintained accurately within ±0·2°C by an electronic relay system. The loss by radiation, at each stage, was compensated by the application of Newtons law of cooling to obtain the correct maximum temperature.

Specific heat values (average of several replicates) were obtained at various temperatures and the data plotted (Fig. 1). From Fig. 1 it is seen that the specific heat rises gradually with temperature and that the highest value is obtained at 70°C. This is in good agreement with the temperature (73°C) for maximum value of specific heat in the case of shellac, reported by Srivastava[1]. However, while in the case of shellac there is a smooth fall in the value of specific heat beyond 73°C, in the case of seedlac the value first comes down to 0·51 at 80°C and goes up to 0·57 at 90°C and again falls to 0·56 at 100°C. The drop at 80°C was unexpected, but was confirmed by repeated determinations. The reason for this is not clear.

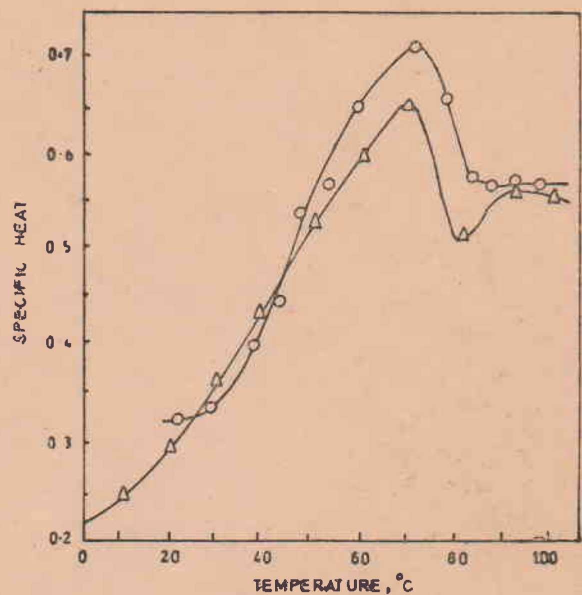

Fig. 1 — Specific heat-temperature curves for seedlac and shellac [O—O, shellac; and △—△, seedlac]

The gradual rise in specific heat with temperature, reaching a maximum near the melting/fusion temperatures of the resin, is quite understandable. When heat is applied to a resin at its fusion temperature, besides rise in temperature, it undergoes a change of state. The total amount of heat applied is, therefore, partly consumed in raising its temperature and partly as the latent heat of fusion. For the same input of heat, therefore, the rise in temperature is lower than if there had been no fusion; in other words, the specific heat observed is higher. Above the fusion temperature, the specific heats should be lower and steady, as no more heat is required for fusing the material; this behaviour, shown by shellac, has also been reported for some other organic compounds like tristearin[3] and tripalmitin[3]. Seedlac shows this behaviour above 90°C.

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