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Correlation of Specific Heat, Flow Behaviour & Hot Alcohol Insolubles with Age of Seedlac

A. Rahman, M. Islam & Promode R. Bhattacharya
Indian Lac Research Institute, Namkum, Ranchi 10

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The specific heat, flow behaviour and hot alcohol insolubles of six samples of seedlac of known history and stored in the laboratory under normal conditions have been determined. While there was no correlation between the hot alcohol insolubles and flow behaviour with the age (period of storage) of the samples, specific heats gave some indication regarding the age. Samples stored up to one year had specific heat of 0·625 and above, while those stored for 1-2 years had specific heat between 0·590 and 0·621 and those stored for over 2 years, below 0·590.

DETERMINATION of the age (i.e. the state of storage polymerization) of lac has always been a problem for the lac industry. Some workers have attempted to correlate the physical and chemical constants, such as life, flow behaviour, percentage of insolubles and rate of filtration as well as acid, saponification, hydroxyl and carboxyl values with the age of the samples, but they were unable to arrive at any definite conclusion[1].

Rangaswami and De[2] reported that there is an abrupt change in the flow behaviour and percentage of insolubles in seedlac samples after 24 months of storage in ordinary godowns. The specific heat of shellac, which is an important physical constant and may be easily determined with great accuracy, has also been shown to fall steadily with increase in the extent of polymerization. Therefore, in order to determine the exact correlation, if any, of these properties with the age of the sample, the flow behaviour, the percentage of insolubles and specific heat were determined in the case of a number of samples of known history and stored for different periods. Sticklac samples were collected from six different lac growing centres in the country in order to take into account the ecological influence, if any, and processed into seedlac by the conventional (tub) washing with water. The histories of the sticklacs are given in Table 1. The samples were then stored in gunny bags as per the usual practice in trade. The variation of the climatic conditions during the period of storage of the samples is evident from the following typical meteorological data recorded at this institute for the year 1965-66: max. temp. range, 23-38°C; min. temp. range, 8·7-25°C; and humidity range, 50·0-85·0%. The samples were then periodically examined for the alcohol insolubles (by the latest ISI/ISO method), flow behaviour (by Victor's method) and specific heat (Srivastava's method[3] with a modification[4] for higher accuracy). The results obtained are plotted in Figs. 1-3.

Insolubles and flow behaviour — It is well known that lac undergoes slow polymerization with time, which results in loss of solubility in alcohol and in flow. Rangaswami and De[2] observed these

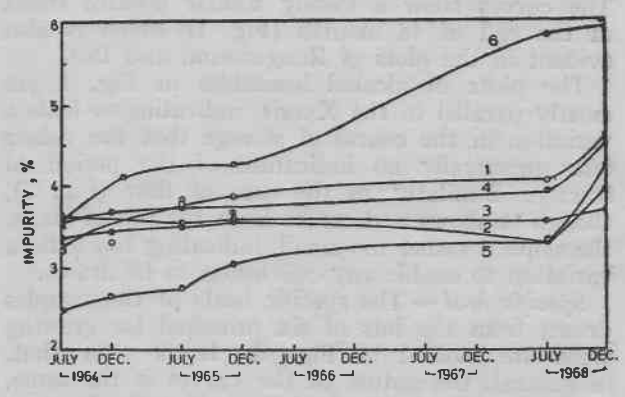

Fig. 1 — Graph showing changes in insolubles (impurity) of six samples against time [Numbers along the curves represent sample Nos. as per Table 1]

Table 1 — History of Sticklac Samples from Different Lac Growing Areas

Sample No.	Source	Kind of lac	Crop and year of processing	Date of receipt (1964)	Seedlac	
					Moisture content %	Total insolubles %
1	Mirzapur	Palas	Baisakhi 63-64	25 May	1·56	3·25
2	Damoh	Palas	Baisakhi 64	12 June	1·64	2·50
3	Balrampur	Ber	Baisakhi 64	17 May	1·85	3·74
4	Daltonganj	Palas	Baisakhi 64	9 June	1·62	3·51
5	Jhalda	Ber	Baisakhi 63-64	13 May	1·94	2·50
6	Gondia	Ber	Baisakhi 64	16 July	1·70	3·53

TABLE 2 — CORRELATION COEFFICIENTS BETWEEN AGE OF LAC AND SPECIFIC HEAT, FLOW AND INSOLUBILITY PERCENTAGE

Correlation between	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Specific heat and age	−0·96	−0·93	−0·93	−0·93	−0·93	−0·96
Flow in mm and age	−0·98	−0·96	−0·92	−0·95	−0·96	−0·98
% Insolubles and age	0·97	0·99	0·75	0·97	0·97	0·98

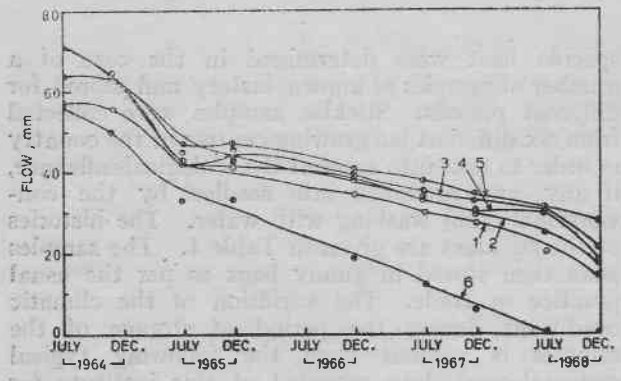

Fig. 2 — Graph showing changes in flow of six samples against time [Numbers along the curves represent sample Nos. as per Table 1]

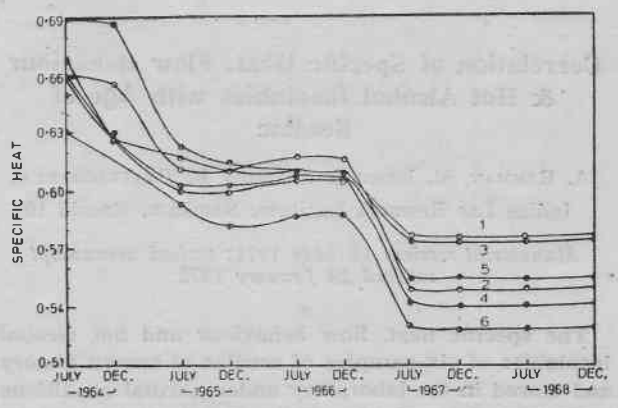

Fig. 3 — Graph showing changes in specific heat of six samples against time [Numbers along the curves represent sample Nos. as per Table 1]

changes in samples after 24 months of storage. In the present study also, similar changes were noticed in all the samples at the end of 48 months. This is contrary to the observations of some earlier workers[1]. It is likely that the samples used by them had already undergone some changes before the start of the experiments, while in the present study, the experiments were started immediately after processing the freshly collected sticklac to seedlac. The curves show a closely similar upward trend at the end of 48 months (Fig. 1) which is also evident in the plots of Rangaswami and De[2].

The plots of alcohol insolubles in Fig. 1 are mostly parallel to the X-axis, indicating so little a variation in the course of storage that the values offer practically no indication of the period of storage. Similarly, in the case of flow (Fig. 2), though it shows a decrease from the initial stage, the slope is rather too small, indicating too little a variation to enable any conclusion to be drawn.

Specific heat — The specific heats of the samples drawn from the lots of six principal lac growing areas are plotted in Fig. 3. It is seen that, in general, the nature of the curves is the same, except for sample 6. It follows that the location of the source of lac has no specific influence. This is considered important, as this method might be helpful for an assay of seedlac in general, irrespective of region, and also because the origin of seedlac remains generally uncommitted by traders.

The specific heat shows a gradual fall up to 2 years, the drop in all the samples becoming noticeable after the first year. The drop after two years is 0·068 and after 3 years 0·119. Thereafter the specific heat remains more or less constant even after 4·5 years of storage. Thus, the specific heats of all the samples stored for 1 year or less are 0·625 and above, and of those for two years of storage 0·590-0·621. The specific heat of samples stored for more than two years is below 0·590. It may be reasonable to conclude that if a seedlac has a specific heat of 0·625 or above, it is less than one year old; if between 0·590 and 0·621, it is 1-2 years old. These ranges may not be very exact but are sufficiently indicative.

From the viewpoint of polymerization of seedlac due to storage, solution viscosity data would also be useful. But to make a true solution of seedlac is always a difficult task, due to several inherent ingredients present in it, including 4·5-6·0% of wax.

By a statistical analysis of the data, the correlation coefficients between age and specific heat, flow and percentage of insolubles have been calculated and are given in Table 2. Analysis shows that the results are highly significant. Age and specific heat and age and flow are negatively correlated, indicating that with increase in age these characters diminish, whereas age and insolubles are positively correlated, indicating that the percentage of insolubles increases with age.

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