Post Harvest Care, Handling and Storage of NRGs

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Resins and gums occupy a prime place among Non-Wood Forest Produce (NWFP), and are known to mankind since time immemorial. These are perhaps the most widely used and traded NWFP's other than items consumed directly as food, fodder and medicine. Use of gums and resins for domestic consumption and sale to earn some cash is very common among the forest dwelling communities, particularly tribals in India.

Lac, being a natural resin, finds innumerable uses in different fields. It continues to be in demand in spite of the stiff competition it is facing from the synthetic resin. The lac crop is harvested for two purposes i.e. for the resin and for brood purposes. For obtaining the resin, the immature lac is harvested and scraped from the twigs of lac producing trees and marketed as *sticklac*. The broodlac is equivalent to seed in other crops from functional point of view and is harvested for infestation of other trees for raising the next lac crop. The harvesting of broodlac is carried out at a proper time only, whether it is for marketing or for infesting other trees.

The lac resin deteriorates in quality during storage. Therefore, lac and lac based products need proper handling and storage practices for retaining their properties and qualities. The deterioration in physical and chemical properties of lac takes place as a result of various chemical changes during storage. As it ages, lac slowly loses its solubility in alcohol, becomes less fluid and possesses poorer life under heat as a result of slow polymerization reactions. The extent of such deterioration depends upon various factors such as method of storage, storage environment (temperature and humidity), type of lac etc. Thus when stored in improper conditions for a long time, the resin becomes useless for all practical purposes which has became a major concern of lac industries.

Polymerization of lac, which is responsible for the degradation of the product, occurs either on heating or aging. Although the mechanism of heat polymerization of lac is well understood, the chemistry involved in the polymerization of lac on aging is far from being resolved (Saha, 1993). One of the early approaches to this problem led to the hypothesis that the changes are due to formation of micellar aggregates (Nagel, 1927). Later on Palit (1942) reported the formation of intermediate product (semi-polymers) during storage. He explained that during storage of lac semi-polymers are continuously being formed through ether linkages. No evidence about the unequivocal character of the product was cited, however, the acid value of lac remains unaltered even after long storage. This suggests that the polymerization of the resin during storage involve reactions other than esterification. There is strong evidence that light influences the course of polymerization reaction in lac during storage. This points out to some photo-chemical reaction in the nature of slow oxidation leading to the formation of peroxides. These peroxides then split into radicals which initiate polymerization. From the reaction scheme proposed by Saha (1992) for the slow polymerization of lac during storage, it may be concluded that oxygen is the agent which initiate the polymerization reaction.

Some studies have been conducted to reduce the heat degradation of lac in its various commercial forms (sticklac, seed lac and shellac). The pioneering work in this direction was undertaken at ICAR-IINRG, Ranchi (Formerly ILRI) by Rangaswamy & De (1944). They tried to store lac under controlled conditions of temperature and humidity (as in air-conditioned godowns) and compare it with ordinary storage. They reported a gradual loss of alcohol insolubility, increase in melting point, and rise in unsaponifiables in both seed lac and shellac during ordinary storage. In addition, life, fluidity and colour of shellac and rate of filtration of seed lac were found to be adversely affected. It was also concluded that storage in A.C. godowns effectively checked the degradation in qualities of lac. However, storage and transportation under air conditions is costly and not always economically feasible. It was therefore necessary to search for alternative methods of storage under ambient

conditions that will stabilize the properties of lac and lac based products during storage. Saha (1993) studied various methods of storage under ambient conditions in order to find the best method of storage. He found storage of dry stick lac (at about 4% moisture content) in Hessian bags was the best. It was also concluded that at ambient temperature, lac should be stored away from light preferably at a relative humidity of around 45%. Use of chemical retarders and antioxidant has also been attempted to control the degradation of lac when stored at room conditions.

Storage methods for lac in its various forms

Sticklac: The fresh sticklac (particularly *ari*) if kept in a heap or bags is liable to coalesce into big lumps that make it very difficult for further processing. Hence, sticklac is generally spread on a floor, preferably earthen floor, and raked from time to time till dry. Loss due to driage may be as much as 30 % in case of *ari* lac and 5 to 10 % for *phunki*. Sticklac can also be stored in heaps of a maximum height of about one foot. Storage of sticklac is usually done in a cool dry place in thatched sheds with proper circulation of air. Dry sticklac having moisture content of less than 4%, is also stored in gunny bags of 50-60 kg capacity.

Seedlac & Shellac: Seedlac and shellac are generally stored in open conditions by spreading on cemented floors in a well-ventilated cool place, which also help in removal of moisture from the products. Aeration is must for storage of shellac and seedlac to reduce blockage. Shellac is normally allowed to cool off after stretching for a few hours and then transferred to a cool-shaded godown, where it is spreaded on floor for 8-10 days. Once dried, shellac can be stored and transported in gunny/paper bags. During summer and rainy season, shellac is best stored in air-conditioned warehouse which maintain a temperature between 14-18^{o}C. Storage under such condition maintains the quality of lac resin although its main function is to prevent shellac from blocking in the hot weather which is encountered for most of the year in India.

While transporting, seedlac & shellac of ordinary grades are packed in gunny bags of 75 kg capacity each. Superior quality shellac is sometimes packed in cloth-lined gunny bags or paper bags (25 kg capacity) for export purposes. Plastic bags are not used for storage/transportation of lac as it sticks to the material under heat and pressure.

Dewaxed lac: Dewaxed lac has a greater tendency to form into blocks at ambient temperature than those containing wax and extra precaution is necessary in storing de-waxed lac. Dewaxed and decolourized lac should always be kept in cold storage and transported in refrigerated containers.

Bleached lac: bleached lac is manufactured in two forms viz. hanks and powdered form. Packing and storing of hanks or bars presents no problem. Bleached lac in the dry powdered condition, however, needs some care and is usually stored in plastic sheets/trays inside cold rooms at 18-20^{o}C temperature. In such condition, bleached lac does not block or deteriorate on storage if the moisture content is less than 2.5%. For transportation, it may be packed in bags or sacks made of water-proof materials like resin treated paper bags and laminated paper cartons.

Button Lac: Buttons tend to stick together during rainy season when the relative humidity is high. It is usually stored in loose, by spreading on cemented floor inside dark and aerated rooms. It can be stored up to one year at ambient conditions. For transportation to long distances it is packed in cartons and bamboo *tokri* (around 20 Kg capacity).

Storage methods for gums and other resins

Guar gum: Guar gum powders are generally packed only in sound clean, dry and un-used polythene bags placed inside gunny bags or multi-ply craft paper sacks. Guar gum powders and its derivatives are stable in dry form. It has a long storage life in its dry form provided that it is warehoused properly. The properties of guar gum remain unchanged for 12-18 months. However, when exposed to humid conditions, guar gum absorbs moisture which results in microbiological degradation, fermentation and

lumping of the powder and the properties of the gum is adversely affected. Hence, guar gum should be packed in moisture proof packets/containers and stored in a cool dry place away from heat and sunlight. It is advised to consume the guar gum within a reasonable time period once the bag is opened. The shelf life of guar gum may be extended by adding suitable preservatives.

Gum arabic: The crude gum arabic is stored and exported either in burlap or jute sacks. The graded gum is packed in heavy duty bags of about 80 kg each. The US regulations require that only new, unused jute sacks are used. Semi-processed and processed kibbled variety, granules and powdered gum Arabic is exported in drums, polyethylene lined multi-wall paper bags or polyethylene lined cardboard boxes. Gum arabic, when stored in cool (21 -24^{o}C) and dry place, has an unlimited shelf life.

Gum karaya: Gum karaya tends to agglomerate or form lumps when exposed to wet and humid conditions. Therefore, handling recommendations include storage in sealed polythene lined containers. For extended storage, materials should be warehoused in a cool, dry place. The graded gum is packed in heavy duty bags of about 80 kg each. Sometimes the gum is powdered and packed in 5 to 6 kg kraft paper bags or 75 to 100 kg fibre drums. In dry form, Karaya loses viscosity in storage, especially under high heat and humidity, the rate of loss for powdered material is more as compared to granules. To minimise this, storage under colder temperature is advised. The viscosity loss of Karaya dispersions in storage can be minimised by the addition of preservatives like benzoates, sorbates, phenols and related compounds.

Gum ghatti: Graded gum ghatti is usually packed in burlap bags of 50 kg capacity for storage and transportation purposes. Warehousing in a cool, dry place is recommended for extended storage. If the gum becomes damp, it tends to agglomerate and form lumps.

Rosin: Rosin is packed in Tin Patra Barrels of 200 kg capacity and store in cool condition under shed.

Propolis: In general, propolis is fairly stable, but proper storage is important. Propolis and its extracts should be stored in airtight containers in the dark, preferably at less than 10 ˚C-12 ˚C and away from excessive and direct heat. Very old propolis from the hive should not be mixed with fresher propolis. Over 12 months of proper storage, propolis will lose very little or none of its antibacterial activities. Alcohol extracts may be stored even longer.

References

Jaiswal, A.K. and Sharma, K.K. 2003. Post harvest care of broodlac and transportation. *Training manual on scientific cultivation and uses of lac*. Published by Indian Lac Research Institute, Namkum, Ranchi: 52-55.

Mukhopadhyay, B. and Muthana, M.S. (Editors). 1962. *A Monograph on Lac*, Published by Indian Lac Research Institute, Namkum, Ranchi.

Palit, S.R. 1942. *J. Indian Chemical Society*, Ind. News Ed. 5.

Rangaswami, M. and De, S.C. 1944. *Effect of storage on lac*, Bulletin No. 56, Indian Lac Research Institute, Ranchi.

Saha, S.K. 1992. Mechanism of degradation of lac on aging. *J. Polym. Material*, 9: 229-234.

Saha, S.K. 1993. Studies on storage of lac. *Indian Shellac*, March: 17.