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ASSESSING THE PROPERTIES OF LAC MIXED WITH SALT DURING STORAGE

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ABSTRACT

Lac is a natural resin secreted by tiny insects called *Kerria lacca* (Kerr.). Mixing of salt (sodium chloride) in fresh scraped lac is commonly practiced in some places such as Gujarat, West Bengal etc. to avoid lump formation during storage and transportation. Fresh kusmi scraped lac was mixed with salt and a control sample were kept separately in jute sack for three years at ambient condition. The scraped lac samples were washed with 0.1% washing soda (sodium carbonate) and converted to seedlacs at regular interval of six months. Physico-chemical and coating properties of seedlac were studied. Yield of the seedlac obtained from salted sample was less (~ 8%) in comparison to that obtained from control sample. Flow, hot alcohol insoluble and color index were found better in seedlac obtained from salted sample, while life under heat and rate of filtration were better in seedlac obtained from control sample. Coating properties such as gloss, scratch hardness, impact resistance and flexibility was found inferior in seedlac obtained from salted sample to that of seedlac obtained from control sample.

***Key words*:** Lac**,** Scraped lac, Seedlac, Salt, Storage, Physicochemical, Coating properties.

Introduction

Lac is a common term used for a natural resin secreted by tiny insects called *Kerria lacca* (Kerr.). Lac insects thrive on the tender shoots of specified host plants such as palas, ber and kusum. Some bushy host plants such as *Flemingia semialata* are also used for lac cultivation (Sharma and Ramani, 2010). The insects suck the plant sap and secrete the resin as their own protective covering. Harvesting the crop, the encrusted shoots are cut from the branches and encrustations are scraped from the twigs, which is called scraped lac or sticklac. The scraped lac is packed and stored in jute sacks and transported to Haats and Mandis for sale (Giri *et al.,* 2010). Removing the impurities such as sticks, stones etc. as far as possible by crushing, sieving, winnowing and washing out the dye with water in primary processing yields the semi refined product known as seedlac. Seedlac is an important commercial product, which is used for preparation of shellac, bleached lac, aleuritic acid etc. (Baboo and Goswami, 2010). Seedlac is melted and converted either into button lac (hand made process) or shellac through hot filtration.

Producing an average of 20,000t of lac annually, India is maintaining world leadership in production of lac (Yogi *et al.,* 2015). Lac is non-toxic, biodegradable and its sources are renewable. It possesses a rare combination of valuable and desirable properties and consequently finding place in diverse areas of applications. Surface coating (Paints, lacquers and varnishes) is the main application area where almost 50% of lac is consumed for polishing, varnishing and finishing of wooden and metal objects. Some other application areas include adhesives, cosmetics, leather, foods, pharmaceuticals, printing ink and electrical industries.

The lac resin undergoes various chemical changes during storage, results in deterioration in the physical and chemical properties (Khanna *et al.,* 1986). Fresh lac possesses good flow (fluidity), life under heat (heat polymerization time) and quickly dissolves in spirit. Flow, life under heat, hot alcohol insoluble, colour index and rate of filtration are the important quality parameters of lac, which determines its quality. As lac ages, it slowly loses its solubility in alcohol, becomes less fluid and possesses poor life under heat as a result of slow polymerization reactions. Polymerization of lac, which is responsible for the degradation of the product, occurs either on heating or aging. The extent of such deterioration depends upon various factors such as method of storage, storage environment (temperature and humidity), type of lac etc. (Saha, 1992; Giri *et al.,* 2010; Goswami *et al.,* 2009).

In lac trade, mixing of ingredients such as oxalic acid, titanium dioxide and rosin are very common. Seedlac is treated with oxalic acid to improve brightness and reducing the colour of seedlac; attracting customers. It has been reported that treatment of oxalic acid increased the rate of polymerization of shellac (Goswami

Mixing of salt checked the lump formation of lac in rainy season, improved flow, solubility per cent and colour while decreased life, filtration rate and coating properties of lac.

et al., 2009). Mixing of titanium dioxide to seedlac reduces the colour of button lac in a great way, but it adversely affects the properties of lac. Mixing of rosin to seedlac improves flow, life under heat and desired colour of shellac, at the cost of degrading coating properties of lac (Ansari *et al.,* 2013). It was found that in some places such as Gujarat and West Bengal, common salt (Sodium chloride) is mixed in fresh scraped lac, especially in rainy season (Katki) crop to avoid lump formation of lac during storage and transportation. The present study was carried out with an objective to assess the changes in quality parameters of lac mixed with salt during storage.

Material and Methods

The fresh *kusmi* scraped lac was taken from Institute Research Farm (IRF). Salt used was purchased from local market. The scraped lac was mixed with salt (Sodium chloride) (5% w/w) and kept in jute sack at ambient temperature as also a control sample. The samples were monitored regularly during storage and studied for three years at six months interval. The samples were crushed and washed with 0.1% washing soda uniformly at every six months of storage.

Determination of physico-chemical properties

Different physicochemical properties such as flow, life under heat, hot alcohol insoluble, colour index and rate of filtration of seedlacs were studied as per IS: 6921-1973.

Determination of coating properties

20% solutions of seedlac were prepared in ethanol. Films of the solutions were developed on pre-cleaned and degreased tin panels and glass slides by flowing method. Curing of films was done at ambient temperature for 7 days (Kumar, 1965). Coating properties such as finish and gloss, adhesion and flexibility, scratch hardness, impact resistance, water resistance and chemical resistance of the films were studied using standard procedure.

Gloss of the films was measured on tin panels with the help of gloss meter at an angle of 45° according to ASTM: D 523-99. Gloss was recorded comparative in respect of standard black stone (57%). Flexibility was measured as per ASTM D522, with conical mandrel by rotation of the roller frame, tapers from 37 to 3mm diameter. Scratch hardness of films coated on tin panels was measured by an automatic scratch hardness tester as per British Standards Method of test for Paints (BS3900: Part E2). The impact resistance of the cured film samples on tin panels was conducted as per BS 3900 (Part E3) by dropping a hemi-spherical shaped indenting tool (diameter 7mm) weighing 10.5 lb (4.75Kg) from 22.5 inch (55cm) height over the panels. Water resistance was carried out according to ASTM D 5402. Here the glass slides coated with sample were dipped in water for 7 days. Wax sealing of the coated glass slides from all the sides was done prior to dipping in the water. Chemical resistance test was carried out by dipping the glass slides coated with samples in the chemicals. The chemicals used were H_2SO_4 (10%), NaOH (10%) and Ethyl methyl ketone (EMK). The coated glass slides were sealed with wax from all the sides before dipping in the chemicals so as to expose the materials to the chemicals.

Results and Discussion

Samples stored for six months resulted that the control sample coalesced together and lump formation took place, while the sample mixed with salt remained as such (separated), may be due to salt absorbed moisture from the scraped lac. As the summer and rainy seasons were over, the control sample lost agglomeration slowly and turned into smaller lumps. The samples were crushed and washed with 0.1% caustic soda solution uniformly. During washing, it was observed that higher amount of colour (dye) came out from salted sample in comparison to that of control sample. Yield of the seedlac obtained from salted sample was less (69%) in comparison to that obtained from control sample (77%). It may be due to cleansing effect of salt, as it is known as good cleansing agent and also good preservative. Seedlac obtained from salted sample was apparently brighter and lighter in colour compared to that obtained from the control sample.

Physico-chemical properties of both the seedlacs were studied, have been depicted in table 1. Analysis of data revealed that hot alcohol insoluble %, flow, color index and rate of filtration were better in seedlac obtained from salted sample than those of the seedlac obtained from control sample, may be because of the

Table 1: Physico-chemical properties of seedlac obtained from salted scraped lac and control samples.

Properties	Seedlac obtained from salted scraped lac	Seedlac obtained from control scraped lac
Yield (%)	69.00	77.00
Hot alcohol insoluble %	2.40	4.51
Flow (mm)	52.00	44.00
Life (min.)	42.00	47.00
Colour index	10.00	17.00
Rate of filtration (in ml. at 30 ^{0}C)	88.00	86.00

cleansing effect of salt, making seedlac brighter and lighter in colour.

Effect of salt on different properties during storage

After a year of storage, it was found that jute sack having control sample degraded and decomposed at the contact area with surface and a big hole was formed while jute sack having salt mixed sample did not show any effect. It is inferred that microorganisms were developed in control sample, causing damage to the jute sack while the salt checked the development of microorganisms in salt mixed sample. The sample mixed with salt showed fungal attack in next rainy season may be due to the presence of salt which absorbed moisture from the atmosphere leading to fungal development. A very characteristic phenomenon was observed after a year of storage that the sample mixed with salt was apparently darker in colour compared to the control sample due to long contact of the sample with salt. But as the samples were washed, seedlac obtained from salted lac was lighter in colour than those of control sample.

In continuation of the study, the samples were processed to seedlac at regular interval of six months for three years. Higher amount of colour (dye) came out from salted sample in comparison to control sample in each washing. Seedlac obtained from salted lac was lighter in colour than that of control. Yield of seedlac obtained from salted lac was lower than control (Fig. 1).

Flow

Flow of seedlac obtained from salted lac was found to be higher than those obtained from control sample, may be because of less wax material and impurity present in seedlac due to washing in the presence of salt. Flow of seedlac decreased with age but the rate of decrease was higher in seedlac obtained from salted sample as compared to control sample and flow of seedlac obtained from control sample was recorded higher after three years of storage (Fig. 2).

Life under heat

Unlike flow, life under heat of seedlac obtained from salted sample was lower to that of control sample and decrease in life of the samples was found to be uniform with age (Fig. 3). Rate of polymerization increased in seedlac obtained from salted lac at high temperature, may be due to more washing in presence of salt leading to more removal of wax present in scraped lac. (Fast degradation in life of seedlac was observed).

Hot alcohol insoluble percentage

Hot alcohol insoluble was found to be higher for seedlac obtained from control sample than those obtained from salted sample, but insolubility increased faster in seedlac obtained from salted sample (Fig. 4). This also indicates the fast polymerization of seedlac obtained from salted lac leading to increase in hot alcohol insoluble percentage.

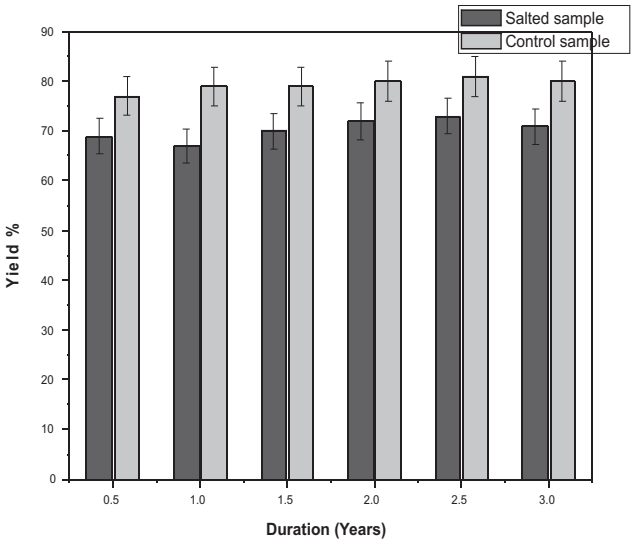

Fig. 1: Yield % of seedlacs obtained from salted and control samples.

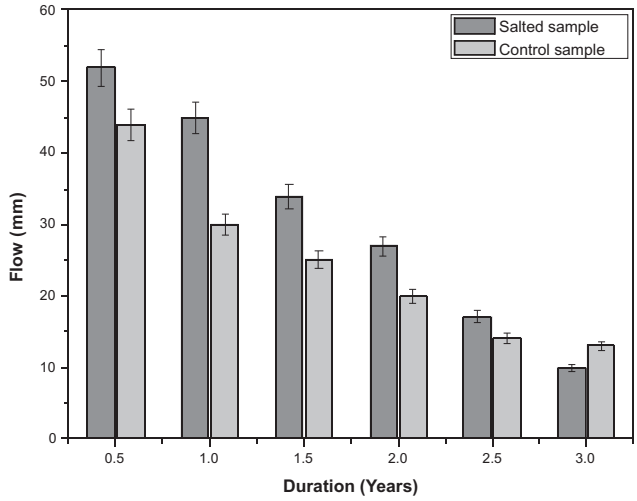

Fig. 2: Flow of seedlacs obtained from salted and control samples.

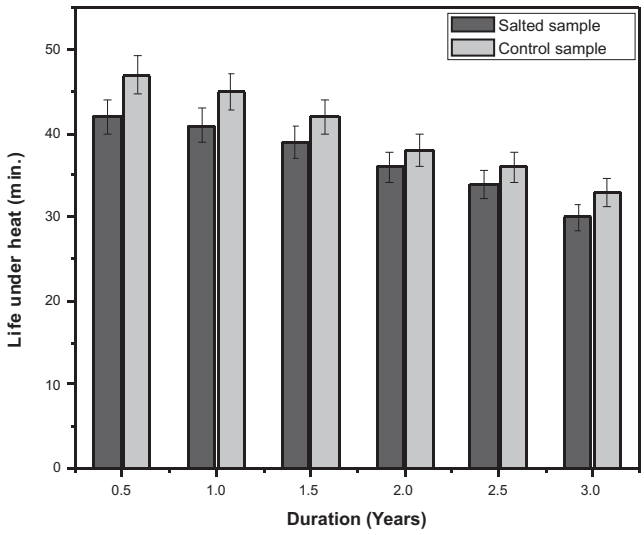

Fig. 3: Life under heat of seedlacs obtained from salted and control samples.

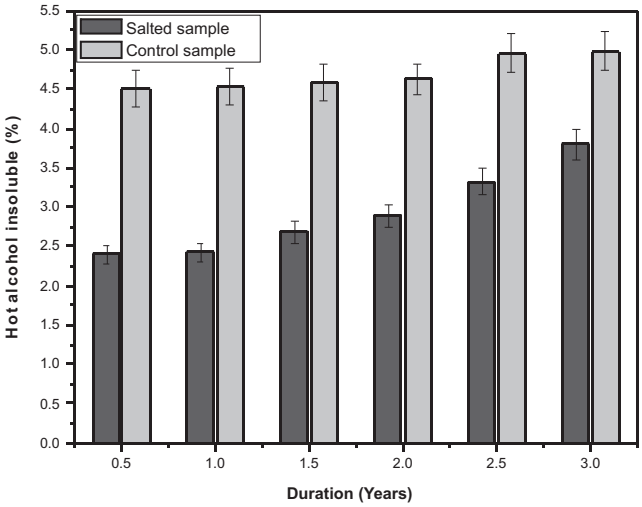

Fig. 4: Hot alcohol insoluble % of seedlacs obtained from salted and control samples.

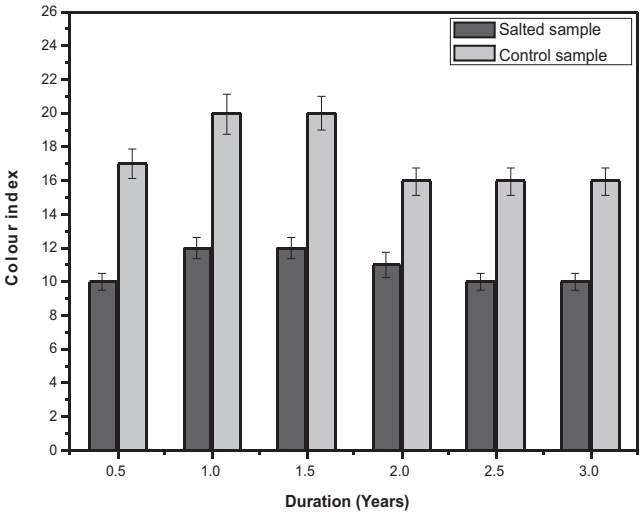

Fig. 5: Colour index of seedlacs obtained from salted and control samples.

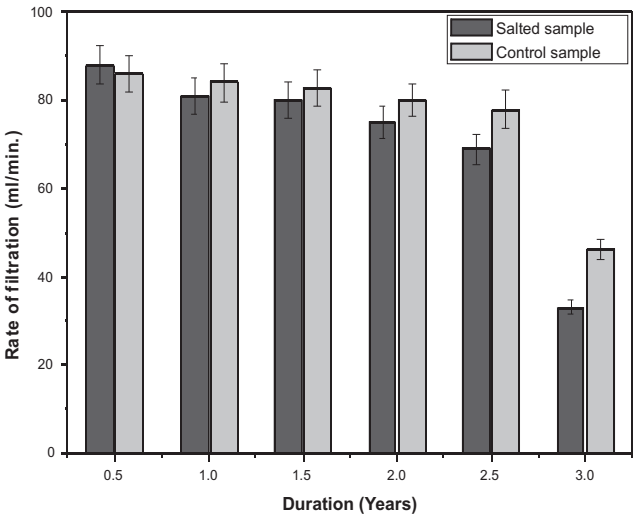

Fig. 6: Rate of filtration of seedlacs obtained from salted and control samples.

Colour index

Colour of the seedlac obtained from salted sample was found to be lower than that of seedlac obtained from control sample (Fig. 5), due to washing of scraped lac in presence of salt. Washing along with salt washed away higher concentration of lac dye (colour) from the salted sample.

Rate of filtration

Rate of filtration of solution of seedlac obtained from salted sample was initially found to be slightly higher than that of solution of seedlac obtained from control sample, but recorded reverse thereafter. Rate of filtration decreased with age and fast decrease was recorded for seedlac obtained from salted sample, may be due to increase in polymerization (hot alcohol insoluble percentage) of seedlac (Fig. 6).

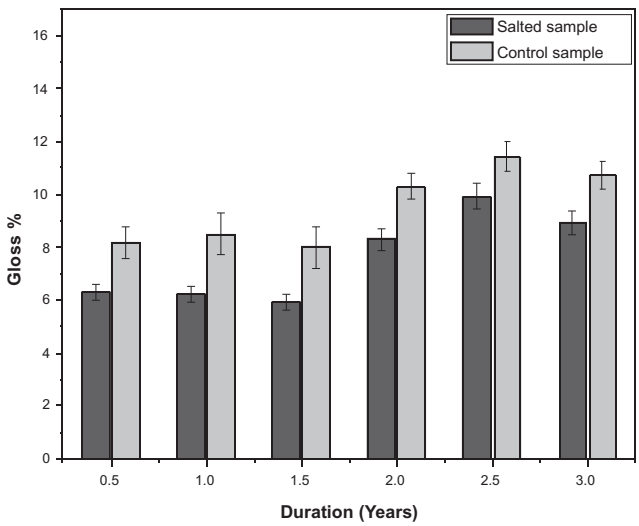

Fig. 7: Gloss of films of seedlacs obtained from salted and control samples

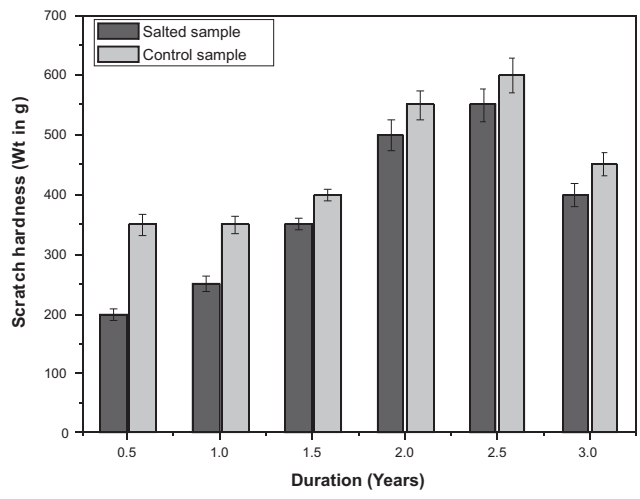

Fig. 8: Scratch hardness of films of seedlacs obtained from salted and control samples.

Coating properties

Coating properties of the seedlacs obtained from salted and control samples were studied. It was found that coating properties such as gloss, scratch hardness, impact resistance and flexibility was better in seedlac obtained from control sample in comparison to that of salted sample. No marked difference in water and chemical resistance was observed.

Finish and gloss

Significant difference was observed in gloss percentage of films of seedlac solutions. Gloss of seedlac obtained from control sample was higher than salted one (Fig. 7). It is believed that salt decreased glossiness of the films. Gloss of the films was found to be increased uniformly with age for both the seedlac samples.

Scratch hardness

Scratch hardness was found to be higher for the seedlac obtained from control sample than that obtained from salted lac, because of seedlac obtained from control sample is having higher content of wax (Fig. 8). It is thought that salt washed away the wax present in lac, leading to brittleness in the films. Brittleness resulted into lowering down the scratch resistance property of the films.

Impact resistance and flexibility

Impact resistance and flexibility of seedlac obtained from salted sample were also reduced may be due to increase in brittleness of the films which in turn resulted by the presence of salt.

Conclusion

Based on the study, it may be concluded that mixing of salt in rainy season lac crop checked the coalescing, lump formation of scraped lac and degradation of jute sack. Seedlac from salted lac

Yield of the seedlac obtained from salted sample was less (approximately 8%) in comparison to that obtained from control sample. Seedlac obtained from salted sample showed better flow, lesser hot alcohol insoluble % and lighter color while life under heat and rate of filtration were found better for Seedlac obtained from control sample. Coating properties such as gloss, scratch hardness, impact resistance and flexibility were found inferior for seedlac obtained from salted lac to that of seedlac obtained from control sample.

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भण्डारण के दौरान लवण के साथ मिश्रित लाख के गुणों का मूल्यांकन

एम.एफ. अंसारी, एस.के. गिरी एवं बी. बाबू

सारांश

लाख एक प्राकृतिक राल है, जिसे *केरिया लाका* (केर.) नामक छोटे से कीट द्वारा निस्सारित किया जाता है। ताजे निकले लाख में लवण (सोडियम क्लोराइड) का मिश्रण करना कुछ स्थानों यथा- गुजरात, पश्चिम बंगाल, में आम प्रक्रिया है ताकि भण्डारण एवं परिवहन के दौरान पिण्ड संरचना होने से बचा जा सके। ताजे कुसमी लाख को लवण के साथ मिश्रित किया गया और नियंत्रण नमूनों को परिवेशी अवस्था में तीन साल के लिए जूट सैक में अलग से रखा गया। स्क्रैप किए गए लाख नमूनों को 0.1 वाशिंग सोडा (सोडियम कार्बोनेट) से धोया गया और छः माह के नियमित अन्तराल पर सीडलैक में रूपान्तरित किया गया। सीडलैक के भौतिक-रासायनिक एवं लेपन गुणों का अध्ययन किया गया। लवणित नमूनों से प्राप्त सीडलैक का उत्पादन नियंत्रण नमूनों से प्राप्त उत्पादन की तुलना में कम (~8) था। लवणित नमूनों से प्राप्त सीडलैक में प्रवाह, उष्ण अल्कोहल अविलेय एवं रंग तालिका बेहतर पाई गई जबकि नियंत्रण नमूनों से प्राप्त सीडलैक में ताप के तहत जीवन और निस्यंदन की दर बेहतर थी। लेपन गुण, यथा- चमक, खरोंच कठोरता, प्रभाव प्रतिरोध एवं नमनीयता, नियंत्रण नमूनों से प्राप्त सीडलैक की तुलना में लवणित नमूनों से प्राप्त सीडलैक में निम्न पाया गया।

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