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A REVIEW PAPER ON LAC AND LAC DYE

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ABSTRACT

In the early 21st century the market for natural dye in fashion industry experiencing a renaissance. The greater part of natural dyes are vegetable dye obtained from plant source but there are dyes also obtained from insects e.g. Lac Dye. They can also produce different shades of color. The present review paper provides an overview on potential of Lac and Lac dye.

KEYWORDS: *Lac, Lac dye, Dyeing, Assessment*

INTRODUCTION

Dyeing is an ancient art as well as modern complex science. Primitive people have been endeavoring to add color to the world around them. Primitive dyeing technique includes stamping plants to fabric or rubbing crushed plant pigments on to the cloth. They used natural matter to stain hides, decorate shells and feathers and also to paint their story on the walls of ancient caves. Lac dye is obtained from an insect Coccus laccae, found on the twigs of certain tree native to Southeast Asia. The insect produces a resin known as sticklac. Lac dye is based on anthraquinoid type of structure and composed of laccaic acid and erythrolaccin. Laccaic acid is a water soluble compound whereas erythrolaccin is water insoluble. During the extraction of lac dye, the amount of dye depends on the percentage of laccaic acid present in stick lac (Gupta and Prasad1993). The insect lac, *Laccifer lacca* or *Kerria lacca* belongs to family Lacciferidae. Lac insect is soft-bodied, round tiny creature, which completes its life cycle on host plants within six months. During the life cycle, it secretes reddish brown gelatinous substance around the branches of host plants, which gives sticklac.

Lac dye is acidic in nature, soluble in water and other solvents such as methyl alcohol, amyl alcohol, acetone, acetic acid, formic acid, but insoluble in ether, chloroform and benzene. Since lac dye is acidic in nature can safely be applied to protein substrates such as wool, silk, and other animal hair.

Lac Production

India is the leading lac producer, with an annual production of over 20,000 tons (Sharma et al., 2006) and 75 per cent of it is exported to over hundred countries mainly in processed and semi-processed forms. Lac makes a significant contribution to the foreign exchange earnings of the country. During the year 2004-05, India earned a foreign exchange to the tune of Rs 165 crores from Lac. Lac cultivation has a potential for generating employment for both men and women. Lac cultivation is being carried by all types of farmer i.e. marginal, small farmers and big farmers. The lac production in India is mainly restricted to the states of Chhattisgarh, Jharkhand, Madhya Pradesh, West Bengal, Maharashtra, Orissa,

besides a few others (Sharma et al., 2006). Chhattisgarh state ranks first in the production of lac in India followed by Jharkhand (Khobragade et al., 2012). Madhya Pradesh is the third largest producer of lac in the country.

Extraction of Lac Dye

Indian Lac research Institue (2006) presented a note on lac dye entitled "Lac dye-A potential material for proteinous fibers." Lac dye is important by- product of lac industry; when stick lac is crushed and washed with water, the water-soluble dye nearly 1.0 per cent dissolves and is thrown off as a lac effluent. A study entitled "Reclamation of lac dye from lac effluents" was carried out by Ghosh *et al.* (1964). Powdered stick lac sludge (1 kg) was thoroughly mixed with the required amount of powdered borax (100-200g), and a little water (200-230 ml), left overnight for ageing. Thereafter, sufficient water was added to make it one per cent borax solution and stirred for an hour. Then 5 ml of glacial acetic acid was added with stirring, than the coagulated matter and other suspended impurities are allowed to settle. After about 2 hours the clear liquid was acidified with 50 per cent sulphuric acid. The precipitated lac dye was again filtered through cloth and sun-dried or dried in a steam-heated stainless steel vessel. The dry mass was powdered which contain 70-75 per cent dye.

Prasad and Agarwal (1989) presented a paper on "Insect dyes-An industrial perspective" in the compendium of the first national seminar on natural dyes at Lucknow. The crushed stick lac was washed thoroughly with water. The solution was allowed to settle, and the supernatant liquid is taken off. The PH of the solution was brought to 8 by addition of caustic soda and then treated with calcium chloride (with agitation). The precipitated dye was filtered and washed to make it free from impurities. Paul *et al.* (1996) conducted a study on "Natural dyes: classification, extraction and fastness properties." Lac dye can be obtained by extracting stick lac with water and sodium carbonate solution followed by precipitating with lime. Patra (1998) carried out an experiment on "Potential of lac dye." Stick lac was crushed into pieces, wetted with water and kept overnight. The wet pieces of stick lac were churned. The water-soluble dye is driven out during churning. The solution was filtered, and the extracted dye was found to be 50 to 98 percent pure.

Chemistry of Lac Dye

Paul *et al.* (1996) conducted a study on "Natural dyes: classification, extraction and fastness properties." Lac contains water-soluble red dye, laccaic acid an alkali and spirit soluble yellow dye, erythrolaccin. The laccaic acid obtained is the mixture of several closely related coloring matters. The crude dye is fractionated by column chromatography into five fractions, designated as laccaic acid A,B,C,D, and E respectively, of which A and B are the major constituents. Laccaic acid A contains 2.5% nitrogen and has the molecular formula C26 H19 NO12. Laccaic acid B has no nitrogen and its molecular formula is C24 H16 O12. It is characterized as alcohol corresponding to laccaic acid A, where -OHreplaces -NHCOCH3. Laccaic acid C, crystallized from methanol is the first naturally occurring anthraquinone, carries an amino acid side chain. Laccaic acid D has the molecular formula of C16 H10O7, is found identical with xanthokermisic acid. Laccaic acid E is found to be deacetyl laccaic acid A. An experiment has been carried out by Patra (1998) entitled "Potential of lac dye". Lac contains water-soluble red dye laccaic acid,alkali and spirit soluble yellow dye erythrolaccin. Laccaic acid responsible for dyeing is a hydroxy anthraquinone carboxylic acid. Lac dye is acidic in nature and is generally present as its sodium/potassium salts, which are completely soluble in cold water. On the other hand, the pure dye is sparingly soluble in cold water but highly soluble in boiling water.

Dyeing of Lac Dye

The study on "Lac as a natural dye" was carried out by Agrwal (1997). Lac dye is acidic in nature melts above 23^{o}C.Dissolves 50 to 55 per cent and 98 to 99 per cent in cold water and boiling alcohol respectively. An investigation was carried out by Patra (1998) on "Potential of lac dye". Silk yarn was mordanted with 2 to 5 per cent mordants. Dye bath was prepared with the M.L. ratio of 1:30, and dyed for an hour at boiling temperature in acidic condition. A little solution of myrobalan (*Terminalia chebula*) was added during dyeing to the dye bath to achieve greater fastness. pH of the dye bath was maintained by addition of small quantities of acetic acid.

Gupta and Prasad (1993) conducted a study on "Lac dye-A potential material for coloring food and proteinous fibers." Lac dye is non-toxic, soluble in methyl alcohol, amyl alcohol, acetone, acetic acid and formic acid but insoluble in ether, chloroform, and benzene. It dissolves slowly in ethyl alcohol. The aqueous solution is orange-red whereas alkaline solution is reddish violet. It also dissolves in concentrated, sulphuric acid with a beautiful carmine red color. Lac dye in general, is applied on mulberry silk, but an attempt on tasar silk was made by Ghosh *et al.* (2001) and studied "Application of lac dye on tasar silk." The dye bath was prepared by maintaining the MLR 1:70 at 60-70o C temperature for 60 minutes. Indian Lac Research Institute (2006) conducted a study on "Lac dye-a potential material for porinous fibers." The stock solution of 1 per cent dye was prepared and filtered through cloth. The dye solution was added to the common salt solution (15 parts on the weight of the material and 50-60 parts iron free water) in the dye bath. The acidic PH was maintained by adding either acetic acid or sulphuric acid and the scoured sample was entered into a dye bath. The bath is heated slowly to boiling in 15 minutes and maintained this temperature for an hour. Mordant was then added to the dye bath to obtain desired shade.

Assessment of Lac Dye

Kariyappa *et al.* (2006) worked on "Processing of eri cocoon in mill spinning to produce quality spun silk yarn and its characterization". The red eri spun silk yarn when dyed with lac dye, showed better dye uptake, with excellent wash, perspiration and rubbing fastness properties.

Kongkachuichay *et al.* (2001) made an investigation in Thailand "Studies on dyeing silk yarn with lac dye: effect of mordants and dyeing conditions". Experiments were carried out to study the effects of dyeing temperature and time on breaking strength of dyed silk. It is found that dyeing temperature and dyeing time have slightly affected the breaking strength, whereas mordanting methods did not show the significant effect on breaking strength of dyed silk yarn. Gosh *et al.* (2001) conducted an experiment on "Application of lac dye on tasar silk". The wash fastness of pre mordanted samples ranged from 4 to 5. The sample dyed with mordanting has given the wash fastness at the range of 3 to 4. Singh (2000) conducted a study on "Natural dyes: The pros and cons. In general natural dyes have low fastness to light and washing. If innovative methods are used, their potential may be fully tapped. Mordant was more important than the dye itself in determining the light fastness of colored textiles. Red natural dyes are mostly stable to light and washing, but the choice of mordant may in some cases affects the wash fastness. Mahale *et al.*(2000) in the article "Color fastness of are canut dye in acidic pH" revealed that arecanut dyed silk samples pre-mordanted with 1 per cent potassium dichromate and 5 per cent potash alum gave better results for washing, rubbing and perspiration. Among all the samples simultaneously mordanted with 1 per cent concentration of potassium dichromate produced excellent results for all the four agencies in acidic media. The sample post mordanted with 1 per cent copper sulphate and potassium

dichromate exhibited excellent color fastness to four agencies light wash, perspiration and rubbing in acidic media.

CONCLUSIONS

The scenario of natural dyeing is gradually making its way in the global market and the production of eco-friendly naturally dyed textiles itself is a boon to save the environment from hazardous synthetic dyes. Fast moving inexpensive synthetic dyes stand as a big question before natural dyes. But, the non-toxic, non-carcinogenic and eco-friendly characteristics of natural dyes made its own way to reach the hearts of health-conscious consumers. Hence, naturally dyed textiles shall help the entrepreneurs to take up this venture. Though natural dyes are not as brilliant as synthetic dyes but are in variably usual. Lac dye is an ancient dye in India known from Atharuaveda produce unique shades from light pink to dark red can be widely applied in the field of apparel, made-ups, and household furnishings. Thus sky is the limit to produce endless shades from natural dyes. Lac dye is one of the insect dyes. History of lac dates back to Vedic period. Atharuaveda gives a brief account of lac insects and its medicinal values. The Vinaya texts of Buddhists also describe the extraction method of lac dye and its application. Chinese knew the art of dyeing with lac dye about 4000 years ago and was extensively employed for dyeing silk to impart an attractive lustrous red color (Agarwal, 1997). In order to satisfy the demand of green-minded consumers, the lac dye is the safer alternative for dyeing with natural dyes.

REFERENCES

1. *Gupta, D.C. and Prasad, K.M., 1993, Lac dye a potential material for colouring food and proteinous fibres. Regional Workshop on Natural Dyes, pp.156-159.*
2. *Sharma, K.K., Jaiswal, A.K. and Kumar, K., 2006, Role of lac culture in biodiversity conservation: issues to stake and conservation strategy. Curr. Sci., 91(7): 894- 898.*
3. *Ghosh, A.K., Mukherjee, M. and Sengupta, S.C., 1964, Reclamation of lac dye from lac effluents. Res. Ind., 9(5): 129-131*
4. *Prasad, K.M. and Agarwal, S.C., 1989, Insect dyes an industrial perspective, compendiam of the first national seminar on natural dyes, Lucknow, pp.33-34.*
5. *Paul, R., Jayesh, M. and Naik, S.R., 1996, Natural dye : classification, extraction and fastness, properties. Tex. Dyer and Prin., 29(2): 16-23.*
6. *Patra, S.K., 1998, Potential of lac dye. The Indian Tex. J., 108(12): 40-41.*
7. *Agarwal, S.C., 1997, Lac as a natural dye. The Indian Tex. J., 107(10): 26-28.*
8. *Ghosh, S.S., Sengupta, D. and Thangavelu, K., 2001, Application of lac dye on Tasar silk.Indian Silk, 40(4): 27-29.*
9. *Kariyappa, Somasekar, T.H,. Ramaswamy, G.N., Roy, S., Shashidhar, C. and Pattanashetty, R.B., 2006, Studies on processing of eri-cocoon in mill spinning to produce quality spun silk yarn and it's characteristics. Manmade Tex. in India, 49(9): 339-348.*
10. *Kongkachuichay, P., Shitangkoon, A. and Chinwongomorn, 2001, Stuides on dyeing silk yarn with lac dye : effect of mordants and dye concentrations. Sci. Asia, 28(2): 161- 166.*

11. *Singh, O.P., 2000, Natural dyes: The Pros and Cons. The Indian Tex. J., 110(4): 42-46.*
12. *Mahale, G., Sunanda, R.K., Bhavani, K. and Sakshi, 2000, Colourfastness of arecanut dye in acidic pH. The Tex. Ind. and Trade J., 38(11-12): 159-163.*
13. *www.ilri.ernet.in*