

LAC

an introduction...



भारतीय लाख अनुसंधान संस्थान

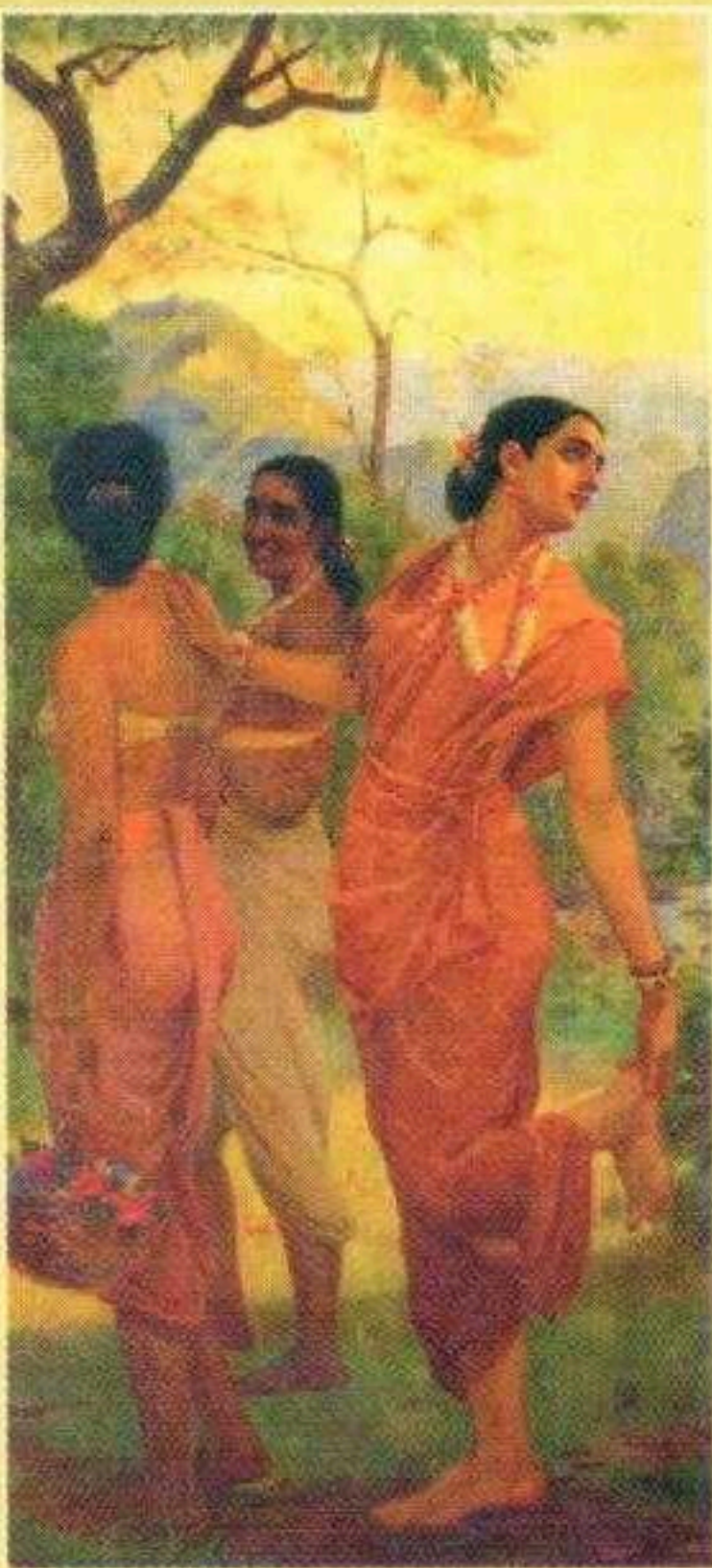
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What is lac?

Lac (*Laksha* in Sanskrit) is a product of commerce derived from a specialized group of plant bugs commonly known as lac insects, which thrive on specific trees called lac hosts. Lac is a source of three basic materials, viz., resin, dye and wax.



Shakuntala, a character in Kalidasa's drama



Lac encrustation

Historical background

The history of lac can be traced back to Vedic period (c. 1500 - 500 BC). Atharva Veda devotes a complete chapter of nine couplets containing vivid description of '*Laksha*' and its use in invigorating potion and wound healing. '*Lakshagriha*' (House of lac) was fashioned by Purochak at the instance of Kauravas as described in the great Indian epic, Mahabharata. A number of medicinal formulations in Ayurvedic and Unani systems contain lac resin or lac dye.

Vinaya texts of Buddhists describe use of lac dye in dyeing of fabrics. Kalidasa's works contain descriptions of use of lac dye for cosmetic purposes. The works of a number of foreign travelers reveal the trade of lac from India to a number of countries during post-vedic and medieval periods

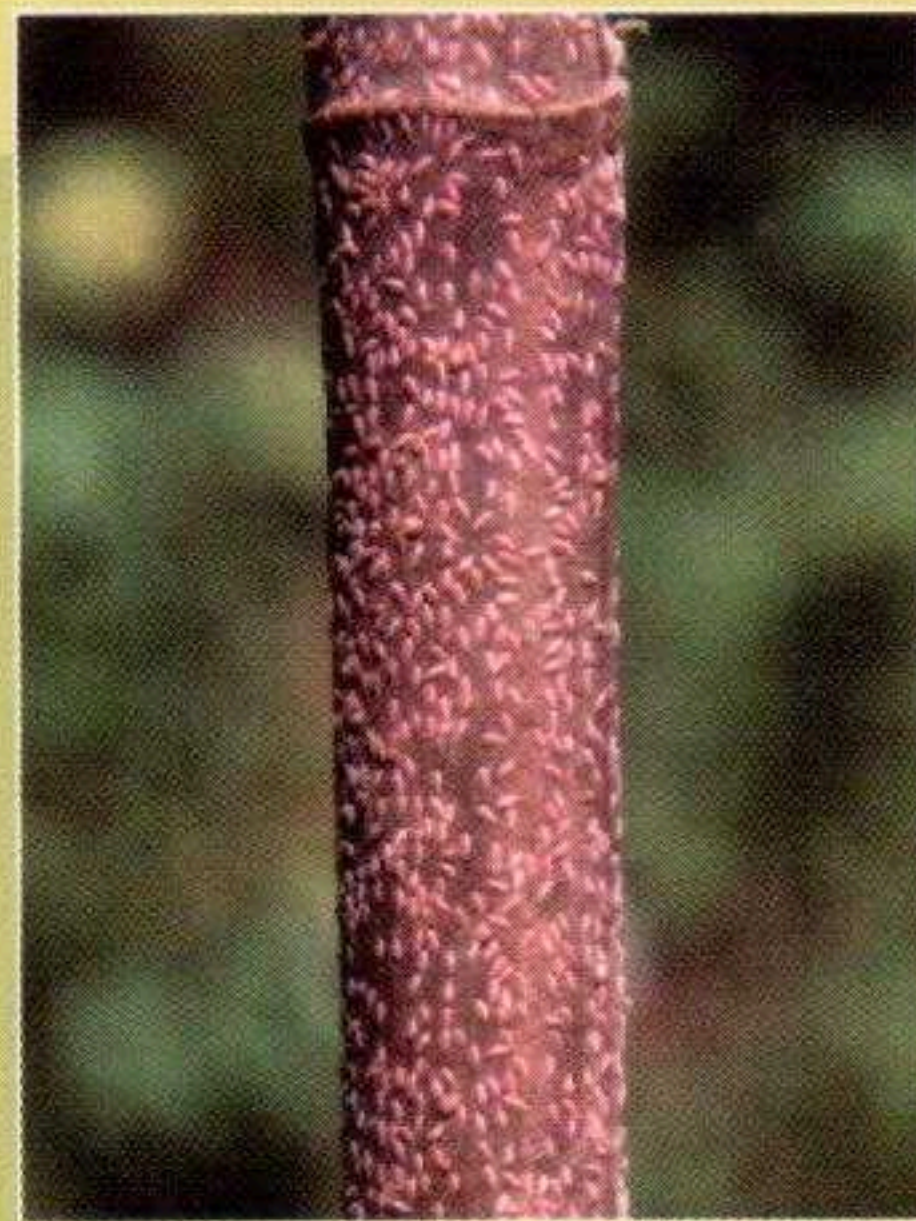
East India Company built up a big commercial lac industry in India. First record of lac dye export to Europe was in 1607, which flourished up to close of nineteenth century. Subsequently, the lac resin exports picked up particularly for use in gramophone industry, varnishes, etc. The use of lac has now diversified into a wide range of areas.

"Taken as a drink thou (lac) grantest life to and protectest (the suffering) man. Thou art (like a mother) the nourisher and comforter of mankind."

(Atharva Veda V Sukta, V Book)

Lac insect, host and culture

Lac insects settle closely on the host plant and derive their food from the sap of the host. Once settled they do not move and become permanently fixed through the resinous secretions, which also forms a protective covering them. The life of lac insect thus becomes inextricably linked with that of its host plant. Fully grown lac insect colonies tend to form encrustations around the shoot of the host.



Newly settled lac insect larvae



Major lac growing belt of India

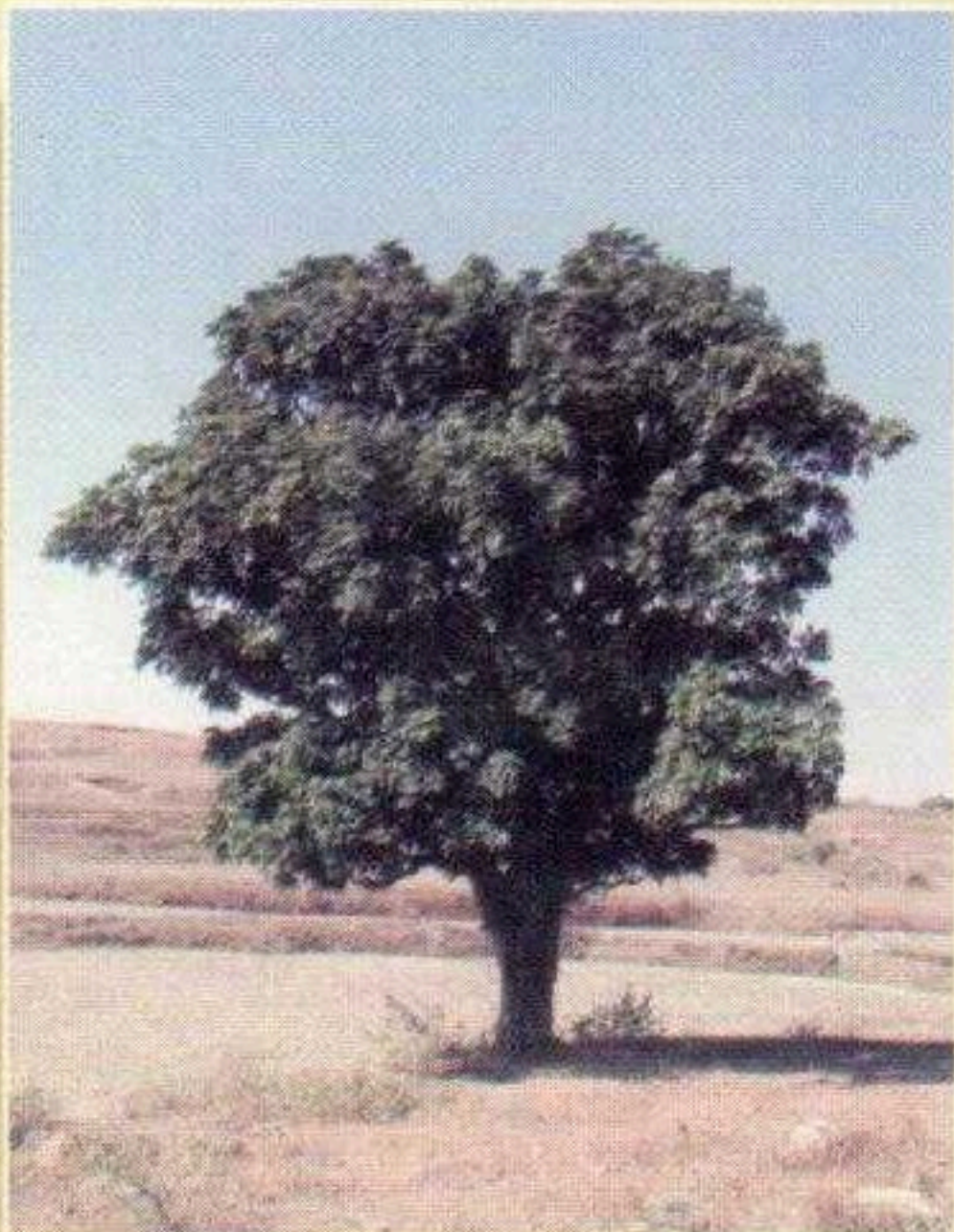
The distribution of lac insects is restricted mainly to tropical and subtropical regions, 40° North and South of Equator. Even though eighty-seven species of lac insects have been reported worldwide, only a few species are useful for commercial lac production.

Moderately hot to mild temperature and humid conditions are favourable for lac culture. Thus, lac production is limited to a few South, South-East and East Asian countries in the tropical forest region.

A large part of India offers climatic conditions suitable for lac production. It is the global leader in lac production; other lac producing countries include: Thailand, Indonesia, China, etc.



Farmers harvesting lac crop



Kusum tree

In India, lac production comes mainly through culture of Indian lac insect *Kerria lacca* on hosts such as, *ber* (*Ziziphus mauritiana*), *palas* (*Butea monosperma*) and *kusum* (*Schleichera oleosa*). Two lac crops are produced, corresponding the two cycles completed by the insect in one year. The Indian lac insect is represented by two infrasubspecific forms, namely, *kusmi* and *rangeeni*, differing for the life cycle pattern, host plant preference and quality of the lac produced. *Kusmi* insect is characterized by high productivity and the best quality of resin produced.

Importance of lac cultivation

Lac cultivation has some unique merits. Some of these are as under :

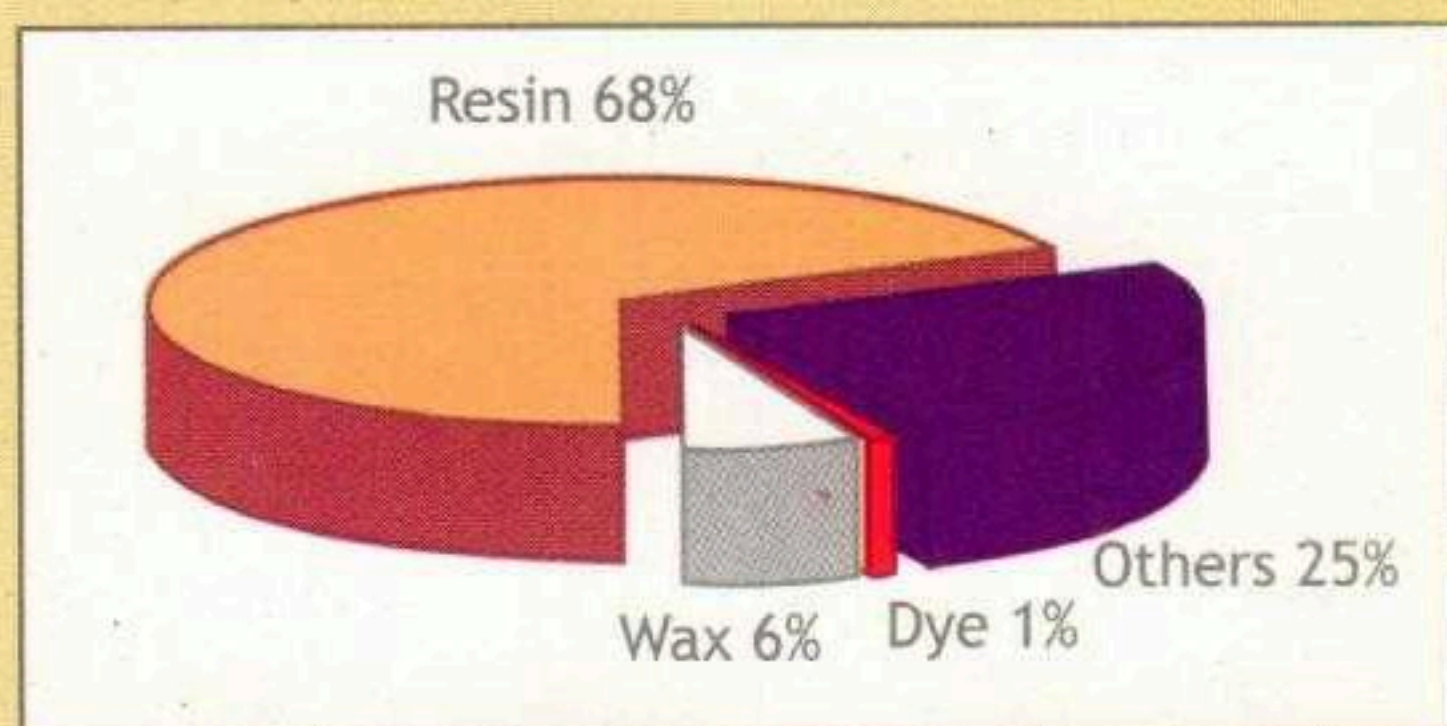
- A good source of livelihood to resource-poor farmers, tribals inhabiting sub-hilly tracts
- It requires no irrigation, meager fertilizers, labour, etc.
- A good crop for marginal and degraded lands. No competition for land or farm operation with agricultural/ horticultural crops
- Highly remunerative cultivation. A hectare of *ber* plantation with *kusmi* lac cultivation can provide net return of 3-5 lakhs/year
- It is like an insurance crop especially during drought years as the crop is very good during such adverse climate
- Lac cultivation involves significant women participation and helps ecosystem development



Lac grower

Lac composition

Lac encrustations are removed from the twigs of host plants by scraping. The raw lac thus obtained is known as sticklac. It contains resin, wax, dye and materials derived from the insect body, bark of host as well as other impurities. The raw lac is therefore refined to obtain the desired components.



Approximate composition of lac



Lac resin

The lac resin is a polyester complex of long-chain hydroxyl fatty acids and sesquiterpenic acids. It can be fractionated into hard and soft resins.



Lac wax

Lac wax is a complex mixture of long-chain acids, alcohols, esters and hydrocarbons.



Lac dye

Indian lac dye is a mixture of at least five closely resembling anthraquinone derivatives called laccaic acids, designated as A, B, C, D and E.

Chemical nature of the three major commercial components of lac

Lac applications

All the important components of lac, viz., resin, dye and wax forming about two-thirds of raw lac find application in an incredibly wide range of areas. Aleuritic acid, a constituent of lac resin is isolated and used as starting material in perfumery industry.

Shellac is FDA (USA) approved food additive, classified under GRAS (generally accepted as safe). Food standards of European Union, Australia, New Zealand also approve shellac. Shellac and lac wax are listed in "Everything Added to Food in the United States (EAFUS)." Use of lac dye in food applications is approved in Japan and China.

(Centrespread depicts diversified application areas of lac)



Food industry

- Coating of fruits
- Coating of candies, chocolates, chewing gums, etc.
- Coating of coffee beans
- Coating of aluminium foils in pizza making
- Marking ink for food
- Glazing paper wrappers for food
- Fortification of cereals with micronutrients



Cosmetic and jewellery industry

- Manufacture of bangles, earrings, etc.
- Manufacture of perfumes
- Hair spray and lacquer
- Eye shadows and liners
- Microencapsulated perfumes
- Lipstick, nail polish, mascara, etc.



LAC RESIN

Pharmaceutical industry

- Coating of tablets
- Coating of lozenges
- Marking ink for capsules, tablets, etc.
- Ayurvedic and unani medicines
- Coating of medicines for slow release



Adhesive industry

- Gasket cement compound
- Optical cement
- Diamond and crystal cutting
- Sealing wax
- Grinding wheel
- Paper adhesive tape
- Masking tape for automobiles and construction



Electrical & electronic industry

- Air-drying and baking-type insulating varnishes
- Cement for fluorescent and CF lamps
- Coating of isolators, PCBs, etc.
- Micanites
- Coating of spark plugs
- Adhesives for Si-chips and solar cells
- Photo registration





Varnish, lacquer and paint industry

- Varnish for wooden furniture and building materials
- Varnish for musical instruments, picture frames, leather items, etc.
- Sealers and repair paints
- Printing ink
- Finishing earthenware and terracottas
- Water thinnable primers and paints
- Lacquering of metal surface and wooden articles
- Correcting ink and pattern paper materials



Miscellaneous

- Stiffening of hat
- Firecrackers
- Handicrafts
- Preservation of paintings
- Bioactive compounds



LAC WAX

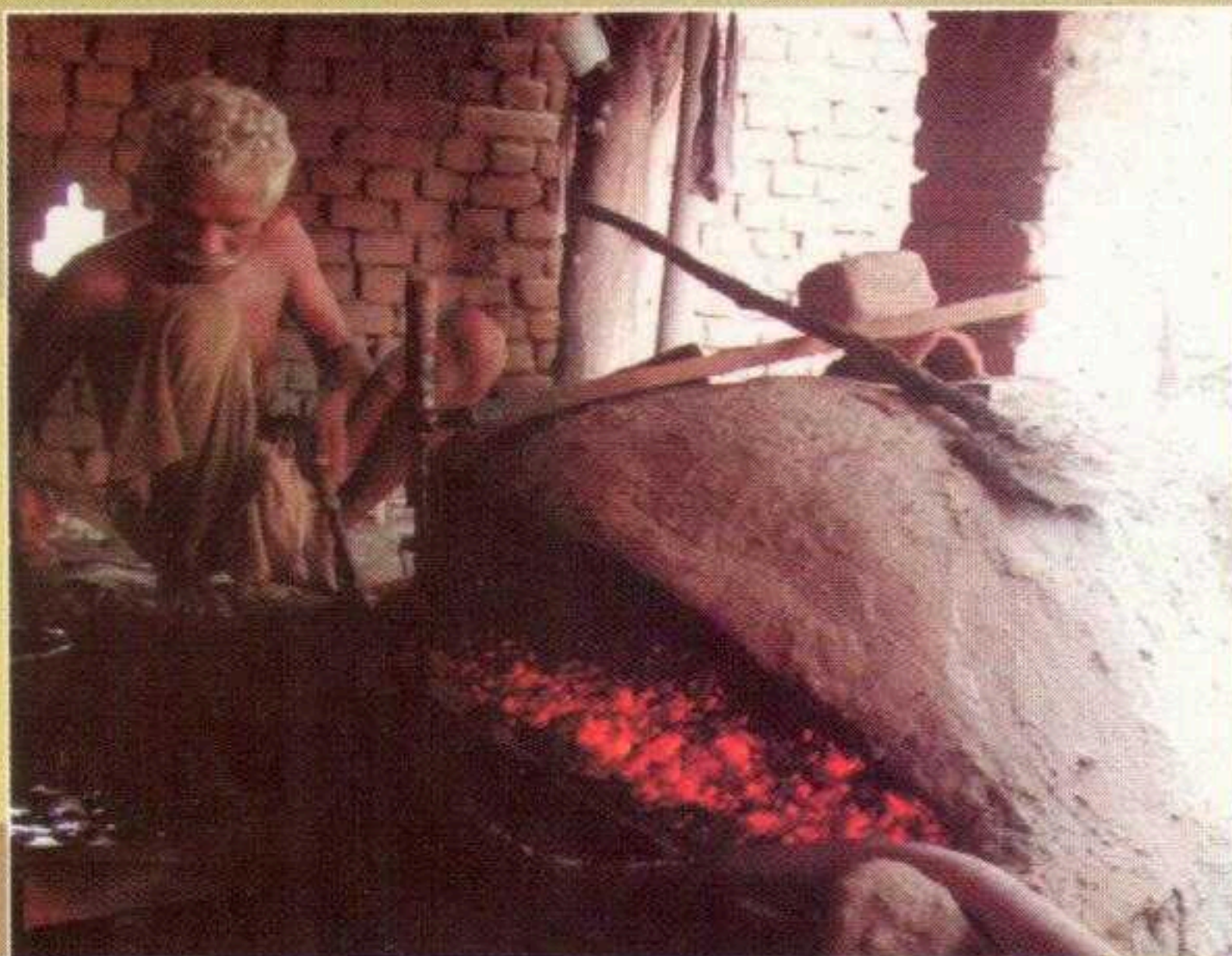
- Shoe, automobile and floor polishes
- Crayons and tailor's chalk
- Lipstick
- Bottle sealer
- Fruit and confectionery coating
- Electrical potting compounds
- Additive to various paint formulations
- Deadhesive agents
- Additive for ink ribbon

LAC DYE



- Dyeing of silk and wool items
- Soft drinks, wines, sauces, etc.
- Chocolate and confectionery finishing
- Sausage finishing
- Bean jams





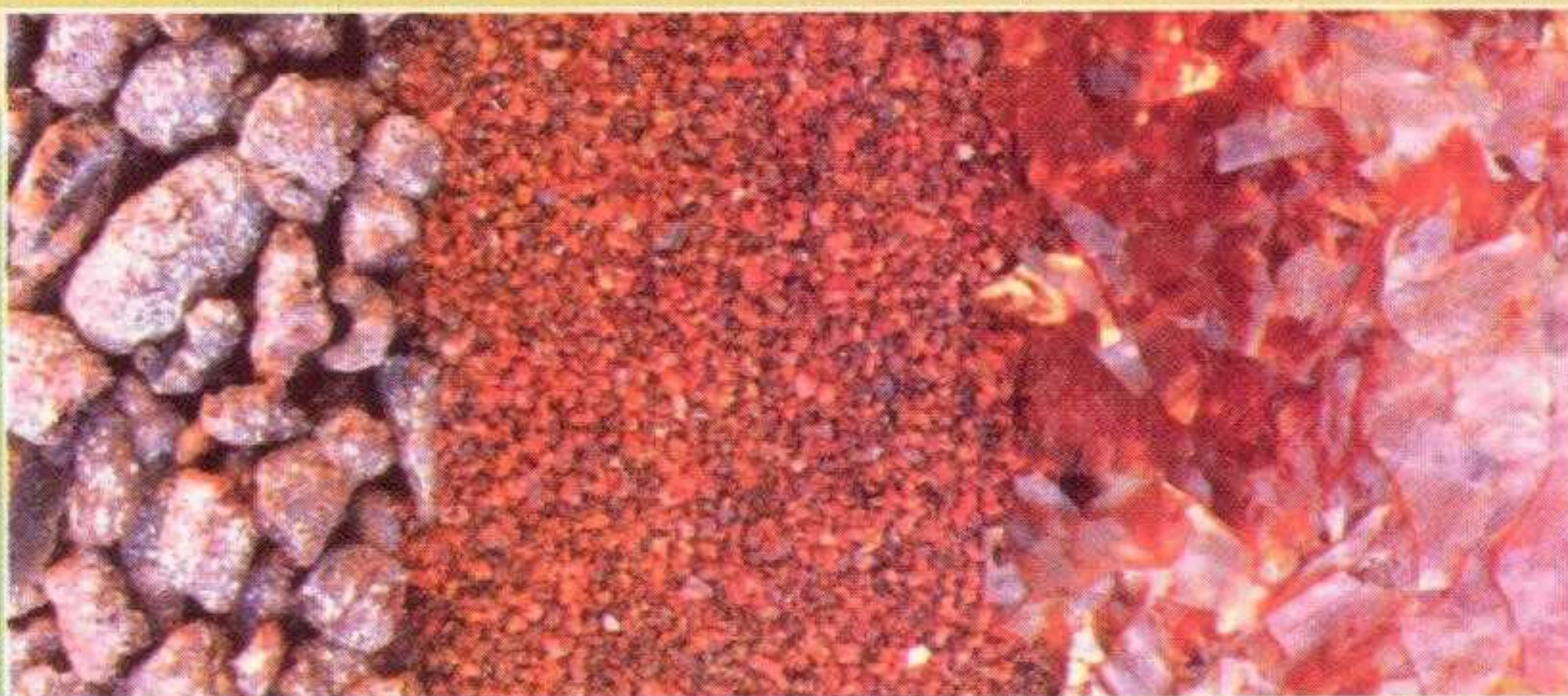
Indian *bhatta* for manufacture of hand-made shellac

Lac processing and industrial scenario

Sticklac is crushed into small grains, sieved, washed with water and dried. The semi-refined resinous product thus obtained is known as seedlac. A major portion of the seedlac is either processed by a system of hot melting, filtering and stretching it into thin sheets of shellac or by a solvent process into dewaxed and decolourised shellac. In India, shellac is manufactured mainly through mechanized process, but some quantity of hand-made shellac is still produced through manual technique popularly known as *bhatta* process. The colour in the resin, which is not desired in some application areas, can be fully removed by a chemical process to obtain bleached lac. All these products contain the resin.

Lac dye can be isolated from the water obtained during the washing of sticklac.

Lac wax is obtained while dewaxing, during the manufacture of dewaxed decolourised shellac and bleached lac.



Raw lac, seedlac and shellac (left to right)

Aleuritic acid (9,10,16-Trihydroxypalmitic acid) is a major constituent acid of shellac. It is obtained through alkaline hydrolysis of lac resin and subsequent isolation. It is mainly being used for the synthesis of perfumery compounds. There has been a spurt in the export of this chemical from India during recent years.



Aleuritic acid

India produces more than 20,000 tons of lac annually. Lac industry is of considerable economic importance to India as it provides livelihood to over one million cultivators. Over 150 lac-processing units are there in the country engaging about 5,000 workers.

A major quantum of the lac produced in India is exported to various countries for varied uses. It exports about 10,000 tons of various grades of lac to over 50 countries. The USA, Germany, Indonesia and Arab Republic of Egypt are some of the major lac importing countries.



Shellac production in mechanized unit

Product standardization

BIS (Bureau of Indian Standards) quality standards have been specified for all the common lac and lac products. ISO standards have also been laid down for certain lac grades. However, the trade is not widely employing these standards in marketing. The Indian Lac Research Institute, Ranchi provides support for the quality evaluation of lac and lac products through its ISO 9001:2000 certified Quality Evaluation Laboratory; other units engaged are: SHEFEXIL and a private firm in Kolkata.



Quality evaluation of lac

Lac-related organizations

There are several organizations in India, which support the lac industry in the country.

Indian Lac Research Institute, Ranchi

(www.icar.org.in/ilri)

The Indian Lac Research Institute (ILRI) is a nodal Institute at national level for research and development on all aspects of lac, such as production, processing and product development, training, technology dissemination, repository of information and national and international co-operation.

It undertakes on-farm and off-farm training on lac production, entrepreneurship development, training on lac processing, consultancy and quality evaluation of lac and lac-based products.

The activities of the institute are as follows:

Research Activities

- ♦ Lac production technology
- ♦ Lac processing and product development

Transfer of Technology

- ♦ Training and consultancy
- ♦ Technical advisory service
- ♦ Testing of lac and lac products
- ♦ Field demonstrations



Indian Lac Research Institute, Ranchi

**Shellac and Forest Products Export Promotion Council
(SHEFEXIL), Kolkata**

(www.shellacepc.com)

It is the nodal Export Promotion Council to promote exports of "Minor Forest Produce (MFP)" and the registering authority for related exporters under the Foreign Trade Policy. It plays a catalytic role in promoting India's MFP exports, acting as a bridge between exporters and various government agencies to ensure smooth growth.

Institute of Forest Productivity (IFP), Ranchi

(www.envfor.nic.in/icfre/ifp/ifp.html)

IFP is an R&D organization under the aegis of Indian Council of Forestry Research and Education (ICFRE), Ministry of Environment and Forests, Govt. of India. It is mandated to steer, undertake and coordinate research, development and extension in forestry sector in the states of Bihar, Jharkhand, West Bengal and Sikkim. The Institute aims at enhancing productivity of faunal and floral resources, conservation of biodiversity, eco-restoration of degraded lands and protection of diverse and fragile ecosystem unique to the region.

**Jharkhand State Co-operative Lac Marketing and Procurement
Federation Ltd. (JASCOLAMPF), Ranchi**

(www.jascolampf.com)

The main objective of the Federation is to help lac growers in providing remunerative price of their produce. It also undertakes procurement of raw lac, processing into different products and their disposal.

**Tribal Co-operative Marketing Development Federation of India
Ltd. (TRIFED), New Delhi**

(www.trifed.co.in)

This is a body of Govt. of India for sustainable development of nature's bounty for the tribal people through marketing of non-wood produce. Besides other activities, it provides assured markets and remunerative prices for tribal produce and undertakes price support operations wherever and whenever required.

Indian Society for Advancement of Lac (ISAL), Ranchi

(isal@ilri.ernet.in)

This is an independent non-governmental society devoted to converge all the stakeholders of lac to work towards a unified goal of promotion and growth of lac industry in India.

"Lac being a natural, biodegradable and non-toxic material, has a bright future, as the entire world is looking to and promoting use of such materials, for creating a better world to live in."

(Dr. R.S. Paroda, Former DG, ICAR, New Delhi)

Perspectives of future

Lac has withstood the competition from synthetics due to its unique properties.

Greater focus would be laid on quality of human life in the coming years. An ever increasing global concern about impact of synthetic materials on human health has generated tremendous interest for natural alternatives especially in the food, cosmetic and textile industries. Lac, as an eco-friendly, non-toxic, biodegradable and natural material, thus has a great scope for use in a number of areas, in view of its safety to human life and biosphere. As eco-friendly source, its importance would grow with time. The versatile lac is a treasure of varied applications awaiting the scientists to unfold further.



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