SKILL DEVELOPMENT

Recent Technologies at A Glance

ICAR - Indian Institute of Natural Resins and Gums

Namkum, Ranchi - 834 010

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Contents

Machinery

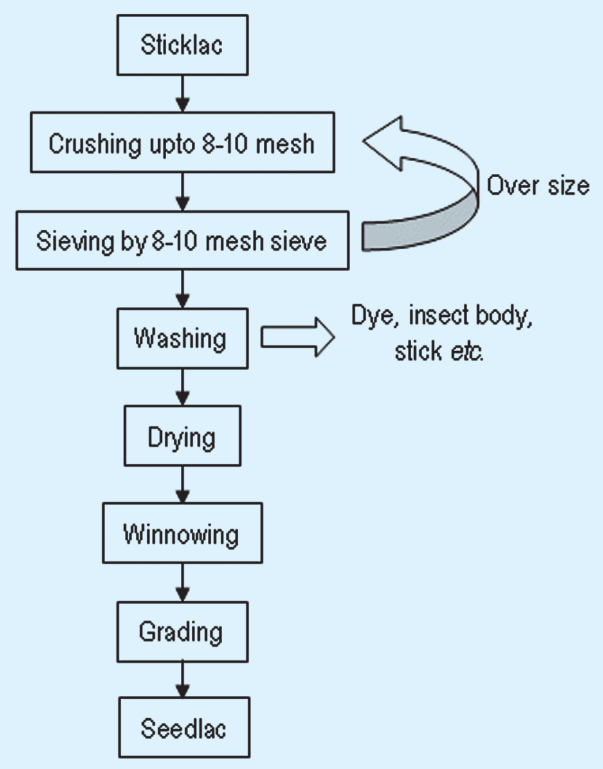
Small Scale Lac Processing Units

In primary processing of lac, lac sticks can be scrapped using lac scraper cum crusher.

The scrapped lac thus obtained contains impurity in the form of sticks, bark, stones, sand, insect bodies *etc.* Sticklac is further crushed in the crusher to break the lac cells to desired size and for removing insect dead bodies, lac dye and other impurities. Crushed lac is sieved in the lac grading machine to grade the crushed lac in form of grains for further unit operations.

Lac grains obtained after grading are washed in lac washing machine with required amount of soda on the basis of quality of washing so that soda added in the lac removes impurities effectively. Washing is continued till change of colour of wash water at the end of the washing operation.

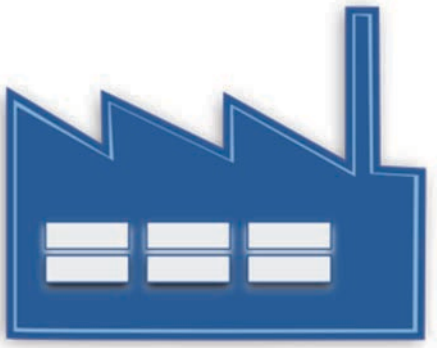
After completion of washing, washed lac is dried in thin layers and raking is done from time to time using wooden rakes/hoe/by feet. After drying, dried lac is winnowed using lac winnower to separate out the particles of sand and wood. The winnowed dried lac is graded in lac grader to obtained uniform size of seedlac.



Applications :

The developed units can be used for primary lac processing at growers /village level and value addition through seedlac making.

The units are suitable for village level entrepreneurship and employment generation in rural areas



Industrial Products

Water Thinnable Paint

Lac-based water-thinnable coating material has been developed by modifying lac with suitable synthetic resin for cementitious surfaces. It can be applied by brush to produce hard, smooth and matt finish on plaster of Paris treated surface, limed surface, asbestos and masonry surfaces. The films dry in 10-12 minutes in air. The composition is consistent as it produces smooth and uniform film. The air-dried films coated on glass slide and RCC panels showed excellent resistance towards water, acid and desired alkali resistance. The paint film on interior wall remained unaffected more than four years of its application on paris treated surfaces (No flaking, peeling off and discoloration were observed). The properties of the developed composition were tested following standard methods and were found comparable with those of two good quality commercial samples. Covering power was recorded to be 120 ft2 per liter for double coat. The paint samples have also been evaluated by the paint consumers and they have reported that the paint is good and can be used for commercial purpose.

The paint is water based. It do not have harmful solvents as most synthetic paints do. It don't contain volatile organic compounds and offensive smell.

In cities, where houses/flats are in a very closed system (air-tight), the chemical substances that are used in building materials create bad effects to the human body **(Sick House Syndrome).** Main elements of paints such as acrylic, urethane, epoxy resin have been reported to cause allergic reactions. Researches are being made to minimise the synthetic resin content or to find alternatives for these widely used synthetic resins.

Key advantage

The process of manufacture is very simple. It can be scaled up to desired level without difficulty. The technology has been transferred to many entrepreneurs and given successful demonstration for the preparation of the product. It is an export material (28.8 tonnes in 2006-07), country earned about Rs 31.79 lakhs; thus there is potential for entrepreneurship. The ingredients are easily available in the market

Gasket Cement Compound

Gasket shellac cement compound is a standard product used to fix in position all kinds of gasket in between two metallic parts of internal combustion engine. It provides sealing of joints against leakage of oil. The Gasket shellac compound is a viscous and homogeneous solution of shellac and other cheap additive in organic solvents, mainly denatured spirit.

The compound finds main application for fixing in position all types of gaskets in manufacture, repair and maintenance of automobile engines. It is also used for coating rivets to strengthen the joints, prevents corrosion; as a jointing compound in ordinary cargo and passenger vessels for plate seams.

Key advantage

The process of manufacture is very simple. It can be scaled up to desired level without difficulty. The technology has been transferred to many entrepreneurs and given successful demonstration for the preparation of the product. It is an export material (28.8 tonnes in 2006-07), country earned about Rs 31.79 lakhs; thus there is potential for entrepreneurship. The ingredients are easily available in the market.

Improved Lac-based Wood Varnish

The improved lac-based varnish incorporates a non-spirit solvent system, for polishing wooden furniture, musical instruments, etc. The varnish is amenable to conventional application methods: by pad & brush. The films dry quickly (10-15 min.) in comparison to commercial samples (4-5 hr). The shorter drying time, compared to commercial varnishes, protects the surface from sticking of the dust particles and reduces the time for consecutive coatings. The varnishes retain the texture of costly wood and provide a beautiful sheen. The films of these varnishes are resistant to both water and heat.

Key advantage

- It is based on natural resin- lac
- Quick drying films; saves labour & time, minimized sticking of dust particles & permits quick recoats.
- Thin coats can be applied to minimize amount of varnish consumed
- The films resistant to both water and heat.
- The varnish retains the texture of costly wood and provides a beautiful and unique sheen.
- Old films can be removed easily by emery paper for re-polishing.


Lac Glaze

Multi Purpose Glazing Varnish : Lac Glaze

Metal wares/objects/articles made of brass, copper, aluminium get tarnished because of exposure to atmospheric-effects. Similarly, articles made of plastic, rexin, rubber and painted artworks/murals etc. become dull and unattractive with the passage of time. Such articles invariably need periodical cleaning of the oxidative coating by rubbing and varnishing

Commercially available polishing formulations do not provide any long-lasting protection from such adverse effects on metal objects which require periodical care and regular maintenance. Consumers always prefer using a coating, which is permanent in nature and avoids frequent application of restorer.

Lac Glaze, a semi-synthetic shellac-based air-drying multipurpose glazing varnish is natural, eco-friendly and non-toxic. A double coat of varnish on the desired surface, after drying, gives a visually appealing glossy finish and lustrous shine resulting in a natural attraction for the viewers. The varnish can be applied by brush, dip-coating, spray and even a cotton-pad.

Characteristics / properties of Lac Glaze:

Gloss (%) Standard black glass Silver coated glass Stone	 100 38 >100
Drying time	within 20 minutes
Finish	Glossy, smooth, hard-coating and adherent
Scratch hardness	1600 g
Flexibility test	Pass
Water-resistance	No blushing after continuous immersion for more than 24 hr. at ambient temperature.
Resistance to acid vapour	No effect for more than 24 hr.

Lac Wood Shine

Wooden articles even today continue to be a part and parcel of modern life and a good varnish is needed not only to protect but also to beautify them. The lac wood shine varnish is based on natural resin-lac. It is eco-friendly, non-toxic imparting fine finish and possesses qualities like hardness, gloss, heat and water-resistance, besides being excellent embellishing agent. The polished surface neither whitens, when it comes in contact with water, nor shows any sign of staining or sticking, when any hot object (98 ^{o}C) is placed on it. It can be applied by brush, dip-coating, spray and even a cotton-pad. The varnish practically possesses all the desirable features/ characteristics of a modern wood lacquer satisfying consumers.

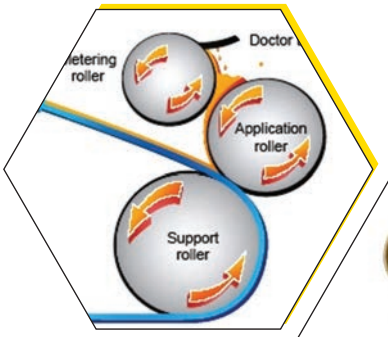
The manufacturing-process of the varnish is very simple, it only involves blending of solutions of shellac/resins at room temperature. The process does not require any elaborate machinery, space and can be adopted by even unskilled artisans, including women folk

Advantages

- It is based on natural resin--lac.
- It has fast recoating property, thereby saving time, labour and cost.
- It protects surfaces from dust particles.
- Re-coating is easier as the varnish films can be removed conveniently by emery paper.
- Easy manufacturing-process of varnish is an additional advantage.

Characteristics/Properties of Lac Wood Shine

Appearance	Clear transparent solution
Colour	Pale to dark brown depending upon the colour of shellac used
Drying time	Dries hard in 1 hr.
Acid value (unit)	10-12
Surface coverage	Approximately 10-12 m2/L
Shelf life	Does not deteriorate even upto 2 years
Scratch hardness	1 Kg (load over 1 mm ball)
Flexibility	No cracks or peeling when bent over 3 mm conical mandrel.
Water-resistance	No blushing upto one week on continuous immersion in water at 30 ^{o}C.
Heat-resistance	No disfiguration and sticking when beaker of boiling water is placed over the film.
Gloss	75 to 90% of the standard black glass


Doctor
Application roller
Support roller

Lac-based Can Coating : CANLAC

Metal cans are generally coated with a thin layer of synthetic resin(s), to prevent the interaction of the metallic surface of the can with the packaged material. This is essential for maintaining the integrity of the can, as well as to prevent contamination of the canned material through leaching. This is particularly important in the case of food packaging. The cans may also be coated externally to give them a decorative finish.

CANLAC lacquers are based on the natural resin, lac. They is suitable for internal coating of general line and food grade cans, as well as foils, for protective and decorative purposes. The compositions have an attractive 'gold' finish (without the use of additional pigments), and excellent flexibility, 100% gloss, acid resistance, sulphur resistance, appropriate scratch hardness and impact resistance. The formulations have been successfully evaluated at Regional Testing Laboratory, Ministry of Industry, Govt. of India, Kolkata, and have been found to pass all the stringent mandatory tests as per IS 5818 specifications for internal food can lacquers.

Application Protocol

The compositions can be roller-coated or applied by spray, depending upon requirement, by adjusting consistency. The coated sheets can then be fabricated into cans. Alternatively, pre-fabricated cans can be coated internally or externally by spraying, as per requirement. Suitable dyes can also be incorporated for foil coatings with attractive shades. The coated foils can then be used for packaging of sweets, confectioneries, chocolates, etc. Foils can also be fabricated into casseroles, for use in railway restaurants, fast food restaurants, catering establishments, delicatessens etc, where food-packaging requirements generally exist.

Properties of CANLAC

1. Does not contain any artificial dyes or pigments
2. Does not contain any plasticisers or drying oils
3. Does not contain any epoxy resins
4. Does not contain spirit or methyl alcohol
5. Does not contain any driers
6. Do not require hardeners; are single pack systems
7. May be used as RC as well as spray lacquers
8. May be suitably coloured with dyes for use as external/decorative finishes
9. May be used as foil coatings also
10. Does not require any specialised expertise or equipment to prepare.
11. Is based on a natural resin which is eco-friendly and self-sustaining.

Food Processing & Technology

Natural Fruit Coating Formulation for *Kinnow*

Kinnow is a high yield mandarin hybrid cultivated extensively in the Punjab region. Benefit obtained by the fruit from waxing includes reduced moisture loss and shriveling, reduced post harvest decay and longer shelf life.

Process of manufacture

Lac-based formulation was developed at ICAR-IINRG, Ranchi for *kinnow* fruits, using lac resin as principal component. The film produced by the formulation not only provides gloss to the surface but also helps the fruit to breath, so that it remains fresh for longer period. The technology of *kinnow* coating formulation was commercialized and licensed to M/s Gupta Brothers (Shellac), Ranchi. The firm had launched the product commercially under the brand name 'Friendly Shine'.

Process description

These waxing plants basically consist of a feeding mechanism, a cleaning/washing unit, a waxing unit, a drier unit and a sorter-cum-grader unit. Fruits are fed into the feeding unit and subsequently on rollers for washing. They are then fed into the coating unit. The fruits are then fed into a drying unit, equipped with IR lamps and large fans for sucking moist air. The coated and dried fruits again roll down to the grader for sorting and grading.

Properties/Uses

The formulation has many advantages over commercial ones :

- The major constituent of formulation is lac which is natural and non-toxic without added fungicide
- Provides enhanced gloss, shelf life and firmness to the fruits
- Unlike commercial formulations, lac-based formulation is operator's friendly, which means it, doesn't produce any obnoxious smell or vapors during waxing
- Approximately two tons of fruit can be coated with one litre of formulation
- Since it is a water based emulsion hence it can be used in pilot plant, combining washing and wax treatment in one operation.

FreshCoat : Extending Shelf Life of Pomegranate

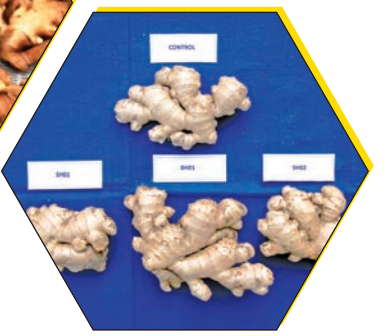
Pomegranate *(Punica granatum L)* is a commercially important fruit growing in arid and semi-arid regions of the world. In India, Maharashtra is the leading state in production of pomegranate, followed by AP, Karnataka and Gujarat. Bhagwa and Ganesh are two important cultivars of the fruit. The edible portions of the fruit are known as arils, which contains abundant amounts of anthocyanins, a known anti-oxidant, often present in "functional foods." Hence, pomegranates are also called "super fruits". It is also a good source of vitamins, minerals, soluble and insoluble dietary fibres, Vitamin C and Vitamin K.

Post Harvest Issues

Pomegranate is a non-climacteric fruit, which ripens on the plant; harvesting is done only after full maturity is achieved. It fetches high price in the market, but suffers from significant post-harvest losses, in terms of dehydration, leading to weight-loss and shrinkage on storage. Control of physiological loss in weight can be achieved through coating protocols. Cosmetic appearance is also enhanced in the process. Lac-resin based formulation FreshCoat SHO2 has been optimised for post harvest treatment of pomegranate.

Properties of FreshCoat SHO2

1. Aqueous based; dries rapidly after application.
2. Prevents weight loss and shriveling; enhances storage life
3. Improves cosmetic appearance; increases mechanical strength of produce
4. Prevents pathogenic attacks; contains no synthetic biocides
5. Helps in retention of natural flavors
6. Has no storage issues; left-over formulation can be used in subsequent batches.
7. Can be washed off before use; is completely odorless and flavorless
8. Is based on toxicologically safe ingredients; short-term toxicity tests of the formulation at CSIR-IICT, Hyderabad, do not indicate any mammalian toxicity upto permitted dosage of 2000mg/kg body weight.


CONTROL

FreshCoat: Extending Shelf Life of Ginger

Ginger *(Zingiber officinale)* or Adrakh is the underground stem (rhizome) of a perennial herb, which is used as a spice and as a preserve. The knobby rhizomes are dug up when the 1 meter tall leaves and stems of the plant wither, which occurs between 6 and 12 months after planting. It is then sold in the market either in "unscraped" form, i.e. with intact outer brown cortical layers, or "scraped" i.e de-corticated form. It may also be dried and sold as saunth. The state of Kerala leads in ginger cultivation in the country, followed by Meghalaya, Orissa and WB. Ginger is used both for culinary as well as for medicinal purposes.

Post Harvest Issues

Ginger fetches good price in the market, but suffers from significant post-harvest losses, in terms of dehydration, leading to decrease in weight and shrinkage on storage. This is of particular concern for export markets. Control of physiological loss in weight can be achieved through coating protocols. Cosmetic appearance is also enhanced in the process. Lac-resin based formulation FreshCoat BH01 has been optimised for post harvest treatment of ginger.

Properties of FreshCoat BHO1

1. Aqueous-based; dries rapidly after application.
2. Prevents weight loss and shriveling; enhances storage life
3. Improves cosmetic appearance; increases mechanical strength of produce
4. Prevents pathogenic attacks; contains no synthetic biocides
5. Helps in retention of natural flavors
6. Has no storage issues; left-over formulation can be used in subsequent batches.
7. Can be washed off before use; is completely odorless and flavorless
8. Is based on toxicologically safe ingredients; short-term toxicity tests at CSIR-IICT, Hyderabad, do not indicate any mammalian toxicity upto permitted dosage of 2000mg/kg body weight.

FreshCoat : Extending Shelf Life of Seed Spices

Coriander *(Coriandrum sativum* Linn) or *dhania* is botanically a fruit, comprising 2 locules containing one seed each. Practically all parts of the plant have an aromatic odor, due to the presence of essential oils, The seeds are widely used as a flavoring agent for domestic use, bakery and meat products, as well as in medicine and perfumery industry. In India, Rajasthan is the leading state for production of coriander, followed by Andhra Pradesh. Similarly, Cumin or *jeera* is the elongated, oval seed of the plant *Cuminum cyminum* Linn. It is one of the earliest known spices known to man. It has a nutty, earthy flavor, and is used widely in vegetarian and non-vegetarian preparations, bakery products and spice mixes. Cumin is primarily grown in semi-arid and arid tracts of Rajasthan, Gujarat and MP.

Post Harvest Issues

The essential oil present in coriander contains *d*-linalool, *p*-cymene, nerol, carvacrol and geranyl acetate. Due it its volatile nature, this tends to decrease on storage, resulting in loss of flavour. The essential oil in cumin, containing cuminaldehyde, β-pinene, terpenene, and ρ-cymene, also decreases on storage. In addition to flavor loss, whole cumin is particularly prone to fungal infestation when stored in ambient conditions, typically during monsoons.Both coriander and cumin are also targeted by insect pests. Post harvest issues of these seed spices can be addressed by coating with FreshCoat B.

Application Protocol

Coating can be manual by simple dipping, or mechanised in a pan coating unit or fluidised bed coating system. Pan coating is recommended, as it is cost effective and can be operated by semi-skilled personnel.

Properties of FreshCoat

- Aqueous based; dries rapidly after application
- Improves cosmetic appearance; increases mechanical strength of produce
- Prevents pathogenic and insect attacks; contains no synthetic biocides
- Enhances storage life through retention of natural flavors is completely odorless and flavorless after application
- Has no storage issues; left-over formulation can be used in subsequent batches
- Is based on toxicologically safe ingredients; short-term toxicity tests at CSIR-IICT, Hyderabad, do not indicate any mammalian toxicity upto permitted dosage of 2000mg/kg body weight.

Fish to Dish : Nuggets from Freshwater Catfish

Pangasius pangasius is a large Indian catfish, colloquially called *basa, bacha or bachua,* occurring in all the important east-flowing rivers. Originally from SE Asia, it is now being systematically cultivated in India, due to its fast growing nature, and ability to survive in open aquaculture ponds and fish cages. Its fillets are characterized by high moisture levels, low protein, lipid, cholesterol and polyunsaturated fatty acids. Being a highly perishable commodity, distress selling can be avoided, and fish farmers can be insulated from uncertain markets to a large extent, if options for value-added products exist.

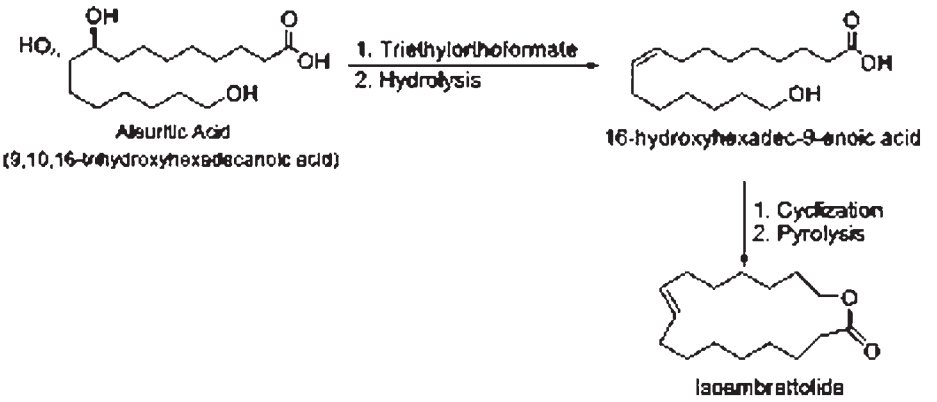
Value-Addition

Nuggets are convenience foods, prepared from mince of fish fillets, together with spices, condiments, seasoning and binding agents. They are pre-cooked, packed and stored in refrigerated conditions and fried before consumption. In this technology, natural gums have been incorporated instead of traditional binders. This approach results in reducing overall calorie content, and offers other health benefits such as increase in protein content and decrease in cooking loss. Reduction in moisture content also helps in increasing the shelf-life of the product.

Many of the unit processes can be carried out manually in an SSI, but dedicated machinery are also available for fish processing in hygienic conditions under appropriate food safety regulations. These include (1) Heading and Gutting Machine (2) Filleting Machine (3) Skinning Machine (4) Mincing Machinery (5) Steam Cookers and (6) Chillers

Moulds with suitable dies, vacuum packaging machine, storage vessels, freezers, steel working tables, running water and assured supply of electricity, waste and effluent management system, as also transportation of finished product under cold conditions are essential components to be considered when setting up such a Unit.

Cosmeceuticals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Aleuritic Acid
(9,10,16-trihydroxyhexadecanoic acid)
1. Triethylorthoformate
2. Hydrolysis
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OH
OH
16-hydroxyhexadec-9-enoic acid
1. Cyclization
2. Pyrolysis
O
O
Isoambrettolide

Isoambrettolide

Musks are of central importance for the fragrance industry. They form the bottom note of a perfume composition, i. e. the musky undertone stays the longest on the skin or on the fabric. Muscone, civetone, and exaltone are the main odorous principles from the animal kingdom, whereas the lactones exaltolide, and (Z)-7-ambrettolide have been isolated from plants. Ambrettolide is obtained from the essential oil and the resinoids of ambrette plant Hibiscus abelmoschus, which is grown in South America, Indonesia and the West Indies. Its round, warm, musk note is highly appreciated in perfumery. Isoambrettolide, a geometrical and positional isomer of natural ambrettolide, is a very attractive substrate as an alternative musk resource which is obtained industrially from aleuritic acid, a major constituent acid of lac.

Process know-how for production of isoambrettolide from aleuritic acid, a constituent acid isolated from seed lac (semi-refined form of lac), has been developed. Aleuritic acid has been converted to an unsaturated acid, 16-hydroxy hexadec-9-enoic acid, by orthoester formation followed by its alkaline hydrolysis. Cyclization of the unsaturated acid under acidic condition followed by pyrolysis produced isoambrettolide. It is a simple process involving unsaturation reaction followed by cyclization and distillation steps.

Properties:

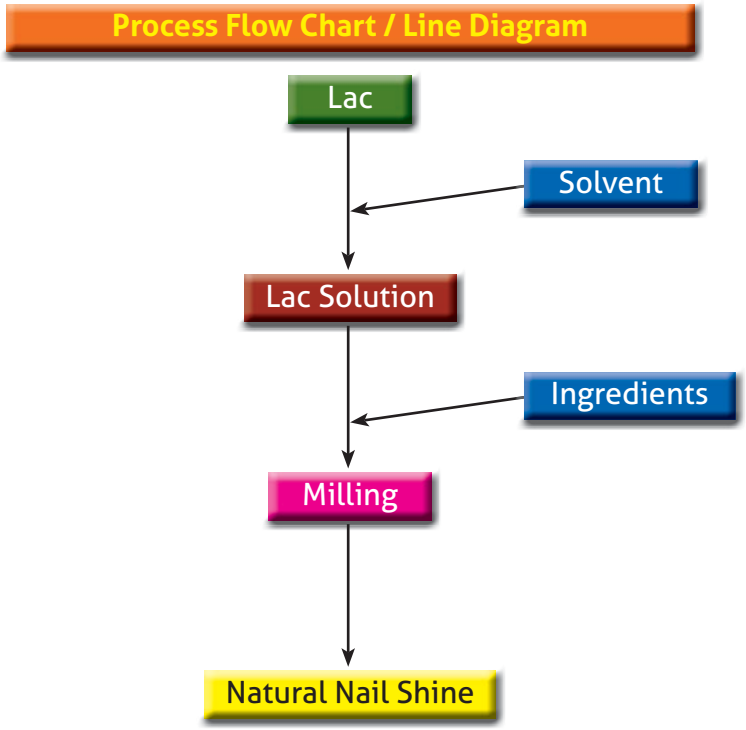
Physical state	Liquid
Colour	Colourless to light yellow clear liquid
Odour	Sweet musk fruity smell
Specific gravity	0.95 at 25 °C
Refractive Index	1.48 at 20 °C
Boiling Point	115-116 °C at 0.2 mm Hg

Isoambrettolide has a highly desirable and useful musk odour characterized and used as the animal note in perfumes. It is also utilized as a component in perfumed articles such as soap and detergents to promote musk fragrances. Major raw materials/ chemicals required for synthesis of the material include aleuritic acid as starting material, triethyl orthoformate, toluene, potassium hydroxide, *p*-toluene sulphonic acid, sodium sulphate, ethanol and diethylether.

Natural Nail Shine

Nail polish has become an indispensable part of the fashion these days. Nail polishes are synthetic resin based and can come into contact with food material while eating. Now there is increased interest in use of natural materials particularly in foods and cosmetics, in view of safety.

A natural Nail Polish formulation has been developed by IINRG based on Lac and can be applied to human fingers and toe nails for its decoration and protection. It gives attractive and beautiful finish to nails. It provides very glossy, hard, smooth and durable finish on nails. It is quick drying and non-hazardous to health. Properties of the nail polish have been evaluated as per IS: 9245:1994, and the polish meets all the requirements of BIS specification. Nail polish remover has also been developed



The technology of the nail polish has been transferred to Mahatma Gandhi Institute for Rural Industrialization (A National Institute under the Ministry of MSME, Govt. of India), Wardha (Maharashtra).


Crushing / Washing
Stick lac
Seed lac
Lac Dye
Preparation of Alta

Lac Dye based Natural Alta

Painting feminine toes in deep red Alta is a tradition of India. Alta is an important cosmetic used by Indian woman to decorate their feet especially during marriages and festivals. Lac dye is red colored natural dye obtained as a byproduct during washing of stick-lac while preparing seed-lac. This lac dye is used for developing two different color formulations of natural Alta, IINRG-LDA-91 (Orange colored) and IINRG-LDA-94 (Deep red colored).

Skin caring ingredients like glycerin which imparts moisturizing effect to the skin and turmeric extract which is reported as antifungal agent, are added to the Alta formulations. These herbal supplements when mixed in the Alta makes it not only safe but also of medicinal value to the skin. The formulations prepared are quick drying which minimizes sticking of dust particles and permits quick recoats. Being semi-permanent in nature it is gentle to the skin and older films can be removed easily by thorough washing with soap or detergent for re-polishing

In spite of above advantages over synthetic dyes, lac dye possesses some technical drawbacks like low color fastness, nonuniform composition, availability and relatively higher costs. But all these odds can be concealed by safety aspects of the natural Alta. Natural Alta (IINRG-LDA-91 and 94) developed at ICAR-IINRG is a unique blend of beauty and safety, whereas in synthetic dyes safety is not guaranteed.

	Lac dye based Alta	Commercial Alta
1	It is made from Natural lac dye	Prepared by synthetic dyes and colors
2	During its preparation no toxic chemicals are used	Prepared from azo dyes and other contaminants
3	Natural Alta developed has medicinal value	Reported to cause depigmentation of skin after prolonged use
4	Supplementary skin caring agents cure the skin problem	Has adverse effect on skin
5	Moisturizes skin and is skin friendly	Not skin friendly
6	Available in two different colors, orange and deep red.	No color choice
7	Costlier due to relatively higher price of lac dye	Cheaper as compared to natural Alta
8	The fastness is not like synthetic color so it is removed by thorough washing with soap or detergent.	The color persists and cannot be removed easily.

Notes

Notes

Notes

भाकृअनुप
ICAR

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

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