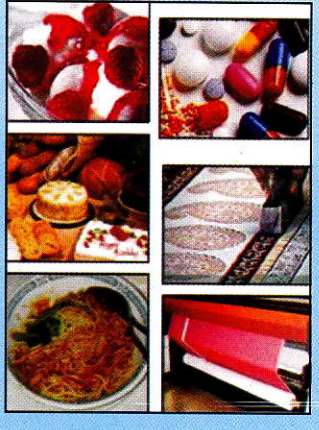
Natural Resins and Gums of Commercial Importance – At a Glance



INDIAN INSTITUTE OF NATURAL RESINS AND GUMS
(Formerly Indian Lac Research Institute)
Namkum, Ranchi- 834 010, Jharkhand (India)

Technical Bulletin

Natural Resins and Gums of Commercial Importance – At a Glance

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The Indian Institute of Natural Resins and Gums (IINRG) formerly Indian Lac Research Institute is a unit of the Indian Council of Agricultural Research (ICAR). ICAR is an autonomous body and the apex organization for the agricultural research in India. IINRG undertakes, independently and in partnership with other agencies, research, training and providing technical information and advice related to lac cultivation and processing and utilization of natural resins and gums.

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Foreword

Resins and gums, commonly used in every day life, are having ample importance as non-wood forest produce. With a view to better utilize the infrastructure and provide R & D support to entire sub-sector of natural resins, gums-resins, the Indian Council of Agricultural Research (ICAR), New Delhi has expanded the mandate of erstwhile ILRI. Besides continuing research on all aspects of lac, the Institute would also undertake research on processing and value addition of all plant resins, gums and gum-resins.

India is a rich center of plant bio-deversity having more than 45,000 plant species including about 120 gum and resin yielding plants. Indonesia, India and China are among the World's major producers of gums and resins. India produces annually about 2,81,000 tons of gums and about 1500 tons of gum-resins. Annual average export during 2001-02 to 2005-06 was Rs 7,848 million. This included Rs. 1,371 million of resins and Rs. 6,363 million of gums. India is traditionally largest producer of lac, guar gum and karaya gum.

In recent years, due to back to the nature trend there has been a revival of interest in natural resins and gums extracted from forests by rural and tribal people who depend on these resources to sustain their livelihood. The gross value of goods and services provided by the forestry sector is estimated at an average of Rs. 26,330 crores i.e. about 2-37% of GDP. of this recorded forest revenue about 50 million population inhabiting forests and sub-forest areas and 70% of employment in the sector is in minor forest produce (about 1.6 million mandays). It is and admitted fact that neither the forests nor the tribals and poor inhabiting theses should be removed for environmental protection. The only approach appears to be developing minor forest products like natural resins and gums based economic activities in these areas to uplift the poor and maintain required forest cover or vegetation.

Gums and resins are low volume, high value produce. These can be processed to add value in quality for higher returns. In some products value addition through primary processing alone results in 3 times higher returns. Developing products of commercial use would further augment returns, employment and export earnings.

I and sure that the basic information contained in this bulletin would be useful to manufacturers, consumers and researchers working in the field of natural gums and resins. I congratulate the authors in bringing out this bulletin.

June 26, 2008
IINRG, Ranchi

Bangali Baboo
Director

Introduction

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. Thousands of forest dwellers particularly in the central and western Indian states depend on gums and resins as a viable source of income.

Resins and gums are metabolic by-products of plant tissues either in normal course or often as a result of disease or injury to the bark or wood of certain plants. There are a large number of trees in India which exude gums and resins. Some of these are of local or limited interest, while a few are used extensively all over India and also entered the export trade of the country. Annual average export of gum & resin during 2001-02 to 2005-06 was Rs 7,848 million. This included Rs 1,371 million of resins and Rs 6,363 million of gums. The gums and gum-resins of commercial importance collected from the forest are gum karaya, gum ghatti, salai gum, guggul, and gums from various species of *Acacia*, including Indian gum arabic from *Acacia nilotica* and true gum arabic from *A. senegal*. The important commercial resins are obtained from Pinaceae (rosin, amber), Leguminosae (copal) and Dipterocarpaceae (dammar) families.

The uses of natural gums and resins in food, medicines and in varnishes or as protective coatings go back to very early times. Certain natural gums and resins are approved by the U.S. Food and Drug Administration for use in food and pharmaceuticals. The present day uses of natural gums and resins are numerous and they are employed by a large number of manufacturing industries including food and pharmaceutical industries. Some of the plant based gums and resins of commercial importance are presented here.

Natural Resins

Resin secretion occurs in special cavities or passages in many plant species. They are formed in the specialized structures called ducts. Resins exude or ooze out from the bark of the trees and tend to harden on exposure to air. With the exception of lac, which is produced by the lac insect *(Kerria lacca)*, all other natural resins are of plant origin. Natural resins of particular importance to the furniture coatings are rosin, damar, copal, sandarac, amber, and manila.

The principal characteristics of resins are:

- They are insoluble in water.
- They are soluble in ordinary solvents like alcohol, ether and turpentine.
- They are brittle, amorphous and are transparent or semi-transparent.
- They have a characteristics luster, are ordinarily fusible and when ignited, resins burn with a smoky flame.

Natural Gums

Gums are a group of plant products, formed primarily due to the disintegration of plant cellulose. This process is known as gummosis. Gums are produced by members of a large number of families but commercial exploitation is restricted to a few tree species of Leguminosae, Sterculiaceae and Combretaceae families. The important gum

yielding trees are *Acacia nilotica (babul)*, *A catechu (khair)*, *Steruculia urens (kullu)*, *Anogeissus latifolia (dhawra)*, *Butea monosprma (palas)*, *Bauhinia retusa (semal)*, *Lannea coromandelica (lendia)*, and *Azadirachta indica (neem)*. Gum is also extracted from seeds of certain plants like guar, tamarind, cassia tora etc. Guar gum is the prominent seed based natural gum.

The principal characteristics of gums are:

- They consist of polysaccharides or their derivatives.
- They are soluble in water or at least become soft and swollen when mixed with water. However they are insoluble in alcohol and other organic solvents.
- They decompose completely on heating without melting and tend to become charred.
- Most gums emanate from plants in a liquid form. They dry up into translucent, amorphous, tear-shaped bodies or flakes on contact with air.

Gum-resins

Gum-resins are a mixture of both gums and resins and possess the properties of both the groups. They contain traces of essential oils. These are usually derived from the plant growing in dry and arid regions. Some of the commonly used gum-resins are asafoetida, myrrh, salai, guggul etc.

ROSIN

Rosin, also known as colophony, is the solid form of resin obtained from pines and some other plants, mostly conifers.

Local name: rosin

Plant Sources: *Pinus roxburghii, Pinus wallichiana, Pinus keysia*

Family: Pinaceae

Distribution: Extensive chir pine *(Pinus roxburghii)* forests are found in the Himalaya between an elevation of 1000m and 1900m. Chir pine yields commercially important oleo-resin which forms the raw material for *rosin* and turpentine oil industry in India. Blue pine *(Pinus wallichiana)* forests occur at elevation of over 2100m in the Himalaya. Khasi pine *(Pinus keysia)* is found in the Garo, Khasi and Naga hills whereas some exotic species of pines have been introduced at various places in India. Of the above species, only chir pine is widely tapped for resin on commercial basis, particularly in the hills of Jammu & Kashmir, Himachal Pradesh, Garhwal and Kumaun.

Production in India: 25,000 tons per annum (approximately)

Other producing countries: China, Indonesia, Portugal, Brazil and Russia.

Harvesting/Collection of Resin

Method of harvesting/tapping: For commercial purposes, resin is obtained by tapping standing pine trees i.e. by making a cut which exposes the surface of the wood. Resin canals are large and irregularly distributed in chir pine trees. The resin in the longitudinal ducts tends to reach the surface

Pinus roxburghii tree

through transverse ones in the rays. Consequently, for tapping the trees only a shallow incision is necessary, as the flow of resin from the transverse ducts stimulates secretion of resin in large ones. The maximum flow of resin is from top of the incision, where both the horizontal and vertical ducts are cut. On exposure to air, the volatile oil in the oleoresin (turpentine oil) gradually evaporates leaving clear, hard, glossy substance called rosin, which forms a protective coating over the incision and tends to stop further flow of resin.

In India two kinds of tapping are in vague, viz., (i) light continuous tapping, (ii) heavy tapping.

(i) Light continuous tapping: Light continuous tapping is done in trees above 0.9m in girth. Trees between 0.9 and 1.8 m in girth are tapped in one channel, and those

above 1.8 m in girth in two channels each at a time. The first channel or each set of two channels is tapped for five years. At the end of five years, a new channel or a new set of two channels, as the case may be, is started leaving an inter space of 10 cm between the old and new channels. At the end of second five year period, another channel or set of two channels is again made leaving another inter space and so on till tapping has progressed right round the tree. This is the common mode of tapping that is being practiced in India and the trees are regularly tapped without any rest.

(ii) Heavy tapping: In heavy tapping (also known as tapping to death), maximum possible out turn of the resin is derived before the trees are due for felling and it is achieved by cutting on the tree as many channels as it can bear, with a minimum inter space of 10 cm between the successive channels. It is generally started five year in advance of main felling in prospective regeneration areas and two years in advance of thinning in areas marked for thinning. The lowest girth prescribed for heavy tapping is 60 cm.

There are four methods of tapping pine trees i.e. (i) Box method, (ii) Cup and lip method, (iii) Rill method and (iv) Bore hole method. At present, three methods are commonly employed for tapping pine trees in India. These are (a) Box method, (b) Cup and lip method and (c) Rill method.

(a) Box method: This is the oldest method of resin tapping. A cavity or box of 10cm x 10 cm and upto 12 cm deep is chopped at the base of the trees. It is meant to collect the resin as it exudes from the blaze or incision that is made just below the box, by chipping bark and outer layer of the sapwood. The resin oozes

Box method

out of the blaze and is collected in the box. However, this method is very damaging and the trees tend to die within few years after resin tapping is started.

(b) Cup and lip method: In this method, the outer bark of the tree is scraped off with the adze to a reasonably smooth surface of 60 cm long, 15 cm wide and 25 cm above the point where the lip is fixed. In light tapping, channels are initially located on south or south-west face of the tree as better yields are obtained from the warmer aspects. Subsequent channels are made in an anti-clockwise direction. A cut of about 15 cm broad and slightly slanting outwards is made with a curved chisel and mallet about 25 cm below the lower edge of the blaze. The lip, a rectangular piece of galvanized iron (15 cm X 5 cm), is driven into the cut to collect resin into a pot kept below. The pot is partially covered to prevent pieces of bark, dirt etc. from falling into the cone, and also to minimize the evaporation of resins that accumulate into it. In order to open up the clogged resin ducts and aid in the smooth and continuous flow of resin, the channels are freshened at definite intervals.

The cup and lip method of tapping has a

Cup and lip method

number of disadvantages. Even though a channel depth of 2.5 cm has been prescribed for the blazes, very often the depth exceeds the prescribed limit. The inherent hacking action involved in case of adze, makes it very difficult to control the depth of the blazes. Also the tapper makes much deeper blazes in the hope of getting more resin. Deep cuts around the hole results in loss of timber and make the trees less resistant to wind storms. Moreover, after covering the circumference of the tree, a second cycle of tapping is not possible because of the slow healing of deeper blazes. This generally results in abrupt fall in resin production.

(c) Rill method: This is an improved method, standardized at Forest Research Institute, Dehradun to overcome the disadvantages of the cup and lip method. In rill method, the bark of the tree over a surface area of about 45 cm in height and 30 cm in width is removed with the help of a bark shaver. The surface is made very smooth and the thickness of the bark left should not be more than 2 mm to facilitate freshening of the blaze. The blaze frame is kept on the stem in the vertical portion, 15 cm above the ground level and the position of the blaze is marked with a marking gauge. The control groove is cut with a grove cutter by drawing it from top to bottom. The lip is then fixed in the tree with nails.

For freshening of the blaze, the tapper stands near the tree on one side of the blaze and holds the freshening knife at the lowest point of the control groove. The knife is then pulled up by the tapper along with blaze line marked on the tree. The depth of the rill is about 2 mm into the wood. After making a freshening on both arms of the blaze a 1:1 mixture of dilute sulphuric acid (20%) and dilute nitric acid (20%) is sprayed on the freshly cut rill with the help of spray bottle. Exudation of oleoresin starts soon after the rills are made. The pot containing the oleoresin is emptied into a collection can. The resin adhering to the pot is removed with the help of a scraper. The control groove is also increased to avoid accumulation of resin in it.

Rill method

(d) Bore hole method: Forest Research Institute, Dehradun has developed a new tapping technique known as bore hole technique of resin extraction from *Pinus roxburghii*. In this method holes are made near the ground level with the help of a machine into tree's sapwood to open the resin ducts and exudating resin is collected in a closed container. The hole in each tree is done approximately 10 cm above the ground. It has been found from the studies that holes of 15 cm depth and 2.5 cm diameter are suitable for obtaining maximum resin yield. The holes are drilled straight into the tree stem with a slight slope towards the opening so that resin drains freely.

Immediately after making the hole the stimulants/ chemicals (mixture of sulphuric acid and ethephon i.e., 2-chloro-ethyl phosphonic acid) are sprayed inside each freshly made hole. Spray volume of 1 to 2 ml are applied to each hole. Chemical treatment is done once only, immediately after boring holes. After treatment a spout is installed inside the hole by gently hammering with a small mallet or pushing with palm of the hand to achieve compression fitting in the hole. The spout is meant for joining the collection container (polybag made up of high density poly ethylene, HDPE, 35.3 x 12 cm) tightened to each spout.

Once the polybag is filled with resin, it is removed from the tree and poured into a collection can and immediately a new poly bag is tied for future collection of resin. Some of the advantages of bore hole method of resin extraction are as follows:

- There is less stress due to small size (2.5 cm diameter) of the hole. The hole heals fast.

Bore hole method

- The technique is very suitable for the protection of tree against fire, insect, pest and diseases.
- Prolong resin flow can be obtained from bore hole for a period of several months without wounding the stem.
- The holes are made with the help of a machine, therefore the labour productivity of the technique is several folds greater than other method.
- The technique could be very effective in conservation and management of pine resources.

Period of harvesting/collection: Rosin from chir pine forests are tapped from April to November each year. Most of the forest trees are owned by Government while a small yield is also obtained from private or community forest

Yield: Experiments conducted on trees

growing at the Forest Research Institute, Dehradun, have shown that a maximum yield of 5.13 kg/blaze/year of resin can be obtained by rill method, while the corresponding yields by the other two traditional methods are 1.5 kg/blaze and 3.1 kg/blaze per year respectively (Chaudhari *et al.*, 1990).

Processing and Value Addition

Resin is collected in bucket and brought to central places from where it is taken to the factory. Resin obtained from chir pine trees is distilled into turpentine oil and rosin. The crude resin is processed in the following manner:

Crude resin is in a very impure state when it reaches the factory. It contains water, bark, needles, dirt and even insects. They are stored in a suitable shed after being brought to the factory. Before processing the top of the tin bucket is cut and the dirt that is floating on the top of the resin is removed manually.

During winter, resin is a bit hard to work, so some amount of turpentine oil is mixed to dilute the resin. The screw elevator lifts this resin along with the impurities to the mixing vats which are large vessels made of mild steel. They have V-shaped bottoms that are provided with steam jackets for heating the resin. The resin is heated indirectly in this vat by passing steam through copper coils for 4 to 6 hours to melt the resin in it. The temperature is maintained upto 95°C. The molten resin is then stirred with iron arms mechanically and passed through 40-mesh stainless steel wire net to remove bigger impurities like pine needles, bark pieces etc. and then pumped by centrifugal pump into a rest vat. The resin is allowed to rest in the rest vat for about 18 to 20 hours. During this rest

Distillation unit

period, the impurities and dust if present, settle down by gravity. The dust/impurities are removed through a bottom valve and sent for processing separately as inferior grades of rosin. Resin from rest vat is carried to the compression chamber, from which it is carried to distillation kettle by steam pressure.

In the distillation kettle, the resin is cooked for 1-2 hours by indirect steam. The molten resin remains inside the copper tubes and steam remains in the outside. In this process the turpentine oil and moisture present in the resin get evaporated and condense in the condenser. Turpentine oil is collected in a Separator.

The rosin left in the distillation kettle is taken out at 165°C and collected in trolleys, wherein about 100-200 grams of oxalic acid (depending on the quality of resin) is mixed to

Rosin

Storage of rosin

increase the transparency / shine of rosin.

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

Quality control: Both rosin and turpentine oil find wide use in various industries. They are graded into various categories for commercial use. There are 12 grades of rosin which are in vogue in trade circle and are also recognized by the ISI (1955), as given in Table 1.

Table1. Different grades of rosin

Type/Value	Grade	Lovibond Colour		
		Red	Yellow	Blue
Pale	X	1.35	13.0	-
	WW	1.85	19.5	-
	WG	2.6	30.0	-
	N	3.6	41.0	-
	M	4.9	51.0	-
	K	6.2	60.0	-
Medium	I	8.8	80.0	-
	H	12.0	100.0	-
	G	17.0	100.0	-
	F	27.0	120.0	0.1
Dark	E	47.0	139.0	1.2
	D	75.0	160.0	3.2

Properties

- Rosin is brittle solid and consists mainly of free organic acids called rosin/resin acid of the formula $C_{19}H_{29}COOH$ and related neutral materials like resin acid esters, anhydrides, aldehydes, hydrocarbons, unsaponifiable matter and fatty acids.
- Its colour varies from light yellow to red, brown, blue, or black.
- Its specific gravity is 1.08 and melting point is from 100 to 140°C.

Industrial Applications

- Rosin is used in making cements, varnishes, paints, sealing wax, adhesives, inks and some soaps.
- It is used as a dressing for machine belts and bows of violins and cellos.
- It is used in the preparation of certain metals for soldering.
- Rosin gives a stiff coated surface to certain kinds of paper. This is needed for printing and writing.
- In pharmacy, rosin is used in some ointments, plasters, and similar preparations.

- Athletes rub it upon their hands or the soles of their shoes to prevent slipping. It is also extensively used for its friction-increasing capacity in stringed instruments.
- The tin-lead solder commonly used in electronics has about 1% rosin as a flux.
- It is also used in the manufacture of linolium, sealing wax, oil, cloth, special flooring compounds and coverings, lubricating compounds and disinfectants.

List of Manufacturers/Traders/ Exporters of Rosin

Manufacturers of rosin

1. **Rosin and Turpentine Factory**
   Nahan-173001, Himachal Predesh
2. **Rosin and Turpentine Factory**
   Bilaspur National Highway (H.P), Bilaspur
   Himachal Predesh
   Tel. No. 01978 222464(O)
3. **Rosin and Turpentine Factory** Miransahib, Jammu & Kashmir
4. **Indian Turpentine & Rosin Company Ltd**
   P.O. Clutterbuck Ganj- 243502
   Bareilly (UP)
5. **Rosin and Turpentine Factory**
   Tilwara, Uttar Pradesh

Traders, exporters of rosin

1. **Uttaranchal Terpene Products (P) Ltd.**
   Gali No.9, Rampur Road, Haldwani,
   Nainital, Uttranchal - 263139
2. **Fast Track India**
   338/2, Nh-8, Village Rangpuri, New Delhi - 110 037
3. **Himlaya Terpenes Private Limited**
   309-310, Building No. 5, Jogani Industrial Complex Sion Chunnabhatti, Mumbai, Maharashtra - 400 022
4. **Surjan Colour Company**
   Payal, Agrasen Rd., Zenda Chowk,
   Dharampeth, Nagpur - 440010
5. **Tamilnad Dyes & Chemicals**
   M No. 30, South Masi Street K. K. G. Plaza,
   Madurai, Tamil Nadu
6. **Trupti Enterprises,**
   9 Roy Lane, Kolkata, West Bengal
7. **Excel International**
   A/603, Madhav Kunj, Near Swimming Pool, M.G. Road, Kandivali (West),
   Mumbai, Maharashtra - 400 067
8. **Ultimate Chem (India) Pvt Ltd**
   A/33, Marol Nand Dham Udyog Co-op Society Ltd, II Floor, Marol Maroshi Road,
   Andheri (East), Mumbai
   Maharashtra - 400 059, India
9. **K. V. Paints & Chemical Co.**
   70, Najafgarh Road Industrial Area,
   Rama Road, New Delhi - 110 015
10. **Sarva Mangalam Enterprises**
    MD-63, Pitampura, Delhi - 110 088
11. **Star Asia Fareast Company Limited**
    B-22/7, Mahananda Nagar, Ujjain,
    Madhya Pradesh - 456 010
12. **Sanjeev Industries**
    BD 5, Vishakha Enclave, Pitam Pura,
    Delhi - 110 088
13. **Riddhi Siddhi Enterprises**
    No. 2/3-A, Arekempanahalliopp, 9th Cross,
    Wilson Garden, Bangalore,
    Karnataka - 560 027

14. **J. M. D. Polymers Private Limited**
Village Gharaula Road Kurukshetra, Ladwa,
Haryana - 136 132

15. **Mahendra Rosin and Turpentine Private Limited**
702, Nippon Building II, 37, Juhu Tara
Road, Mumbai, Maharashtra - 400 049

16. **Imexco, Inc.**
No. 15, 2nd Main Road, Karpagam Gardens
Adyar, Chennai, Tamil Nadu - 600020

17. **Guru Kripa Resins Private Limited** Packing
PPR Comp, MIDC Area, B-Cross Road
Andheri East, Mumbai - 400 093

18. **Pankaj Enterprises**
Ambica Vihar Phase-1, Bhotia Parao
Nainital Rd., Haldwani
Uttaranchal - 263139

DAMMAR

Dammar designates a group of resins obtained from Indian or East-Asian trees belonging to the families Dipterocarpaceae and Burseraceae and principally those of the genera *Shorea, Balanocarpus*, or *Hopea*. The principal dammars of India are *sal* dammar, white dammar and black dammar.

Local names: Hindi, Bengali: *Sal dhuna, lal dhuna, ral, dhup*; Kannnad - *Almatti Dhupa, Manda Dhupa*; Telugu - *Kan Kungilium, Karunga Kungilium*; Marathi - *Dhup, Ral-dhup*

Plant Sources

Sal dammar - *Shorea robusta* (Family: Dipterocarpaceae)

White dammer - *Vateria indica* (Family: Dipterocarpaceae)

Black dammar - *Canarium strictum* (Family: Burseraceae)

Distribution: Trees of these families are medium to very large, widespread and of very great importance as a source of tropical hardwood throughout the Indian and Southeast Asian regions.

Shorea robusta: It is a large sub-deciduous tree, found extensively in parts of north, east and central India.

Vateria indica: It is a large, elegant, evergreen tree, indigenous to the evergreen forests of the Western Ghats from North Karnataka to Kerala.

Canarium strictum: This is a large deciduous tree found upto an elevation of about 1500 meters in the Western Ghats and in the west coast forests south of Konkan.

Sal Tree

Production in India: 80 tons per annum (approx.).

Other producing countries: Indonesia, Thailand, Vietnam, Laos and Cambodia

Harvesting/Collection of Resin

Method of harvesting/tapping: Most of the resins are produced by tapping trees, however some are collected in fossilized form from the ground.

Sal dammar: In India, tapping involves removing 3-5 narrow strips of bark, 90-120 cm above the ground. In about 12 days, the grooves become filled with the resin, which oozes out a whitish liquid that becomes brown soon on dying. The cavities of the grooves are freshened, after which the exudation continues and the resin is collected

as before. The process is repeated several times in a year.

White dammar: Semi-circular incisions are made on the stem of the tree up to the surface of the sapwood. Blazes or cuts are so spaced as to cause least damage to the tree. The resin starts oozing from the incisions in 3-4 days and continues for 60-90 days. The resin is also exuded when the bark is scorched by lighting fires around the base of the tree. This method gives a high yield of resin but damages the timber and may even kill the tree.

Black dammar: Tapping is done by making vertical incisions on the bark in a belt about 1.8m from the bottom and then lighting a fire round the base of the tree. The resin flows out after two years and continues for about 10 years. The flow lasts for about six months every year from November to April. The viscous resin that oozes out hardens into a somewhat translucent mass of a bright shining colour that is collected manually.

Period of harvesting/collection: *Sal* dammar collection is done several times during the year. Altogether, three lots are obtained, first in June-July, the second in October and the third in January. The resin obtained in June-July is the best in terms of quantity and quality. Black dammar is collected mostly during December to April.

Yield: When tapped once a month in the manner described above, a fully productive tree has been stated to yield about 4 to 5 kg of damar at each tapping, However, there is known to be genotypic (tree-to-tree) variation in yields and some trees may only be tapped every 3 months because of poor yields.

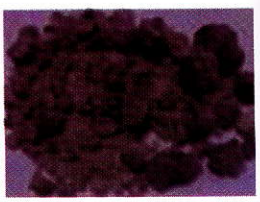
Collection of dammar

Processing and Value Addition

The exuded resin is allowed to dry on the tree before it is collected. Collected resin is cleaned by sieving and hand picking to remove foreign matter, and packed in sacks for transfer to points of sale, either Nationally or Internationally.

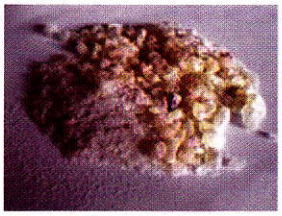
Dammar is sometimes dewaxed for improving the qualities for varnishes made from it. The dewaxed damar is prepared by dissolving damar in a hydrocarbon solvent and precipitating and removing a high-melting, resinous fraction. The remaining soluble fraction is then more compatible with the cellulose component of cellulose lacquers. In India, an oil is distilled from dammar resin which is used for fragrance and medicinal purposes.

Sal dammar



Black dammar

Properties



White dammar

- Damars are solid resins, generally less hard and durable than the copals.
- The colour of dammars ranges from very pale grades to those which are grey-black. The fossilized form is usually grey-brown in colour.
- They are distinguished from copal by their solubility in hydrocarbon-type solvents and drying oils.
- Dammars are partly soluble in alcohol and acetone and completely soluble in benzene and turpentine.
- *Sal* dammar occurs in a nearly opaque, brittle, pale yellow form. It has a faint resinous-balsamic odour.

There is an FAO specification for dammar which gives a number of limits for such things as arsenic, lead and heavy metal content

Industrial Applications

- Dammars are used in the manufacture of paper or wood varnishes and lacquers, some inferior quality paints, and varnishes for caulking boats. They used to be an important ingredient in many types of cellulose lacquers, imparting gloss and adhesive qualities and preventing after-yellowing.
- Sal dammar is widely used as incense especially as an ingredient of *Samagri* which is burnt in religious ceremonies and cremation rites, that emits copious white fumes.

- It is also used for hurdling softer waxes for use in the manufacture of shoe polishes, carbon paper, typewriter ribbon, plastering medium for walls and roofs and as a cementing material for plywood asbestos sheets etc.
- The resin is used in indigenous system of medicine as an astringent and detergent and is given in diarrhea and dysentery.
- A little is used in foods as a clouding or glazing agent.
- Miscellaneous minor uses include manufacture of inks, polishes, water-resistant coatings and injection moulding materials.

List of Manufacturers/Exporters/ Importers of Dammar

1. **Imexco International Inc.**
   No. 15, 2nd Main Road, Karpagam Gardens, Adyar, Chennai 600020, India
2. **M V Exports**
   711,I.T.L. Twin tower Ring road
   New Delhi – 34, India
3. **General Traders**
   22, Strotten Muthia Street, Chennai 600079
   Tamil Nadu, India
4. **Trupti Enterprises**
   9, Roy Lane, Kolkata - 700007
   West Bengal, India
5. **PT. Kalula International**
   Villa Duren Sawit Kav-1, Jakarta - 13470, Indonesia

GUAR GUM

Guar gum is the gum derived from seeds of the guar plant *(Cyamopsis tetragonoloba)*.

Local name: Guargum

Plant Source: *Cyamopsis tetragonolobus* (L.) Taub

Family: Fabaceae

Distribution: The guar or cluster bean is an agricultural crop grown in arid zones of West and North-West India, Pakistan, Sudan and parts of USA. India grows over 850,000 tons, or 80% of the total guar produced all over the world. 75% of the guar gum or derivatives produced in India are exported, mainly to USA and to European countries.

Rajasthan in western India is the major guar producing state, accounting for 70% of the production. Guar is also grown in Gujarat, Haryana, Punjab and in some parts of Uttar Pradesh and Madhya Pradesh.

Production in India:

Guar seeds - 8,50,000 tons per annum (approx.)
Guar gum - 2,10,000 tons per annum

Other producing countries: Pakistan, Sudan, Australia and USA

Cultivation of Guar

Guar is being grown in India since ancient time. The tender green guar is an important source of nutrition to animals and humans and is consumed as a vegetable and cattle feed. Guar is a drought-tolerant plant which needs moderate legume crop, which grows best in sandy soils and needs moderate, intermittent rainfall with lots of sunshine.

Guar crop

Guar plant with pods

below the soil surface. Its roots develop well in lateral direction also. Some of the varieties have small hair on all parts of plant whereas some have glabrous (smooth, no hairs) leaves, stems and pods. The leaves are alternate trifoliate and are borne on long petioles. Plants have single stem, fine branching or basal branching and grow as high as 45-100 cm. The flowers are small, and white. The pods are oblong and 5 to 10 cm in length. Pods normally contain 5 to 12 seeds of oval or cube shape of variable size and color.

For optimum plant growth, guar requires rain before planting and again to induce maturation of the seeds. Too much precipitation can cause the plant to become more "leafy" thereby reducing the number of pods and/or the number of seeds per pod that affects the size and yield of seeds.

Period of cultivation and harvesting: Guar is a rain fed crop and is generally sown after the monsoon rainfall between the second half of July and early August. It is harvested from late October till November.

Yield: The average yield of guar seed in India is around 500-700 kg/ha.

Processing and Value Addition

Guar is a pod-bearing plant with six to nine seeds per pod. Each seed or bean is composed

Guar seeds

Guar splits

of hull, endosperm and germ parts, typically in a weight proportion of 15%, 40% and 45% respectively. The germ portion is predominantly protein, and the endosperm predominantly guar galactomannan or guar gum. Germ and hull are used as animal feed after proper treatment.

During processing, all these three constituents are separated. The guar gum powder is obtained after removing the hull and germ from the seed and grinding the endosperm into fine powder. The endosperm ranges from 32-42 per cent depending on the variety and maturity of the crop. So, the main unit operations involved in processing of guar seeds are cleaning, grading, dehusking, splitting and separation of endosperm, grinding and purification of powder. On arrival at the processing plant, seeds are screened for removal of dirt, stones, sand, metal debris, chaffs and broken seeds. Standard seed cleaning vibrators, electromagnets, and shifter are used for cleaning.

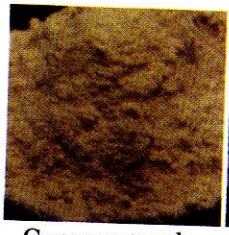
Dehulling and splitting of the seed is done by two processes i.e. dry grinding and wet grinding. In some of the industries, charring of the hull is done by flame treatment and then separation of husk is done. Recovery in wet processing method is 8 to 10% higher than in dry processing. However, the quality of the gum is not good. Hence, dry processing or charring the seed is used in most of the industries. Burr mills, pin mills and modified hammer mills are usually used for splitting of guar seeds into two halves so as to separate the germ and endosperm. The splits are then heated in kilns and passed through the dehusking machines usually consisting of a two-tired chamber, each with a rotating saw-toothed blade. Spilts stripped of their hull pass to sifters that separates the clean endosperm pieces on a 20-mesh screen.

Guar gum powder is produced from endosperm splits simply by grinding in attrition mills, hammer mills, ultra fine grinders or other size reduction equipment. However, guar gum with the best thickening power and fastest hydration rate is produced when the splits are first soaked in water and then flaked, extruded or ground.

The guar gum powder is usually modified with chemicals to give them new properties for broader applications. For industrial applications, many guar gum products are formulated with additives that control the rate of hydration, enzyme resistance, dispercibility, dry flow, or other special properties. The most common commercial derivatives of guar gum are hydroxypropylguar, carboxymethylguar and 2-hydrixy-3(trimethylammonium chloride) propylguar.

Storage and handling: Guar gum powders are generally packed 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



Guar gum powder

Storage of guar gum

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.

Quality control: The commercially available guar gum powder must meet the standards of United States FCA and European Union Specifications (Table 2 and 3). This standard is mainly for food uses.

Properties

- Guar gum is a natural high molecular weight polysaccharide composed of galactose and mannose units combined through glycosidic linkages
- Colour of guar gum powders varies from white to cream-colour
- Guar gum powder and solution is practically odorless and has a bland taste
- Guar gum powder dissolves rapidly in cold as well as in hot water. It is insoluble in organic solvents
- Guar gum powder is slightly acidic in nature and pH of 1% solution ranges from 5.4 to 7.7

Table2: US standard specifications of guar gum powder for food uses

S.No.	Properties	Maximum permissible limit
1	Total Ash	2.5%
2	Moisture	12.0%
3	Acid insoluble residue	4.0%
4	Galactomannan	80.0%
5	Protein	4.6%
6	Arsenic	3 ppm
7	Lead	10 ppm
8	Zinc	25 ppm
9	Copper	50 ppm
10	pH	5.5-7.0

Table3: Maximum permissible microbial content

S.No.	Properties	Maximum permissible limit
1	Aerobic plate count	10,000 per gram
2	Yeast and Mold	500 per gram
3	Coliform	50 per gram
4	*E-coli* and *Salmonella*	Nil

- It has good film forming property
- Guar gum is a very good thickening agent with high water binding capacity
- Guar gum hydrates rapidly in cold water and produce highly viscous solutions
- Guar gum is compatible with many other hydrocolloids used in food formulations
- Versatility due to number of free hydroxy groups to make derivatives for specific applications

Industrial Applications

The largest market for guar gum is in the food industry, where it is used as a thickener and binder of free water. Guar gum also finds extensive use in many industrial applications. The various applications of guar gum in different industries are given in table 4

Table 4. Applications of gaur gum

Industry	Uses
Food Industry	
Bakery	• Improves texture • Increases dough yield • Increases shelf life • Improves crumb structure
Processed Cheese	• Improves texture and flavour • Stabiliser
Soups	• Thickener • Stabiliser
Pastry Ices	• Absorbs free water • Prevents excessive stickiness
Noodles	• Improves texture and form • Improves moisture retention
Meat	• Binder in sausages • Absorbs free water • Improves flow rate • Prevents separation and migration
Dressing and Sauces	• Thickener • Emulsion stabiliser • Improves flow properties
Beverages	• Controls viscosity • Improves body and mouth feel • Improves shelf life
Textiles	• For sizing and finishing
Oil well drilling	• Fluid-loss controlling agent • Additives in fracturing fluids
Mining	• Concentration of ores • Flocculation and better recovery
Construction	• Waterproofing agent
Explosives	• Water binding agent for aqueous slurry explosives
Cosmetics and Pharmaceuticals	• Conditioner and viscosifier • Thickener in toothpastes and shampoos • Binder in tables • To disintegrate compressed tablets • Mild laxative and soluble dietary fiber
Paper	• For improved sheet formation • Increased bursting strength • Increased fold strength • Denser surface for printing • To get better finish

List of Manufacturers/Exporters of Guar Gum

1. **Krystal Colloids**
   Anupam Industrial Estate No. 1, Unit No.-9, Behind Sai Dham Building, Mulund (W), Mumbai - 400 080
2. **M/s. Kapadia Gum Industries Pvt. Ltd.**
   Mulji Laxmidas Bldg, Room No: 30, 2nd Flr, 3 Mint Road, Opposite GPO, Fort Mumbai - 400001
3. **Dabur India Ltd.**
   SP-C-162, M.I.A, Alwar- 301030, Rajasthan
4. **Chopra Guar Gum Industries**
   E-20, MIA, Basni - II, Jodhpur- 342005, India
5. **Durga Enterprises**
   B-69(B), MIA, Basni - II, Jodhpur- 342005
6. **Shree Ram Industries**
   C-80, Marudhar Industrial Area, Basni- 2, Jodhpur- 342005
7. **Dinesh Enterprises**
   E-274, MIA, Basni Phase- II
   Jodhpur- 342005
8. **Hindustan Gum & Chemicals Limited**
   E-282-283, Phase II, M.I.A., Basni
   Jodhpur- 342 005
9. **Supreme Gums Pvt. Ltd.**
   G-999/1000, Sitapura Industrial Area (Extn.), Jaipur, Rajasthan
10. **M/s Allied Products**
    N-91, MIDC Industrial Area, Hingna Road, Nagpur- 400 028

GUM GHATTI

Gum ghatti is the dried exudates of *Anogeissus latifolia*, a tree found in India and Sri Lanka.

Local names

Hindi: *Dhawda, dhawa*; Marathi: *Dhaura*; Telugu: *Tirumanu, Chirumanu*; Gujarati: *Dhavdo*; Tamil: *Vellainaga*

Plant Source: *Anogeissus latifolia*

Family: Combretaceae

Distribution: The tree grows extensively all over the country, more commonly in the dry deciduous forests in the Western Ghats and dry plateaus of Vindhyachal, Satpura and Western Ghats range of mountains, extending in Maharashtra, M.P. Chhattisgarh, Bihar and Orissa. It is a large erect deciduous tree that may grow up to a height of 25 meters, with a smooth light colored bark. Sometimes the bark has whitish grey depressions caused by exfoliation of bark.

In addition to its use as a source of gum ghatti, the tree is also widely used for timber and tannin is extracted from its leaves.

Production in India: 1200 tons per annum (approx.)

Other producing country: Sri Lanka

Harvesting/Collection of Gum

Method of harvesting/tapping: The trees are not usually tapped for gum. The gum oozes out naturally from the bark through injuries and wounds mostly in summers and is collected manually. In some places artificial incisions are made in the tree bark to increase the gum yield. These incisions are made carefully so as not to permanently injure or kill the tree.

Dhawda trees

Period of harvesting/collection: Maximum quantity of the gum is collected during the summer months i.e. from March to mid of June. During this time, as the weather gets warmer, the yield increases. Normally the largest crop is picked in April.

Yield: A tree on an average yields around 1-2 kg of gum in a year. Gum yield depends upon the locality, size and vigour of the growth of tree and method of tapping.

Processing and Value Addition

Harvesting and grading of gum ghatti are done by methods similar to those used for gum karaya. The exudates are hand picked by the locals, mostly tribal and laid to dry in the sun for several days. At the processing centers, gum with bark and gum without bark are sorted. The barks are hand picked and removed from gum. The gums with bark are also fed to processing machine where barks are detached from the gum. The finer crushed particles are screened and removed. The gum is then hand-sorted into various grades according to color and amount of impurity.

Ghatti tears are further processed mainly by grinding in which the gum is pulverized to

Gum ghatti

fine powder. However, various other mesh separations are also made as per the demands of the consumer. During the process of particle breakdown, impurities are removed from the gum by shifting, aspiration, and density table separation. Some work has been done on spray drying the soluble fraction to obtain powdered gum ghatti.

Storage and handling: 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.

Quality control: The main quality criteria at the sorting stage are colour and foreign matter, although even after grading the quality of consignments is often variable. The higher grades should be cleaner and paler than the lower ones, which may be dark brown in colour and have bits of bark present.

Typically, three grades of gum ghatti are available which are exported to various countries. These are No. 1, No. 2, and Unassorted grades. The No.1 grade is light in color with low levels of ash and high viscosity. Number 2 grade is light amber to brown and the unassorted grade is dark brown to nearly black in colour. A BIS specification (IS 7239:1974) exists for food grade gum ghatti.

Properties

- The colour of the gum varies from whitish yellow to amber; though the presence of impurities sometimes imparts a brownish colour to the gum.
- Gum ghatti is partly soluble in water and forms a colourless mucilage.
- Gum ghatti is a moderately viscous gum lying intermediate between gum arabic and gum karaya. It forms viscous solutions at concentrations of about 5% or higher and exhibits typical non-Newtonian behaviour.
- The emulsifying properties of gum ghatti are excellent and considered to be better than gum arabic and thus used in more difficult-to-handle systems.
- Gum ghatti solutions are sensitive to alkali. Viscosity increases sharply with pH upto a maximum at about pH of 8.0 and above that the solutions tend to become stringy.
- Gum ghatti is approved for food use and is in the GRAS list under the Food, Drug, and Cosmetic Act, U.S.A. It is non toxic and is not metabolized in human.

Industrial Applications

Gum ghatti is used

- As an emulsifier and stabilizer in beverages and butter containing table syrups.
- As a flavour fixative for specific applications.
- In the preparation of powdered, stable, oil-soluble vitamins.

- As a binder in long-fibered light weight papers.
- As an emulsifier of petroleum and non petroleum waxes to form liquid and wax paste emulsions.
- In combination with polyacrylamide to aid in the polymerization and formation of uniform and discrete prills of cross-linked polystyrene.
- As drilling mud conditioner and the acidizing of oil wells.
- Used in powdered explosives to improve resistance to water damage.

List of Traders/Processors/ Exporters of Gum Ghatti

1. **Krystal Colloids**
   Anupam Industrial Estate No. 1,Unit No - 9, Behind Sai Dham Building, Mulund (w),Mumbai - 400 080, INDIA
2. **Jethabhai Hirjee & Co.**
   Shed no. - 8, Sion estate, Sion, Mumbai
3. **Laxmi Enterprises**
   170/72, Samuel Street, Mumbai
4. **Jayshree Canvassers**
   Gourakshan Market, Gondia- 441601, Maharashtra
5. **Bahubali Udyog**
   21-A, Industrial Estate, Tifra, Bilaspur - 495 223, Chhattisgarh

GUM ARABIC

Gum arabic is the natural gum exuded by various species of *Acacia*. The main source of commercial gum arabic is *Acacia senegal* L. Willd.

Local names: Hindi & Rajasthani: *Kumta, kumat*

Plant Sources: *Acacia senegal* (L.) Willd. and *Acacia seyal*

Family: Leguminosae

Distribution: The trees are native of North Africa and grow mainly in the sub-Sahara or Sahel zone of Africa and also in Australia, India and South America. *A. senegal* is found in some parts of India mainly in the dry rocky hills of south east Punjab, in the northern Aravalli hills and other drier parts of Rajasthan and Gujarat.

A. senegal is a small sized thorny tree (4 to 5 meters height). *Acacia* trees are grown from seedlings which are planted when they reach the height of 15- 20 cm. Gum production can begin when the trees are 5 years old, although gum may be tapped from the trees after 3 years. However, the quality and yield are consistent only after 5 years

Production in India: 800 tons per annum (approx).

Major producing countries: The main producing and exporting countries in the 'gum arabic belt' include Cameroon, Chad, Mali, Nigeria and Sudan. Sudan dominates the world gum trade with a market share of about 60%.

Harvesting & Collection of Gum

Method of harvesting/tapping: The gum

A. senegal tree

exudes from the cracks on the bark of the tree under difficult conditions such as heat, dryness, wounds, and diseases. The gum flows naturally from the bark of the trees in the form of a thick and rather frothy liquid, and speedily concretes in the sun into tears.

To accelerate exudation and to improve and regulate gum production, *Acacia* trees are tapped by means of incisions (60 cm x 5 cm) made in their branches some weeks ahead of time. Usually mature trees, 4.5-6 m high and 5-25 years old, are tapped by making incisions in the branches and stripping away bark. The gum starts to collect in the wound within 3 - 8 weeks, but this depends on the weather conditions. Gum droplets are about 0.75 - 3 cm in diameter, and they gradually dry and harden on exposure to the atmosphere. These gum tears are manually collected.

Efforts are now being made to improve gum yield by treatment of tree wounds with chemical irritant and injection of hormones.

Period of harvesting/collection: Collection of gum arabic takes place at intervals during the dry season from November to May. During the rainy season no gum is formed since the trees are in full bloom.

Yield: A tree, on an average, may yield 250 grams of gum arabic per annum, although

production may range from a few grams to as high as 10 kg. The highest yields are observed on individuals aged from 7 to 12 years. A young tree usually yield 400 - 7000g annually.

In general, the higher the average temperature, the higher is the yield of gum. Damaged trees give a larger yield of gum. Gum yields are improved by natural factors that lessen the vitality of the trees such as hot weather, poor soil, lack of moisture, etc.

Processing and Value Addition

Just after harvest, the gum is delivered to cleaning sheds for the removal of impurities, sand, and pieces of bark. There after it is sorted to different grades based on colour and per cent of impurities. Sorted and cleaned gum arabic is usually traded as tears that are approximately 2.5 to 5 cm in size packed in 100 kg jute bags.

Gum arabic is further processed in the destination countries into forms needed for incorporation into the final products. These processes include 'kibbling' (making uniform pebble size pieces), granulating, powdering and spray-drying. Kibbling entails passing whole or large lumps of gum through a hammer mill and then screening it to produce smaller granules of more uniform size. These pieces are more easily dissolved in water, and under more reproducible conditions, than the raw gum and so are preferred by the end-user.

Powdered gum may be produced from kibbled gum but it may also be produced by a process known as spray drying. This furnishes a high-quality, free-flowing powder with even better solubility characteristics than kibbled gum. The gum is dissolved in water, filtered

Gum arabic tears

Gum arabic powder

contamination, is sprayed into a stream of hot air to promote evaporation of the water. The powder is then screened to assure uniformity of particle size.

Transportation and Storage: 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°C) and dry place, has an unlimited shelf life.

Quality control: The specifications that are widely used by the importers when importing raw gum arabic are as follows:

- *Optical rotation*: provides assurances that the gum has not come from other tree species
- *Moisture content*: not more than 12-14 % is permitted
- *Foreign matter content*: no more than 3-5 % is permitted
- *Color* (specific parameters)
- *Viscosity* (specific parameters)
- *Microbiological count*: tests for *Salmonella, Escherichia coli* and *Staphyloccus aureus* should be negative

An FAO (JECFA) specification exists for gum arabic intended for use as a food additive and in the United States, a Food Chemicals Codex specification exists. For pharmaceutical use, gum arabic appears in many pharmacopoeias, including the British Pharmacopoeia.

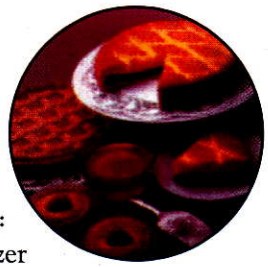
The JECFA specification has undergone a number of revisions over the years. The present one (published in 1990) specifies limits on such things as loss on drying, ash, acid-insoluble matter, arsenic, lead and heavy metals. A BIS specification (IS 6795:1972) is there for food grade gum Arabic in India,

Properties

- Gum arabic is a neutral or slightly acidic salt of a complex polysaccharide containing calcium, magnesium, and potassium cations.
- Gum arabic is nontoxic, odourless, and has a bland taste and it does not affect the odour, colour or taste of the system in which it is used.
- The gum is somewhat yellowish in colour.
- It is insoluble in oils, and in most organic solvents, but usually dissolves completely in hot or cold water, forming a clear, mucilaginous solution.
- Hydrolysis of gum Arabic yields L-arabinose, L-rhamnose, D-galactose and D-glucuronic acid.
- It is in the GRAS (Generally Recognized As Safe) list under the Federal Food, Drug and Cosmetic Act.

Industrial Applications

A brief summary of the industries that use gum arabic is given in the following



Food Industry:

- *Confectioneries*: used to prevent crystallization of sugar
- *Dairy products*: Used as a stabilizer in frozen products
- *Bakery products*: Used for its viscosity and adhesive properties
- *Beverages*: Used as a foam stabilizer in beer, and as a clouding agent to give opacity
- *Flavour emulsifier*: used as an emulsifier and protective collide.
- *Diabetic and dietectic products*: Used because of its low level of metabolism.

Pharmaceutical Industry:

- *Emulsions*: Used as a stabilizer
- *Tablets*: Used as a binder
- *Tablet coatings*: Used as a mucilage
- *Cough drops and syrups*: Used as an emollient and demulcent

Cosmetic Industry:

- *Lotions and protective creams*: Used to give smooth feel
- *Facial masks*: Used as an adhesive
- *Face powders*: Used as an adhesive

Other Industries:

Adhesives: Used as a mucilage, as simple adhesive and glue for miscellaneous paper, glass and metal products

Ink: Used as a protective collide and suspending agent

Lithography: Used as a sensitizers for lithographic plates, elements in the light-

sensitive composition, ingredients of the fountain solution used to moisten plates during pointing, and protectors during storage of plates.

Paper: as a coating for specialty papers and as a coacervate in carbonless paper.

Paints: Used as a protective collide, as a flocculant and emulsifier in vinyl resin emulsions

Textiles: used as sizing and finishing agents and in printing formulations for imparting designs and decorations to fabrics, also used to thicken the dye baths that are used in the printing and dyeing of fibers, fabrics and carpets.

List of Traders/Processors/ Exporters of Gum Arabic

1. **Krystal Colloids**
   Anupam Industrial Estate No. 1,Unit No - 9,
   Behind Sai Dham Building, Mulund (W),
   Mumbai - 400 080
2. **Jethabhai Hirjee & Co.**
   Shed no. – 8, Sion Estate, Sion, Mumbai
3. **Laxmi Enterprises**
   170/72, Samuel Street, Mumbai
4. **Bahubali Udyog**
   21-A, Industrial Estate
   Tifre Bilaspur – 495 223, Chhattisgarh

GUM KARAYA

Gum karaya, also known as Indian tragacanth is the dried exudate obtained from trees of *Sterculia* species (mostly from *Sterculia urens*).

Local names: Hindi: *Gulu, Kadaya, Karaya, Katera, Katilo, Kullo*; Telugu: *Tapsi*

Plant Source: *Sterculia urens* Roxb.

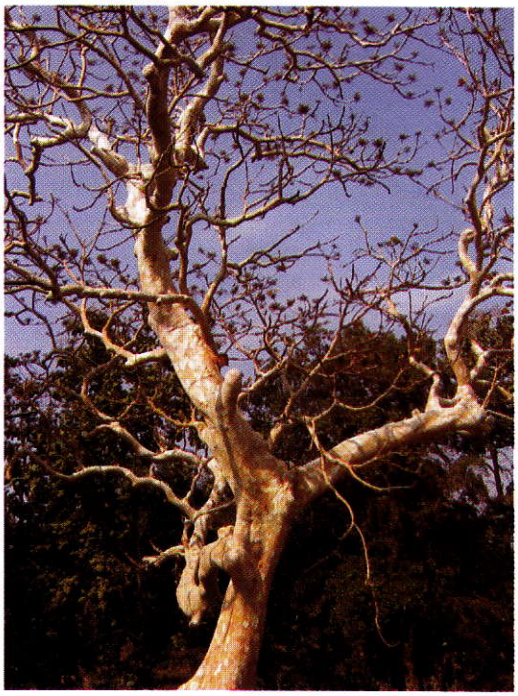
Family: Sterculiaceae

Distribution: *Sterculia urens* are usually found in tropical dry rocky hills and plateau. It is always noticeable from its smooth greenish-gray bark or white stem peeling off in large papery exfoliation, especially in the hot season, and the gaunt white stem with stiff spreading branches. The tree starts shedding its leaf in the cold season and the panicles of flowers appear from December to March at the end of leafless branches. Young leaves sprout in the hot season.

Sterculia urens is indigenous to India having a wide distribution. It is abundantly found in the dry deciduous forests in Madhya Pradesh and Chhattisgarh, which in earlier contributed about 50% of gum production in the country and the remaining came from Andhra Pradesh, Rajasthan, Gujarat, Orissa, Maharashtra, Karnataka and Tamilnadu. However, a greater proportion of recent production comes from Andhra Pradesh.

Production in India: 1500 tons per annum (approx.)

Other producing countries: Sudan and Senegal (where gum karaya is obtained from *Serculia setigera*)



Karaya tree

Harvesting / Collection of Gum

Method of harvesting/tapping: The locals tap the trees by making incisions upto one square foot in dimension on the trunk. The gum begins to exude immediately and the exudation continues for several days. The maximum amount of exudation occurs within the first 24 hours. The gum is in the form of large irregular tears. The tears are picked by the locals who sell the same to the forest contractors registered with the TRIFED. In the state of Andhra Pradesh, the purchases of raw gum karaya are centralized through the state owned Girijan Co-operative Society.

Period of harvesting/collection: The best quality gum is collected during April, May and June i.e. in summer. During this time, as the weather gets warmer the yield increases. The gum collected during the monsoons has low viscosity. In September, after the monsoon, the collection cycle is repeated.

Collection of gum karaya

Yield: A tree of about 1.5 to 2 m girth with two blazes yields 2 to 5 kg of gum in a year and may produce up to 10 kg depending upon the locality, size and vigour of the tree and method of tapping.

Processing and Value Addition

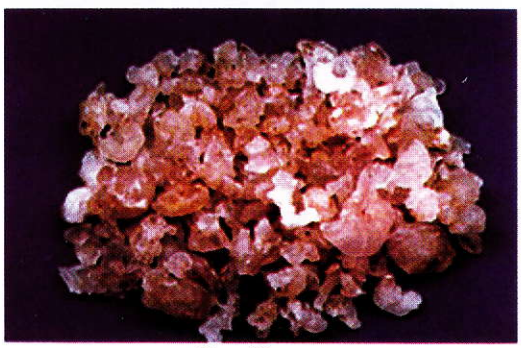
Gum collected by the villagers is delivered to the agents appointed by the trading corporation at rates fixed according to quality of gum. It is then packed in gunny bags and transported to towns. The gum often contains many impurities like tree bark etc.

At the grading centre the big lumps are broken into small pieces of about 1 to 3 cm in diameter. The broken pieces are then graded manually in five different grades, which are registered with the Indian Agmark Organisation, and which are based mainly on criteria of viscosity, colour and free from external bark, sand etc.

Gum is further purified by size reduction and removal of pieces of bark by air flotation methods. Other mechanical methods are used to remove sand, dirt and other types of foreign matter. Gum karaya is also granulated and powdered for obtaining a homogenous dispersion. Granulated or crystal gum karaya are usually processed so that the particle size is between 6 and 30 mesh. These granulated gum karayas are used principally as bulk laxatives.

Storage: 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, gum 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



Gum Karaya

storage can be minimised by the addition of preservatives like benzoates, sorbates, phenols and related compounds.

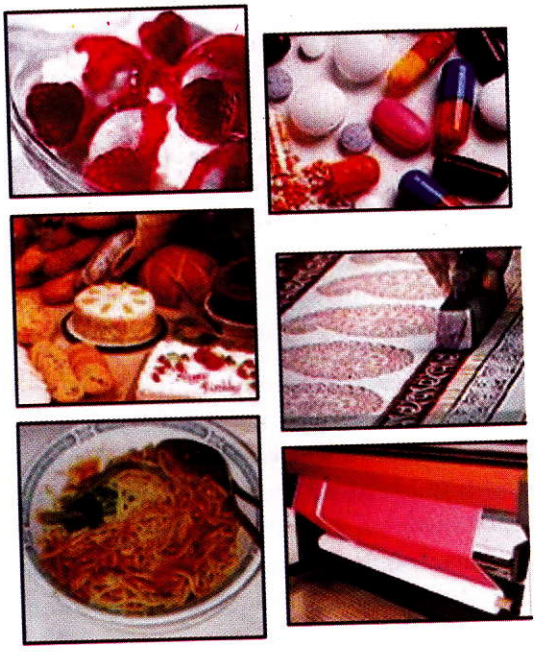
Quality control: There are at least five Indian grades of karaya: HPS (Hand Picked Selected), Superior No.1 and No. 2, FAQ (Fair Average Quality) and Siftings. The first four grades are the main export grades. The main quality criteria at the sorting stage are colour and foreign matter, although even after grading the quality of consignments is often variable. The higher grades should be cleaner and paler than the lower ones, which may be dark brown in colour and have bits of bark present. A BIS specification (IS 12408:1988) exists for food grade gum karaya.

Properties

- Gum karaya is an acidic, partially acetylated polysaccharide
- It is white or intense ruby in colour and solidifies into large, roundish tears
- It is not soluble in water but swells into a jelly like mass in water. It absorbs water very rapidly to form viscous mucilages at low concentrations, although it is one of the least soluble among exudate gums.
- Karaya is a calcium and magnesium salt, with a central chain of D-galactose, L-rhamnose and D-galacturonic acid units, with some side chains containing D-glucuronic acid.
- Heating gum karaya dispersions increases the solubility but results in permanently lower viscosities
- Gum karaya is approved for food use and is in the GRAS (Generally Recognized As Safe) list under the Food and Drug Act.

Industrial Applications

- Used in dental adhesive products.
- Used as a bulk laxative
- As an adhesive for ostomy rings
- It is used as a stabilizer for dairy products and frozen desserts.
- It is used as an acid resistant stabilizer for sherbets, fruit ices and similar low pH products.
- It is used in stabilizing packaged whipped cream products, meringue toppings and aerated dairy foods. It is also used to improve the spreadability characteristics of cheese spreads.
- It is a good emulsion stabilizer for French style salad dressings.
- It is used as a binder for making low calorie dough-based products such as pasta, bread and other bakery products.
- It is used in ground meat products as it provides good water holding and binding



properties to yield finished products.

- In the paper industry, it is used in the manufacture of long fibered, light weight papers.
- It is used in textile printing operations as a thickening agent for the dye in direct color printing on cotton fabrics.

List of Traders/Processors/ Exporters of Gum Karaya

1. **Krystal Colloids**
   Anupam Industrial Estate No. 1,Unit No - 9, Behind Sai Dham Building, Mulund (W), Mumbai - 400 080
2. **Jethabhai Hirjee & Co.**
   Shed no. - 8, Sion estate, Sion, Mumbai
3. **Laxmi Enterprises**
   170/72, Samuel Street, Mumbai
4. **Jayshree Canvassers**
   Gourakshan Market, Gondia- 441601, Maharashtra

GUGGUL

Guggul or Indian Myrrh is the yellowish gum-resin produced by the stem of the guggul tree (*Commiphora spp.*)

Local names: Bengali, Gujarati – *Guggul*; Hindi – *Guggulu, Guggal*; Kannada – *Guggal*; Marathi – *Guggala*; Malayalam – *Gulgulu, Guggalu*; Tamil – *Maishakshi, Gukkal*; Telugu – *Guggal*

Plant Sources: *Commiphora mukul and Commiphora wightii* (Arn.)

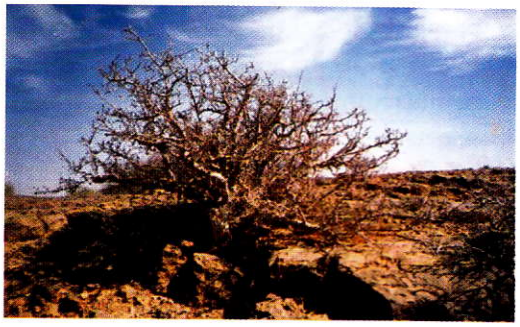
Family: Burseraceae

Distribution: Guggal is a spiny shrub or small tree with many branches, usually growing two or three meters high, that is native to India, Arabia and Pakistan. It is found in the arid, rocky tracts of Rajasthan, Gujarat, Madhya Pradesh and Karnataka in India. The *Commiphora mukul* tree has an ash-colored bark that comes off in large rough flakes, exposing the under bark that also peels away. The tree remains without any foliage for most of the year.

The plant prefers arid and semi-arid climates and is tolerant of poor soil. It grows well in sandy to silt loam soils, which are poor in organic matter and rich in other matters and also considered as drought and salinity resistant plant. The plant has a wide adaptability and if found growing in arid regions under varying conditions.

Production in India: Data not available

Major producing countries: India, Pakistan and UAE

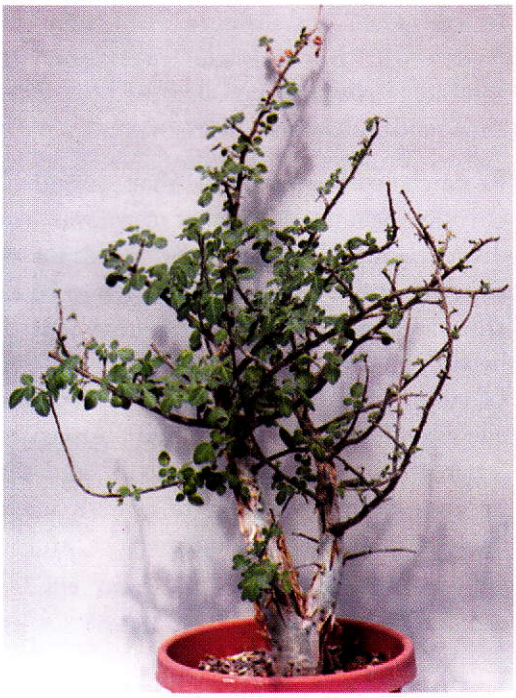


C. wightii

Harvesting/Collection of Gum-Resin

Method of harvesting/tapping: The gum-resin resides in the ducts located in the soft bark of the tree. It is obtained through a process called tapping. After attaining complete maturity of plant, it is tapped from main stem. The resin ducts occur in the bark portion near cambial layer. Plant attaining 7.5 cm diameter is suitable for tapping. Usually 1.5 cm deep circular incisions are made on the main stem, not beyond the thickness of the bark. Guggul oozes out from these incisions as a pale yellow, aromatic fluid that quickly solidifies to form a golden brown or reddish brown agglomerate of tears or stalactic pieces. It is collected manually or

Yellow gum resin from incision



Guggul plant

with spear. The gum-resin is scraped off the wound with the knife. The collection is done at an interval of 10-15 days.

Period of harvesting/collection: The trees are tapped for resin from November through January, and collection continues until May or June through a nick on the bark of the tree.

Yield: A healthy tree yields 250 - 500 grams of gum-resin in one season, and guggal plants typically begin yielding resin after five years. Starting from the sixth year, yield of gum resin increases from 200 to 400 gm per plant.

Processing and Value Addition

The exuded resin is allowed to dry on the tree before it is collected. Collected resin is cleaned by sieving and hand picking to remove foreign matter, and packed in sacks for transfer to points of sale, either nationally or internationally. The collected gum is graded according to its purity.

Extracts of the gum-resin include compounds known for their hypolipidemic properties, the Z- and E- isomers of guggulsterone and its related guggulsterols: guggulsterol I, guggulsterol-II, guggulsterol-III, guggulsterol IV, guggulsterol V, and guggulsterol VI. A standardized extract of the guggulsterones

Properties

The dried gum-resin has a bitter aromatic taste and balsamic odour

The colour of guggul varies from transparent golden brown to dark brown.

It is soluble in most organic solvents.

It burns readily and diffuses an pleasant odour

Industrial Applications

Traditional Uses: Gum guggul is used as incense, to make lacquers, varnishes, and ointments, as a fixative in perfumes, and in medicine.

Gum guggul has been used to treat dysmenorrhea, dyspepsia, endometritis,

Guggul

hypercholesteremia, hypertension, impotence, bronchitis, caries, catarrh, gingivitis, hay fever, hysteria, inflammation, laryngitis, lochia, mania, pharyngitis, phthisis, pyorrhea, rheumatism, sores, sore throat, stimulant, tonsillitis, tumors, wounds bone fractures, gout, scrofula, sciatica, facial paralysis, diplegia, leprosy, leucoderma, pectoral disorders, otorrhea, epilepsy, fever, strangury, hemorrhoids, dysmenorrheal, amenorrhea, ulcers, anemia, coronary, thrombosis, stomatopathy, pharyngopathy, spermatorrhea, urinary calculus, diabetes, trichosis, to enhance phagocytosis, to increase leukocytes, to induce abortion, and as a tonic for the uterus.

Modern Uses: Modern therapeutic uses of guggul include nervous diseases, hemiplegia, leprosy, marasmus, muscle spasms, neuralgia, ophthalmia, pyelitis, pyorrhea, scrofula, skin disorders, spongy gums, ulcerative pharyngitis, hypertension, ischemia, hypertension, and urinary disorders. The Ayurvedic herb *Inula racemosa*, in combination with C. *mukul*, is used to reduce chest pain and dyspnea of angina.

Research studies showed that guggul is effective against aspects of cardiovascular disease. Guggul reduced the stickiness of platelets, and Gugulipid was shown to be an efficacious and cost effective treatment of hyperlipoproteinemia. A webpage to sell Gugulon stated it is marketed to help lower cholesterol, decrease high blood pressure, to "strengthen the structural system" and the immune system, to benefit the heart, to lower cholesterol and high blood pressure, and to eliminate toxins.

List of Manufacturer/Processors/ Exporters of Guggul

1. **Ind Swift Limited**
   781 Industrial Area Phase 2,
   Chandigarh, India
2. **Divine Remedies**
   SCO 64-65, Sector 8-C, Chandigarh, India
3. **Sanat Products Limited**
   3rd.Floor, Sagar Plaza, Laxmi Nagar District Centre, Vikas Marg, Delhi-110092, India

SALAI

Salai gum or Indian olibanum is the gum-resin obtained from the species of *Boswellia* of which *Boswellia serrata* Roxb. ocuurs in India.

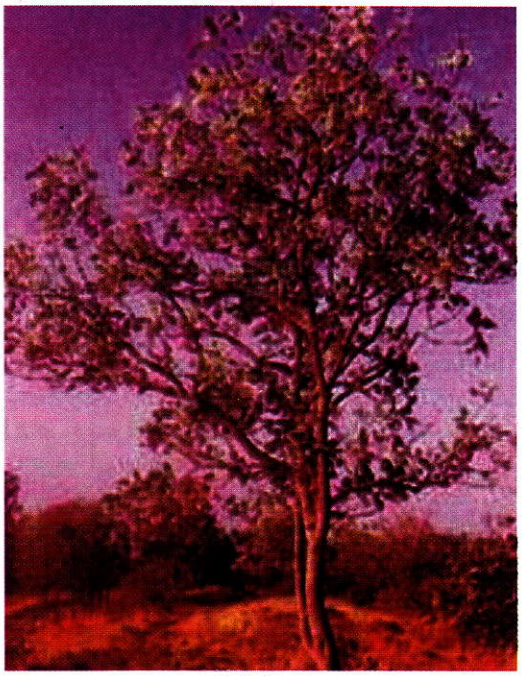
Local names: *salai, luban, salga, shallaki guggal, kundrikam, kungli, morada*

Plant Source : *Boswellia serrata*

Family : Burseraceae

Distribution: It is a moderate to large branching tree, found in dry deciduous forests, being common in dry hills throughout India. It usually has a short bole, 3-5 m in length, sometimes longer if grown in a fully stocked forest. Bark is very thin, greyish-green, ashy or reddish peeling off in thin, papery flakes. The leaves are like those of neem plant and have small white flowers. The tree occurs mainly in Madhya Pradesh, Andhra Pradesh, Orissa, Rajasthan and Gujarat and to a lesser extent in Maharashtra, Uttar Pradesh and in other dry and tropical regions of the country.

The tree is characteristically found on the slopes and ridges of hills, as well as on flat terrain, attaining a larger size on fertile soils. It is resistant to drought and fire. The tree is also frost hardy and serves as a nurse tree for other species. It typically grows on rocky ridges and it does well on neutral soils above gneiss, schist, quartzite, limestone and sandstone. The species has the ability to thrive in the poorest and the shallowest soils where most of its associates remain stunted. Relative humidity should be 40-80% in the winter and 60-90% in the summer. The tree can be found up to 1150 m in elevation.



Salai tree

Production in India: 50 tons per annum (approx.)

Major producing countries: India and Pakistan

Harvesting/Collection of Gum-Resin

Method of harvesting/tapping: Usually trees of 90 cm girth and above at breast height are tapped for the gum-resin. Trees of lower girth classes should not be tapped since any damage done to them may adversely affect their growth. A thin band of bark of about 30 cm in length and 20 cm wide is shaved from the trunk of the tree at a height of about 0.75 meter from the ground. Thus the reddish phloem in which the resin canal and ducts lie is exposed. The blaze is freshened after every fourth or fifth day. The first collection of the

gum-resin is made after 2 weeks. Collection is done by a scraper keeping a tray having a semi-circular edge around the blazed surface. Freshening of the blaze is done from time to tome and the original blaze is slowly widened.

Period of harvesting/collection: Tapping and collection of salai gum generally started from November and continued upto end of May every year. It closes on the onset of monsoon. The gum may be collected after a month of initial blazing. Subsequent freshening of the blazes and collection may be done fortnightly.

Yield: Average annual yield of salai gum per tree is estimated to be about 1 kg, though a well grown tree yields upto 2 to 2.5 kg of gum-resin in a year. The yield of salai gum is found to vary according to season, locality, and size of the tree. Generally larger the girth of a tree, the greater is the yield. Yield has generally been found to be poor in moist region and from trees which are old with black bark, dwarfed and suppressed. Middle aged, sound and vigorous trees give comparatively better yield

Processing and Value Addition

Salai gum is collected in a semi-solid state. After collection, the bark and other impurities are removed manually. The crude gum-resin is allowed to remain in a bamboo basket for upto a month during which the fluid portion, locally known as *ras*, flows out. The *ras* forms about 8 to 10 per cent of the raw material and is used in paints and varnishes. Remaining semi-solid to solid part is the gum resin, which is dried thoroughly and sometimes treated with soapstone powders to make it brittle. It is then broken into small pieces by wooden mallet or chopper. During this process, bark and other impurities are again removed manually. The gum-resin is then graded according to its colour and impurities. Generally four grades are distinguished in the market as follows.

Salai gum

Grade	Colour	Appearance
Super-fine	Light yellow	Translucent
Quality-I	Brownish yellow	Translucent
Quality-II	Brown	Semi-translucent
Quality-III	Dark brown	Opaque

Active Constituents: The gum oleoresin consists of essential oils, gum, and terpenoids. The terpenoid portion contains the boswellic acids that have been shown to be the active constituents in boswellia.

Properties

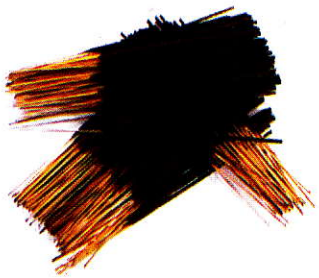
- The colour of salai gum varies from transparent golden brown to dark brown

or dark greenish brown depending on the season of collection and impurities present.

- Salai gum contains on an average 10-11 per cent moisture, 8-10 per cent volatile essential oil, 45-50 per cent resin, 30-35 per cent gum and 4-5 per cent insoluble matters
- Boswellic acid is one of the principal constituents in the gum resin, which has shown anti-inflammatory, anti-atherosclerotic and anti-arthritic activities
- It is soluble in most organic solvents.
- Its softening point varies from 65-72°C and melting point from 73-78°C.
- It burns readily and diffuses a pleasant odour
- The resin portion has a specific gravity of 0.91, acid value of 1.87, saponification value of 65, ester value of 63.14, and iodine value of around 200.
- The gum portion contains mainly pentose with a high proportion of arabinose.

Industrial Applications

Salai gum resin is traditionally used as incense because of its very unique fragrance.



It is widely used in ayurvedic formulations for treating asthma and arthritis. Boswellia has been shown to be as effective and, in many cases, better than drugs like Phenylbutazone and other anti-inflammatory drugs

It is used in indigenous medicine for rheumatism, nervous disease as a diaphoretic, astringent and as an ingredient in certain ointments.

It is also used for lighting fires.

List of Manufacturer/Processors/ Exporters of Salai

1. **Sanat Products Limited**
   3rd.Floor, Sagar Plaza, Laxmi Nagar District Centre, Vikas Marg, Delhi-110 092, India
2. **Krystal Colloids**
   Anupam Industrial Estate No. 1,Unit No - 9, Behind Sai Dham Building, Mulund (w), Mumbai - 400 080, INDIA

ASAFOETIDA

Asafoetida is the dried aromatic gum-resin exuded from the living rhizome, rootstock or taproot of varied plant species of genus *Ferula*

Local names: *Hing, asafetida, ingo, inguwa*

Plant Sources: *Ferula asafoetida* and allied species (*Ferula foetida and Ferula narthex*)

Family: Umbelliferae

Distribution: The perennial asafoetida plants has several varieties and are native to the region between the Mediterranean region to Central Asia, especially Iran and Afghanistan. The other species, known botanically as *Ferula northex*, grow abundantly in Kashmir, Western Tibet and Afghanistan.

Production in India: Data not available

Major producing countries: Afghanistan, Iran, Turkistan. Ferula gum-resins are imported to India, mainly from Iran and Afghanistan. A part of the imported gum-resin is re-exported to various countries after some processing and value addition.

Harvesting/Collection of Gum-Resin

Method of harvesting/tapping: The gum-resin is obtained from incisions in the roots and rhizomes of the plants. Usually plants of four to five years old develop very thick and fleshy, carrot shaped roots. The upper part of the root is laid bare and the stem is cut close to the crown. The exposed surface is covered by a dome shaped structure made of twigs and earth. A milky juice exudes from the cut surface which soon coagulates when exposed to air. After some days, the exudate gum-resin is scraped off and a fresh slice of the root is cut.

Asafoetida plants

A plant with flowers

Period of harvesting/collection: Tapping is usually done in March and April, just before the plants flower

Processing and Value Addition

The milk juice obtained from the root becomes a brown, resin-like mass after drying. Asafoetida is processed and marketed either as lumps or in powdered form. The lump asafoetida is the most common form of pure asafoetida. The trading form is either the pure resin or so-called "compounded asafoetida" which is a fine powder consisting to more than 50% of rice flour and gum arabic to prevent lumping. The advantage of the compounded form is that is is easier to dose.

The gum-resin is also steam distilled to obtain the essential oil known as Oil of Asafoetida.

Properties

- Asafoetida has a powerful odour and a bitter acrid taste, due to the presence of sulphur compounds in it.
- Asafoetida contains about 40-60 per cent of resin, 25 per cent of gum, 10 per cent of

Asafoetida lumps

Asafoetida powder

volatile essential oil and other compounds like ash. The resin consists chiefly of asaresinotennol, free or combined with ferulic acid.

- An analysis of asafoetida shows it to consist of carbohydrates 67.8 per cent per 100 gms, moisture 16.0 per cent, protein 4.0 per cent, fat 1.1 per cent, minerals 7.0 per cent and fibre 4.1 per cent. Its mineral and vitamin contents include substantial calcium besides phosphorus, iron, carotene, riboflavin and niacin.

Uses:

Asafoetida has long been used as a food flavouring and medicinal herb. It is still sometimes used in modern herbalist where it is especially valued in the treatment of hysteria, some nervous conditions, bronchitis, asthma and whooping cough..

The gum resin is antispasmodic, carminative, expectorant, laxative, sedative. The volatile oil in the gum is eliminated through the lungs, making this an excellent treatment for asthma.

It is used as a flavoring agent and forms a constituent of many spice mixtures

Asafoetida is useful in the treatment of respiratory disorders like whooping cough, asthma and bronchitis

It is reputed as a drug which expels wind from the stomach and counteracts any spasmodic disorders. It is also a nervine stimulant, digestive agent and a sedative

List of Manufacturer/Processors/ Exporters of Asafoetida

1. **M/s Malligha Asafoetida Company,**
   89/2A2, Masthanpatti, Andarkottaram (P.O.) Madurai - 625020,
   Tamil Nadu, India
2. **Laljee Godhoo & Co.**
   213, Samuel Street, 1st Floor, Masjid Bunder (W) Mumbai - 400003, Maharashtra, India
3. **Mother Herbs (P) Ltd.**
   C-39, II & IV Floor, 13 Street, Madhu Vihar, Patpadganj, Delhi - 110 092, (India)

4. **Shubh Food Products**
   104-2, Bhandup Industrial Estate, L.B.S. Marg, Bhandup West, Mumbai - 400078, Maharashtra, India

5. **Utkarsha International**
   6, Nilesh Co-Op. H. S. G. Socity, Guru Mandir Road Saraswat Colony Dombivli East, Dist. Thane, Dombivli, Maharashtra - 421 201, India

6. **Chozha Marketing Agency**
   392/67-B, M. P. Nagar, Vellakovil, Tamil Nadu - 638 111, India

7. **National Foods**
   127, Road N, G.I.D.C., Waghodia, Baroda - 391 760, Gujarat, India

8. **Talwar Sons**
   86, Chinna Subanna Street, K. K Pudur, Coimbatore- 641 038 Tamil Nadu, India

9. **Jagdish Gambhir Hingwala / P.J. Enterprises**
   Plot 1-A, R.No. 111, 1st Floor, Sector 19c, Vashi, Navi Mumbai - 400 703.

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