

Natural Gums: Commercially Valuable Plant Products for Value Addition

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Gums are substances mainly collected from various terrestrial and marine plants. Gums are large molecules that can be either hydrophilic or hydrophobic, forming viscous solutions or gels in specific solvents at low concentrations. Industrial gums are polysaccharides of plant and microbial origin that create viscous solutions when dispersed in hot or cold water. Types of gums include plant seed gums (e.g., guar gum, locust bean gum), exudate gums (e.g., acacia gum, tragacanth gum), microbial gums (e.g., xanthan gum, gellan gum), mucilage gums (e.g., psyllium gum), seaweed gums (e.g., alginates, carrageenan), and animal polysaccharide gums (e.g., chitin, chitosan). Although many plants produce gums, only a few tree species from the Fabaceae, Sterculiaceae, and Combretaceae families are commercially viable, with the Fabaceae family being the most significant. Commercially produced gums include gum arabic (*Acacia senegal*), gum ghatti (*Anogeissus latifolia*), neem gum (*Azadirachta indica*), gum karaya (*Sterculia urens*), Joel/Jingan gum (*Lannea coromandelica*) and mesquite gum (*Prosopis juliflora*). These gums have numerous applications in food and other industries. Exudate gums like gum arabic, tragacanth gum, karaya gum, and ghatti gum are deemed safe for consumption based on historical use and toxicological studies, with their GRAS status recognized by the FDA. Food applications of exudate gums include flavour encapsulation, emulsification, thickening, clouding agents in beverages, foam stabilizers, spreadability agents in cheeses, and water binders in bakery and minced meat products. They also have non-food applications in pharmaceuticals, textiles, cosmetics, etc. Ancient Egyptians used gum arabic in textile glues, mummifying fluids, and dye dispersions.

Gum Exudation

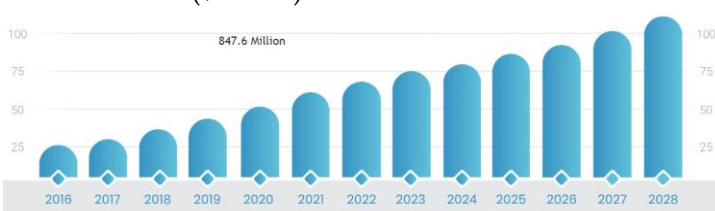
Gum exudation can be a normal part of a plant's metabolism but is often linked to pathological activities. This pathological exudation, or "gummosis," results from factors such as parasitic invasion, microbial infection, chemical stress, physical injury, and various climatic conditions. Exudation serves as a natural defence mechanism, with the gum covering wounds to the bark. When bark is injured, many trees, especially in semiarid areas, exude a gummy liquid

that hardens to protect against infection and water loss.

Gum processors receive crude exudate gum in large chunks, which are then ground, sieved, and purified to remove impurities. In some cases, exudate gum undergoes further purification and spray-drying to eliminate insoluble impurities. Like other gums, exudate gums have food applications due to their stabilizing, thickening, gelling, and emulsifying properties.

Global gum market

The global natural gum market was valued at USD 847.6 million in 2020 and is projected to reach USD 1,423 million by 2028, growing at an annual rate of 4.7%. Asia Pacific held the highest market share in 2020. Major companies in the market include Ingredion (Gum Technology), Deosen Biochemical, CP Kelco, Fufeng Group Company, Jungbunzlauer, Cargill, Hebei Xinhe Biochemical, and Meihua. Natural gums are primarily used in the oil and gas, food and beverages, pharmaceutical, and cosmetics industries. The top exporters of natural gum, resin, gum-resin, and balsam (excluding gum arabic) were Afghanistan (\$129M), India (\$78.7M), Indonesia (\$51.5M), Brazil (\$41.4M), and Somalia (\$35.7M). The top importers were India (\$163M), China (\$54.3M), Portugal (\$37.7M), the United States (\$35.8M), and Saudi Arabia (\$27.9M).



(Source:

<https://www.vantagemarketresearch.com/industry-report/natural-gum-market-0320>)

Most Commercially Valuable Gums

I. Seed Gums

1. Guar gum (Cluster Beans)

India is native to guar or cluster beans, used both as a vegetable and as a source of guar gum. Guar gum, extracted from the endosperm of the *Cyamopsis tetragonoloba* seed, acts as a food and water store. This legume is an annual plant grown in the dry regions of

India primarily as animal fodder. It is a rain-fed crop, sown in July-August and harvested in October-November. The guar seeds are dehusked, milled, and screened to produce guar gum. The main cultivation areas in India include Rajasthan, Gujarat, Haryana, Punjab, Uttar Pradesh, Madhya Pradesh, Tamil Nadu, Maharashtra, Karnataka, and Andhra Pradesh.

Guar gum is utilized in the food, paper, and textile industries, with most demand driven by the shale gas and oil industries. About 90 per cent of exports are used in oil and shale gas extraction. Guar gum, whether modified or unmodified, is a versatile and efficient biopolymer with applications in oil drilling, textile printing, human and pet food, paper production, explosives, and water treatment due to its binding, thickening, film-forming, and lubricating properties.

India is the leading exporter of guar gum, exporting various guar products to numerous countries. In 2022-23, India exported 406,513.53 MT of guar gum valued at Rs. 4,944.60 crores (USD 617.14 million). Major export destinations include the USA, Germany, Russia, Norway, and the Netherlands. About 90 per cent of India's processed guar gum is exported, with India producing 80 per cent of the world's guar, 72 per cent of which comes from Rajasthan.



(Source:

https://apeda.gov.in/apedawebsite/SubHead_Products/Guargum.html)

2. Tamarind seed gum

Tamarind, originally from Madagascar, is now widely cultivated in India, Myanmar, Bangladesh, Malaysia, Sri Lanka, Thailand, and several African, Central American, and South American countries. In India, it is chiefly grown in Madhya Pradesh, Andhra Pradesh, Tamil Nadu, and Karnataka. The seeds of tamarind fruit are smooth, glossy, and flattened oblongs. Tamarind seed polysaccharide is produced from tamarind seeds by sieving and roasting to remove the black testa (seed coat). The light brown tamarind kernel obtained is pulverized and sieved to produce tamarind kernel powder. Tamarind seeds contain about 65% water-soluble gum. The gum is dull white and has a characteristic Odour.

Tamarind gum is widely used in food industry for manufacturing ketchup, sauces, baked foods, meat

products, instant noodles, and ice cream. It is used in textile sizing and as textile thickeners. Tamarind gum is also used as a soil stabilizer in oil drilling in mining and gas industries. In pharmaceutical industry it is employed as a dissolution agent, nasal mucoadhesion agent, and in the manufacture of bio adhesive tablets.

In fiscal year 2023, India produced an estimated 162 thousand metric tons of tamarind (as a whole, not just seed gum), a slight increase from the previous year. Major producing states include Maharashtra, Chhattisgarh, Karnataka, Andhra Pradesh, and Tamil Nadu. The global tamarind gum market was valued at USD 155 million in 2022 and is projected to grow to USD 256 million by 2030, with a compound annual growth rate (CAGR) of approximately 6.5% from 2023 to 2030.



(Source:

<https://www.zionmarketresearch.com/report/tamarind-gum-market>)

II. Gums produced from stem/branches

1. Acacia Gum (Gum Arabic)

Acacia nilotica, a popular farm tree in the central plains of India, is a source of Indian gum arabic. Its pods are valuable cattle fodder, and its leaves, young shoots, and young pods help in milk production. The gum from its bark is dark and was historically a source of true gum arabic, now commercially obtained from *Acacia senegal*. The Central Arid Zone Research Institute (CAZRI) recorded 100 to 400 grams of gum per tree. *Acacia nilotica* gum, known as samogh or samuk in Arabic, is sold in balls and is of inferior commercial quality, historically used as an emulsifying agent and emollient. It is edible and was used to relieve throat and chest complaints. *Acacia nilotica* (Babul tree) is one of the major gum-yielding species in the Indian subcontinent, thriving in drier regions and mainly cultivated in Sind and Ajmer.



Gum Arabic ranges from dark brown to yellowish, with pure gum being translucent and

highly viscous. It is widely used in food industry for making sweets (e.g., laddu, halwa), promoting digestion, and in diabetic and metabolic foods. It acts as a binder in sweets, a stabilizer in dairy products, beverages, confectioneries, and an emulsifier in flavours and juices. In pharmaceuticals it is used as a binder in tablets, stabilizer in syrups and emulsions, and as an emollient and demulcent in cough drops and syrups. Arabic gum also used in cosmetics to smooth creams and lotions and as an adhesive in facial masks and similar products. It is used as adhesive, and glue for paper, glass, and metal products and in paints, it acts as a flocculant and emulsifier.

India's gum arabic market was valued at USD 4.8 million in 2020 and is expected to grow at a CAGR of 8.8% from 2021 to 2026, reaching USD 7.3 million by 2026. The rising demand for confectionery products and pharmaceuticals drives this growth. The USA is the most attractive export market for Indian gum arabic, followed by France. In 2022, India exported \$4.93 million worth of gum arabic, with major destinations being Turkey (\$981k), the Philippines (\$944k), Indonesia (\$651k), Burkina Faso (\$335k), and the United Arab Emirates (\$310k).

2. Neem Gum

Neem (*Azadirachta indica*), a tree in the mahogany family Meliaceae and genus *Azadirachta*, is native to India and Burma, growing in tropical and semi-tropical regions. Neem has been traditionally used in medicine to cure various diseases and in agriculture to improve soil health and crop productivity.



Neem gum is extracted from the Neem tree through induced or natural injury. It is a clear, bright, amber-coloured material that is non-bitter in taste and soluble in cold water. Neem gum belongs to the family of galactan gums. Neem gum is used as stabilizing agent, gels, tablet binder, coater, thickening agent, dyeing and printing of fabrics. It is also used for manufacture of soaps, toothpaste, tooth powders, antiseptic creams and neem glue. In traditional Medicine gum is mixed with beeswax for treating cracked feet, and used as a biopolymer in treating scabies, wounds, ulcers, skin diseases, leprosy, and intestinal worms.

3. Salai gum (*Boswellia Serrata*)

Boswellia serrata, also known as Indian olibanum or Salai gum, is a gum-resin obtained from the *Boswellia* species. It belongs to the family Burseraceae and is commonly found in India. This tree mainly grows in Madhya Pradesh, Andhra Pradesh, Orissa, Rajasthan, and Gujarat, with lesser occurrences in Maharashtra, Uttar Pradesh, and other dry tropical regions. It thrives on rocky ridges and flat terrain, particularly on fertile soils. India produces approximately 50 tons of *Boswellia serrata* gum annually. Major producers are India and Pakistan. The gum-resin is harvested from trees with a girth of 90 cm or more at breast height. Tapping and collection of Salai gum occur from November to May each year. On average, a tree yields about 1 kg of gum per year, while a fully-grown tree can yield 2 to 2.5 kg annually.



The gum resin ranges in color from dark brown or dark greenish-brown (quality III) to light yellow translucent (superfine quality). It is widely valued as incense due to its unique fragrance and also for lighting fires. The gum is widely used in Ayurvedic formulations to treat asthma and arthritis. It is as effective, if not more so, than drugs like Phenylbutazone and other anti-inflammatory drugs. It is used in indigenous medicine for rheumatism, and nervous diseases, as a diaphoretic, astringent, and as an ingredient in certain ointments.

4. Ghatti Gum (*Terminalia anogeissiana*)



Anogeissus latifolia, commonly known as Dindal, is a large erect deciduous tree that grows up to 25 meters tall. It is commonly found in the dry deciduous forests of the Western Ghats and the dry plateaus of the Vindhya, Satpura, and Western Ghats Mountain ranges, extending into Maharashtra, Madhya Pradesh, Chhattisgarh, Bihar, and Odisha. Besides being a source of Ghatti gum, the tree is also valued for its timber and tannin extracted from its leaves. Ghatti gum is not typically tapped; it oozes naturally from the bark through injuries and wounds, mostly in the summer. The gum is collected manually.

A tree yields around 1-2 kg of gum annually. India produces over 1200 tons per annum (approx.) and other Producing Country is Sri Lanka.

The gum varies in color from whitish-yellow to amber, although impurities can impart a brownish hue. Ghatti gum has excellent emulsifying properties, considered superior to gum arabic, making it suitable for more difficult-to-handle systems. It is widely used in food industries as an emulsifier and stabilizer in

beverages and butter-containing table syrups, and as a flavor fixative for specific applications. In pharmaceuticals, it is used for preparation of powdered, stable, oil-soluble vitamins. Used as a binder in long-fibered lightweight papers, as an emulsifier of petroleum and non-petroleum waxes to form liquid and wax paste emulsions. Gum is also used as a drilling mud conditioner and for the acidizing of oil wells in oil industry and in powdered explosives to improve resistance to water damage.

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