Natural Gum Resources in India and their Commercial Importance

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ABSTARCT

Gums are produced from woody plants either naturally from exudations from cracks in the bark or damage to the bark by insects or animals. Gum flow is also artificially induced by incisions in the bark. The viscous, brit le nodule, which forms, can easily be removed by the hand. Gums are nothing but complex carbohydrate derivatives of a polysaccharide nature and are either soluble in water, as in the case of gum arable, or form mucilages by the absorption of large amounts of water. Uses of gums for domestic consumption and for sale to earn some cash are very common among the forest dwelling communities, particularly tribes in India. Annually around 5,000 tons of plant based gums produced in India. Gum Arabic, Gum Ghat i and Gum Karaya are some commercially important gums produced in India. These are used as in confectionaries, dairy products, beverages, as emulsifier in food products, petroleum and for oil-well- acidizing purpose in the industry. Continuous research support is needed for processing, value addition and product development to meet the changing demand of domestic and international consumers

Keywords: Natural gums, plant eudates, gum arabic, gum ghat i, gum industry

Natural gums (gums obtained from plants) are hydrophilic carbohydrate polymers of high molecular weights, generally composed of monosaccharide units joined by glucosidic bonds (Davison, 1980). They are generally insoluble in oils or organic solvents such as hydrocarbons, ether, or alcohols. Gums are either water-soluble or absorb water and swell up or disperse in cold water to give a viscous solution or jelly (Mantel, 1949). On hydrolysis they yield arabinose, galactose, mannose and glucuronic acid.

Access this article online	
Publisher	Website: http://www.renupublishers.com
RP	DOI: 10.5958/2454-9541.2015.00010.9

Gums are typical products of broadleaved trees and shrubs. They are complex carbohydrate derivatives of a polysaccharide nature and are either soluble in water, as in the case of gum arable, or form mucilages by the absorption of large amounts of water (gum tragacanth). Their principal use is in foodstuffs by nature of their ability to impart desired qualities to foods by influencing

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Submission: 18 October, 2014 Revison : 12 January, 2015 Acceptance: 2 June, 2015

their viscosity, body and texture: most frequently in confectionery food, flavouring and soft drinks. They also have pharmaceutical applications as demulcents, adhesives in pill manufacture and as emulsifying agents. Industrial uses are for adhesives, lithography, paints and inks.

Uses of gums for domestic consumption and for sale to earn some cash are very common among the forest dwelling communities, particularly tribes in India. Millions of forest and sub-forest dwellers in the central and western Indian states depend on gums as a viable income source. Majority of NTFPs are available only for short period (around three months in a year) while gums, which can be harvested around six to eight months in a year, provides a steady source of income to the dependent gum collectors. Around 5,000 tons of plant based gums produced in India annually (except guar gum – a seed based gum and annual production approximately 2,10,000 tons). The major gum producing states in India are Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Orissa, Maharashtra, Gujarat, Rajasthan, etc. The export of plant-based gums from India during 2006-07 was 1,730.24 tons valued Rs. 2,218.27 lakh. Due to demand India also imports gums and import of gums in India during 2006-07 was 19,464.08 tons values Rs. 5,879.14 lakh.

Gum Arabic, Gum Ghatti and Gum Karaya are commercially important gums produced in India. Gum Tragacanth from *Astragalus spp.* of Asia Minor is even more valuable. It is a natural emulsifier in food products such as mayonnaise but is now being replaced, because of its high cost, by synthetic fermentation type products. Gums of commercial interest are also obtained from the fruit of the carob (*Ceratonia siliqua*), Gum Mesquite (*Prosopis latifolia*) and Indian Squill from *Urginea indica*.

Based on solubility in water gums are classified as

(1) Soluble: Certain gums dissolve in water to form transparent colloidal solution (e.g. Gum Arabic).

(2) Insoluble: Gums such as gum tragacanth, gum karaya do not dissolve in water but swell up into a jelly-like mass. However, if sufficient amount of water is added they yield a thick transparent solution.

(3) Partially soluble gums: Partially soluble gums first form a swollen jelly by dispersing in water and become solution on addition of more water. Mogador or Morocco gum (from *Acacia gummifera*) is an example of partially soluble gum.

Commercial applications of some of important gums in Food, Pharmaceutical and other allied industries are summarized here.

GUM GHATTI

Gum ghatti (*Anogeissus latifolia*) or Indian gum is a complex non-starch polysaccharide. It has been widely employed in food, pharmaceuticals, paper and other industries primarily due to its excellent emulsification and thickening property (Deshmukh *et al.,* 2012). It is an amorphous, translucent exudate of the *Anogeissus latifolia* tree of the Combretaceae family (Rani *et al.,* 2012). The tree is quite large and is found in the dry, deciduous forests of India. Gum Ghatii has been used in a range of emulsions, suspensions and as a sizing agent in the paper industry (Amar *et al.,* 2006). Gum ghatti is approved for food use and is in the GRAS list under the Federal Food, Drug, and Cosmetic Act.

India and Sri Lanka is the major producer of Gum Ghatti in the world. The annual production of Gum Ghatti in India is approximately 1,200 tons. Maharashtra, Madhya Pradesh, Chhattisgarh, Jharkhand and Orissa are the major states produce Gum Ghatti in India.

This gum has unique commercial position because of its viscosity, intermediate between those of gum arabic and gum karaya, and because it is an excellent emulsifier for difficult to handle mixtures.

Commercial applications of Gum Ghatti are as follows:

Food Products: It is used to stabilize table syrup emulsions containing about 2% butter. In such an application, about 0.4% ghatti is used in combination with 0.08% lecithin.

Petroleum and mining: It is used to emulsify petroleum and non-petroleum waxes to form liquid and wax paste emulsions, which find wide use in the paper industry as coatings and as moisture barriers.

Oil-well acidizing: It is another use for gum ghatti. The gum is moistened with water insoluble nonaquous liquid that is inert both to gum and to the acid solution. Then acid

is added with mixing to form uniform dispersion, which is pumped under pressure to permeate the earth formation. This results in enlarged passageways, which increase the productivity of the well. The drilling mud and other fracture-clogging deposits are washed out, and the oil flows freely.

Miscellaneous uses: Because of its high L-arabinose content, gum ghatti is hydrolyzed to prepare pure L-arabinose on a commercial scale. L- arabinose is used as a flavour adjunct in food and in preparation of nucleosides used as antitumor drugs. Another application of gum ghatti is to stabilize the Prussian blue color in spectrophotometric determinations, and it is used in the polarographic determination of Cu, Pb and Fe.

GUM ARABIC

Gum arabic (GA) is a branched-chain, complex polysaccharide, either neutral or slightly acidic, found as a mixed calcium, magnesium and potassium salt of a polysaccharidic acid (Ali *et al.,* 2009). It is non-toxic, odourless, colourless, tasteless and the most widely used gum in food and drug Industry. It is usually water-soluble, and it does not affect the odour, colour, or taste of the system in which it is used.

Gum Arabic is the main commercial gum exudate. About 85% of the world's supply is produced in the Sudan. This gum is mainly obtained from *Acacia senegal* and some from the related species *A. laeta*, *A. polyacantha* and *A. mellifera*. Major producing countries in the world are Sudan, Nigeria, Chad, Tanzania, Kenya, etc. The approximate annual world production of Gum Arabic is 50,000 tons. The approximate annual production of Gum Arabic in India is 800 tons. The major producing states are Rajasthan, Madhya Pradesh, Chhattisgarh, Gujarat, Punjab, Harayana, etc. Due to its huge demand India imports Gum Arabic and import of Gum Arabic during 2006-07 was 18,840.06 tons valued Rs. 5,327.16 lakh. The export of Gum Arabic from India during 2006-07 was 95.88 tons valued Rs. 124.95 lakh.

Gum arabic is used as an emulsifier and stabilizer in the food and pharmaceutical industries (Osman *et al.,*1993a, b). Other industrial products that use technical grades of gum arabic include adhesives, textiles,printing, lithography, paints, paper sizing and pottery glazing (Idris *et al.,* 1998).

Commercial applications of Gum Arabic are as follows:

Food Industry

Confectioneries: In most confectionery products, gum arabic has two important functions. The most important function is to prevent crystallization of sugar, and thus gum arabic finds its greatest application in confections where the sugar content is high and the moisture content low such as jujubes and pastilles. The second function is to act as an emulsifier to keep fat uniformly distributed throughout the product so as to prevent it from moving to the surface and forming an easily oxidisable, greasy film.

Dairy Products: It has been used as a stabilizer in frozen products, such as ice creams, ices, and sherbets because of its water absorbing properties. The addition of gum arabic prevents the formation of ice crystals of combining with large quantities of water and holding it as water of hydration, thus producing a finer texture in ice cream. The chief objective to use this gum arabic is that the ice cream does not melt readily.

Beverages: Gum arabic is an effective foam stabilizer for beverages and is largely responsible for the "lace curtain" effect on the sides of beer glasses. Eye-appealing opacity in beverages and beverage dry mixes are produced by spray dried combinations of vegetable oil and gum arabic sold commercially as a clouding agent to give the effect of fruit juices.

Pharmaceutical Industry

Suspending agent: It has been employed to suspend insoluble drugs, as well as to prevent the precipitation of heavy metals from solution through the formation of colloidal suspensions. It is one of the best emulsifying and suspending agent for calamine, kaolin suspensions and cod liver oil emulsions.

Antiseptic Preparation: Antiseptic preparations have been made with a mixture of colloidal AgBr and gum arabic. Silver arabate has antiseptic properties that make it suitable for use as a substitute for $AgNO_3$ and organic silver compounds in the treatment of ophthalmic infections. Silver compound preparations for the internal treatment of mucous membranes have been patented.

Medicine: Used for the treatment of low blood pressure caused by haemorrhage or surgical shock. Intravenous saline injections alone were not successful because the salt

escaped too rapidly from the blood vessels. The addition of a 7 per cent gum arabic solution reduced the dissipation rate of NaCl solution.

Other Industries

Adhesives: Used as a mucilages, as a simple adhesive and glue

Inks: Used as a protective colloid and suspending agent

Paints: Used as a protective colloid, as a flocculent and emulsifier in vinyl resin

Textiles: Used in the textile industry as sizing and finishing agents and in printing formulations for imparting designs or decorations to fabrics. Gum arabic is an efficient sizing agent for cloth. Although gum arabic can be used to create desirable effects on cotton, the cost is prohibitively high. It finds limited use in finishing silk and rayon by giving the fabric without interfering with transparency.

GUM KARAYA

The primary structure has been shown to be composed of D-glucuronic acid, D-galacturonic acid,D-galactose and L-rhamnose, in proportions differing according to the quality, type of gum and origin . It forms extremely strong adhesives with small amount of water. It is widely used in pharmaceutical and dental adhesive preparations. Gum karaya is GRAS and is on the FDA list. It is nontoxic and is generally considered not to be metabolized in humans. Karaya gum is used in several industries due to its low solubility in water and low cost. Karaya gum has been used in printing and textile industry, in pharmaceutical and medicinal preparations such as cosmetics, lozenges, jellies, emulsions, lotions, sprays, pastes and laxatives and to control diarrhea (Dikshith *et al.,* 1984).

Gum Karaya from *Sterculia urens*, *S. villosa*_(India), *S. setigera* (Africa), which provides the raw material for emulsifiers, adhesives, fixatives and laxatives. India is the leader in Gum Karaya production and export in the world. Annual production of Gum Karaya in India was approximately 1,500 tons. Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Orissa, Maharashtra and Gujarat are the major Gum Karaya producing states in India. The export of Gum Karaya from India during 2006-07 was 932.33 tons valued Rs. 1,508.69 lakh. India mainly exported Gum Karaya to France, U.K., Japan, U.S.A., U.A.E., etc.

Commercial applications of Gum Karaya are as follows:

Pharmaceutical Industry

- A large proportion of the gum karaya imported into this country is utilized by the pharmaceuticals industry. When used in bulk laxatives, gum karaya is usually processed so that it is 8 to 30 mesh in size. These coarse gum particles absorb water and swell to 60 to 100 times their original volume, forming a discontinuous type of mucilage. This type of mucilage is very effective as a laxative.
- Another important pharmaceutical application of gum karaya is as a denature adhesive. The powder gum is usually dusted onto dental plate, and it swells when it touches the moist surface of the mouth. This results in a more comfortable and tighter fit of the plate.

The rapid swelling of the gum particles, their relative insolubility, and their unusual resistance to bacterial and enzymatic breakdown make the gum suitable for this use.

Food Industry

- Powdered gum karaya is used in French dressing, ice pops, sherbets, cheese spreads, ground meat products.
- It is used in concentrations of 0.2 to 0.4% in the manufacture of ice pops and sherbets. The gum prevents the bleeding of free water and the formation of large ice crystals. Its water absorbing and water-holding capacities and its excellent acid compatibility make it suitable for use.
- Concentrations of 0.8% or less of the gum are used in cheese spreads. It is added to prevent water separation and to increase the ease of spreading.
- Ground meat products, such as bologna, sausages require an efficient water-holding substance that has a small amount of adhesiveness. Gum karaya in Concentrations of 0.25% provides

these characteristics and gives the meat product a smooth appearance.

Textile industry: As a dye thickener for direct-colour printing operations.

Pulp and paper industry: As a deflocculent and binder for lightweight paper manufacture.

Petroleum industry: As a thickening agent for drilling muds and as a plugging agent for secondary recovery operations.

Research in new applications of natural gums and resins is opening up new opportunities. New beverage innovations, such as wine coolers, novel confectionery coatings, high fiber drinks and powders, and synergistic combination with other gums are some of the examples of new product formulations using gums and resins. New patents using gum in confectionery coatings and lithography have been recently granted. With the increasing awareness of natural products use of gums is expected to increase in pharmaceutical industries. Continuous research support is needed for processing, value addition and product development to meet the changing demand of domestic and international consumers, besides creating internal employment and income generation.

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