



Natural Gums: Nature's Multifaceted Polymers

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Natural gums represent a remarkable intersection of biology, industry, and everyday existence. Present in plants, seeds, and occasionally in animal secretions, these adhesive, water-soluble compounds have been utilised by humans for millennia for culinary, medicinal, and artisanal purposes. Despite their extensive history, many individuals possess limited knowledge of the true nature of natural gums and their significance.

What constitutes natural gums?

Natural gums are intricate carbohydrates, formally referred to as polysaccharides, that plants excrete either as a defensive mechanism against injury or as a component of their natural development. They are generally soluble in water, producing viscous solutions or gels, and are frequently adhesive to the touch. In contrast to plant resins, which are predominantly hydrophobic and solidify with time, gums are hydrophilic, indicating their capacity to readily absorb water. This feature enables them to expand and create viscous solutions, rendering them exceptionally valuable in culinary and industrial contexts.

Prominent examples of natural gums comprise:

- Acacia (Gum Arabic): Derived from Acacia trees.
- Guar Gum: Derived from guar beans.
- Tragacanth Gum: Derived from the Astragalus plant.
- Karaya Gum: Derived from Sterculia plants.
- Locust Bean Gum: Derived from the seeds of the Ceratonia siliqua tree.

Each gum possesses distinct qualities, rendering it appropriate for various purposes in food, medicine, and industry.

What is the process of natural gum production?

Plants generate gums as a component of their defensive mechanism. In response to stressors like as injury, insect infestation, or infection, the plant secretes gum to close wounds, inhibit infection, and minimise water loss.

Exudate Gums: These substances are released by tree trunks, branches, or roots in response to injury. Instances comprise gum arabic and gum tragacanth.

Seed Gums: These gums, contained within seeds, are released upon the seeds' contact with water. Guar gum and locust bean gum belong to this classification.

Plant Tissue Gums: Certain gums exist inside plant tissues and can be extracted by aqueous or mild chemical methods.

Following collecting, natural gums are often purified, desiccated, and pulverised into powder for commercial application. In certain instances, they undergo additional processing to standardise their viscosity and solubility for industrial purposes.

Chemical composition of Natural gum

- Natural gums are predominantly polysaccharides, consisting of extensive chains of sugar molecules. These sugars may comprise galactose, mannose, arabinose, rhamnose, and xylose, contingent upon their origin.

- Gum Arabic: Abundant in arabinose and galactose, highly soluble in water, and produces a low-viscosity solution.
- Guar Gum: Primarily composed of galactomannans, which confer significant thickening capabilities.
- Tragacanth Gum: A composite of polysaccharides, comprising bassorin (which swells in water) and tragacanthin (the soluble component), resulting in a thick gel.
- The chemical composition dictates essential features such as viscosity, solubility, and gel formation, which subsequently influence the gum's applications.

Characteristics of natural gums

- Natural gums include distinctive physical and chemical characteristics that render them exceptionally versatile:
- Water Absorption: Gums can absorb multiple times their weight in water, resulting in viscous solutions or gels.
- Thickening Capability: They enhance the viscosity of solutions, rendering them beneficial in culinary and cosmetic applications.
- Stabilising Power: Gums can stabilise emulsions and suspensions, inhibiting the separation of oil and water in products such as salad dressings.
- Film-Forming Capability: Certain gums possess the ability to create thin, pliable films upon drying, which is advantageous in packing and coating applications.
- Biodegradability: As natural polymers, gums exhibit biodegradability and are environmentally sustainable.

Utilisations of natural gums

Natural gums are utilised throughout several sectors owing to their useful attributes. Let us examine some significant domains:

i. Culinary sector

Natural gums are essential in the food business for:

Thickening and gelling: Guar gum and locust bean gum are utilised in sauces, soups, and confections.

Stabilising emulsions: Gum arabic serves as a stabiliser for fruit juices, soft beverages, and ice creams.

Encapsulation of flavours and Nutrients: Gums safeguard delicate substances, including vitamins and flavours, against deterioration.

Baked goods: Gums enhance the texture, moisture retention, and longevity of bread and cakes. For instance, incorporating a minimal quantity of gum arabic into a beverage inhibits sugar crystallisation and maintains the drink's smoothness.

ii. Pharmaceutical sector

Natural gums possess a longstanding historical significance in medicine.

Binders in tablets: Gums facilitate the cohesion of powdered constituents in tablets.

Suspending agents maintain uniform distribution of insoluble medicines in liquid formulations.

Controlled release: Certain gums are utilised to gradually release pharmaceuticals, enhancing their efficiency.

Traditional medicine: Gums such as tragacanth and acacia are utilised in calming syrups and herbal treatments.

iii. Cosmetics sector

Gums are utilised in skincare and cosmetics for moisturisers due to their water-retaining properties, which maintain skin hydration.

Thickening creams and lotions utilise gums to stabilise emulsions and impart a smooth texture to the goods.

Hair products offer protective and conditioning attributes.

Industrial applications

In addition to food and cosmetics, natural gums are utilised in:

- Textile Printing: Gums enhance dye viscosity and guarantee uniform application.
- Paper Industry: Enhance paper quality and coating.
- Adhesives: Natural gums are utilised in adhesives, postage stamps, and envelopes.
- The petroleum industry use guar gum in hydraulic fracturing fluids because of its viscosity.

Significance in economic and environmental contexts

Natural gums possess both functional and economic importance. Countries such as Sudan (gum arabic), India (guar gum), and Iran (tragacanth) generate significant export earnings from gum production. Furthermore, natural gums serve as sustainable and biodegradable substitutes for synthetic polymers, rendering them environmentally advantageous. In contrast to several synthetic stabilisers or thickeners, gums decompose spontaneously, hence mitigating pollution.

Obstacles in gum production

Notwithstanding their benefits, natural gums encounter certain challenges:

Variable Quality: Environmental factors influence gum composition and viscosity.

Challenges in Harvesting: Exudate gums necessitate meticulous tapping and gathering from trees, which can be laborious.

Contamination Risks: Natural gums may include dirt, insects, or germs, necessitating comprehensive sanitation.

Contemporary processing methods are being devised to standardise gum quality and broaden their industrial applications.

Conclusion

Natural gums constitute far more than mere adhesive materials. They are nature's multifaceted polymers, offering nourishment, pharmaceuticals, aesthetics, and industrial applications. From the arid deserts of Sudan to the fertile fields of India, gums support livelihoods and enhance lives. When you savour a creamy ice cream, peruse a glossy magazine, or utilise a herbal syrup, recall that the unassuming natural gum is crucial to much of that enchantment. It exemplifies the genius of nature and human innovation – adhesive, saccharine, and perpetually beneficial.

References

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