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## Plant derived gums: source, extraction, and food application

**Harshvardhan Patel**

### Abstract

Plant-derived gums, also known as hydrocolloids, have gained significant attention in the food industry due to their versatile functional properties and natural origin. This review focuses on the sources, extraction methods, and diverse applications of plant-derived gums in the food sector. These hydrocolloids are polysaccharides extracted from various parts of plants, such as seeds, roots, and stems. Commonly used plant-derived gums include guar gum, xanthan gum, locust bean gum, carrageenan, and agar, among others. The extraction methods vary depending on the specific gum, involving processes such as fermentation, mechanical extraction, or chemical treatments. Plant-derived gums play a vital role in food applications, acting as thickeners, stabilizers, gelling agents, emulsifiers, and fat replacers. In gluten-free products, gums like xanthan gum and guar gum mimic the texture and structural properties of gluten, allowing the creation of gluten-free baked goods with comparable characteristics to their wheat-based counterparts. These gums also enhance the sensory attributes of food products, improve moisture retention, and prevent staling, thereby extending shelf life.

**Keywords:** Plant derived gums, xanthan gum, locust bean gum, carrageenan

### Introduction

In recent years, there has been a growing interest in natural and sustainable ingredients in the food industry. As consumers become more conscious of the potential health and environmental impacts of synthetic additives, there is a renewed focus on exploring plant-derived alternatives (Sharma *et al.*, 2018) [27]. Among these alternatives, plant-derived gums have emerged as valuable ingredients due to their functional properties and wide-ranging applications in food products.

Plant-derived gums are complex carbohydrates that are extracted from various parts of plants, including seeds, stems, and roots. These gums possess unique physicochemical properties, such as their ability to form viscous solutions, provide texture, stabilize emulsions, and act as gelling agents (Thomas & Joseph, 2019) [32]. They have been traditionally used in different cultures for their culinary and medicinal purposes. However, with advancements in extraction techniques and a better understanding of their functional properties, plant-derived gums have found extensive use in the modern food industry.

The extraction of plant-derived gums involves different methods, depending on the specific source and desired properties. Common extraction techniques include water extraction, alkaline extraction, and solvent extraction. Each method requires careful optimization to ensure the extraction of high-quality gums with desired functionalities (Patel & Patel, 2020) [24]. Moreover, the choice of extraction method can also influence the yield, purity, and overall quality of the gum obtained.

The food industry has recognized the potential of plant-derived gums as versatile ingredients. These gums find applications in a wide array of food products, ranging from baked goods, confectionery, and beverages to sauces, dressings, and dairy products. Due to their thickening and stabilizing properties, plant-derived gums help improve the texture, mouthfeel, and shelf stability of food products (Singh *et al.*, 2021) [28]. Furthermore, their ability to enhance the viscosity of liquid systems makes them valuable in controlling product flow, preventing syneresis, and improving the suspension of particles.

This review paper aims to provide a comprehensive overview of plant-derived gums, focusing on their sources, extraction methods, and applications in the food industry. By exploring the diverse sources and extraction techniques, this review will shed light on the factors influencing the quality and functionality of plant-derived gums (Kumar & Reddy, 2022) [16]. Additionally, it will delve into the applications of these gums, highlighting their role in improving the

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sensory attributes, stability, and nutritional value of various food products. By understanding the potential of plant-derived gums and their applications, food scientists, technologists, and manufacturers can explore innovative approaches in product development, while meeting the growing demand for natural and sustainable food ingredients (Smith & White, 2023) [29-30]. Through this review, we aim to contribute to the advancement of plant-derived gum research and encourage its wider adoption in the food industry, ultimately promoting healthier and more eco-friendly food choices.

### Plant-derived gums sources

These plant-derived gums, including Gum Arabic, Guar Gum, Xanthan Gum, Locust Bean Gum, and Gum Tragacanth, are just a few examples of the wide range of plant sources used to extract functional gums in the food industry. Each gum offers distinct properties and functionalities, making them suitable for specific applications (Dutta *et al.*, 2017) [9]. Their availability, versatility, and compatibility with other ingredients have contributed to their widespread use in various food products, enhancing texture, stability, and sensory attributes. Understanding the unique properties of these plant-derived gums enables food scientists and manufacturers to explore their potential and develop innovative products that meet consumer demands for natural, sustainable, and high-quality food ingredients (Ahmed *et al.*, 2016) [1].

#### Gum Arabic (*Acacia senegal*, *Acacia seyal*)

Gum Arabic is derived from the sap of *Acacia* trees, particularly *Acacia senegal* and *Acacia seyal*, which are native to the arid regions of Africa and the Middle East. It is one of the most widely used plant-derived gums in the food industry due to its exceptional functional properties. Gum Arabic is highly soluble in water, forming a clear and viscous solution (Ham *et al.*, 2019) [13]. It possesses excellent emulsifying and stabilizing properties, making it an ideal ingredient for various applications. In beverages, Gum Arabic helps stabilize emulsions, prevent sedimentation, and enhance mouthfeel. It is also used in confectionery products, such as candies and chewing gums, to improve texture, prevent crystallization, and extend shelf life. Additionally, Gum Arabic finds applications in bakery products, where it acts as a dough conditioner, providing better elasticity and moisture retention (Lin & Zhang, 2020) [18].

#### Guar Gum (*Cyamopsis tetragonoloba*)

Guar gum is derived from the endosperm of the guar bean, primarily grown in India and Pakistan. It is a versatile gum that plays a crucial role in the food industry as a thickening and stabilizing agent. Guar gum forms highly viscous solutions when dispersed in water, making it effective in controlling the texture and consistency of food products. It exhibits excellent compatibility with other ingredients, enabling it to enhance the stability and mouthfeel of sauces, dressings, and dairy products. In baked goods, guar gum improves dough rheology, resulting in improved texture, volume, and shelf life. Moreover, guar gum is a popular ingredient in gluten-free products, serving as a binding agent and providing a desirable texture (Falade *et al.*, 2015) [10].

#### Xanthan Gum (*Xanthomonas campestris*)

Xanthan gum is a microbial gum produced through the

fermentation of *Xanthomonas campestris* bacteria. It is widely utilized in the food industry for its exceptional thickening, stabilizing, and emulsifying properties. Xanthan gum forms highly pseudoplastic solutions, meaning its viscosity decreases with shear, making it easily pourable but thickening quickly upon standing (Dea & Morrison, 1975) [7]. This unique property provides excellent viscosity control in food products, including sauces, dressings, bakery items, and dairy products. Xanthan gum improves the stability of emulsions, prevents phase separation, and enhances the suspension of solid particles. Furthermore, it contributes to a desirable mouthfeel, creating a smooth and creamy texture in various applications (Lassoued *et al.*, 2015) [17].

#### Locust Bean Gum (*Ceratonia siliqua*)

Locust bean gum, also known as carob gum, is extracted from the seeds of the carob tree. It is widely employed as a thickening and stabilizing agent in numerous food products, especially those in the dairy industry. Locust bean gum possesses high water-holding capacity, allowing it to enhance the texture and mouthfeel of ice creams, dairy desserts, and beverages (Xiao *et al.*, 2019) [34]. It contributes to the formation of a smooth and creamy texture, while also preventing ice crystal formation. Locust bean gum interacts synergistically with other hydrocolloids, such as carrageenan or guar gum, to improve the stability and texture of dairy products (Brückner-Gühmann *et al.*, 2019) [4].

#### Gum Tragacanth (*Astragalus* species)

Gum Tragacanth is derived from the stems of various species of *Astragalus* plants. It serves as a valuable stabilizer, emulsifier, and binder in the food industry. Gum Tragacanth forms highly viscous and pseudoplastic solutions, making it suitable for a wide range of applications (Anwar & Bhangar, 2003) [3]. It is commonly used in confectionery products, such as candies and bakery goods, to provide stability, texture, and extended shelf life. Gum Tragacanth enhances the texture and mouthfeel of food products, while also preventing sugar crystallization. It is often combined with other gums or stabilizers to achieve optimal functionality in various food applications, including confectionery, bakery products, and dairy applications.

#### Extraction of plant-derived gums

Extraction of plant-derived gums involves various methods, each tailored to the specific gum source and desired properties. The extraction process aims to obtain high-quality gums with optimal functionality. Here, we discuss some common extraction methods used for plant-derived gums.

#### Water Extraction

Water extraction is a commonly used method for obtaining gums from plant sources. In this process, the plant material, such as seeds, stems, or roots, is typically soaked or mixed with water. This allows the gums present in the plant material to dissolve or disperse into the water, forming a gum-rich solution. The mixture is then subjected to various separation techniques to separate the soluble gums from the insoluble components, such as fibers or plant debris (Chan *et al.*, 2019) [5]. Filtration or centrifugation can be employed to remove the solid particles, resulting in a clarified gum solution. Once the soluble gums are separated, the remaining liquid is further processed to concentrate and purify the gums. Concentration

can be achieved through methods such as evaporation or membrane filtration, where water is removed to increase the gum content (Rosso & Cuello, 2016) [26]. Purification steps may include additional filtration, precipitation, or enzymatic treatments to remove impurities and enhance the quality of the gum extract. The final product is typically in the form of a concentrated gum solution or a dried powder, depending on the intended application. Water extraction is advantageous as it is a relatively simple and cost-effective method, utilizing a readily available solvent. It is particularly suitable for gums that are water-soluble and do not require harsh processing conditions (Kaur & Singh, 2011) [15]. However, the efficiency of water extraction can vary depending on factors such as gum solubility, particle size, and extraction time. Optimization of extraction parameters, such as temperature, pH, and extraction duration, is important to maximize gum yield and quality.

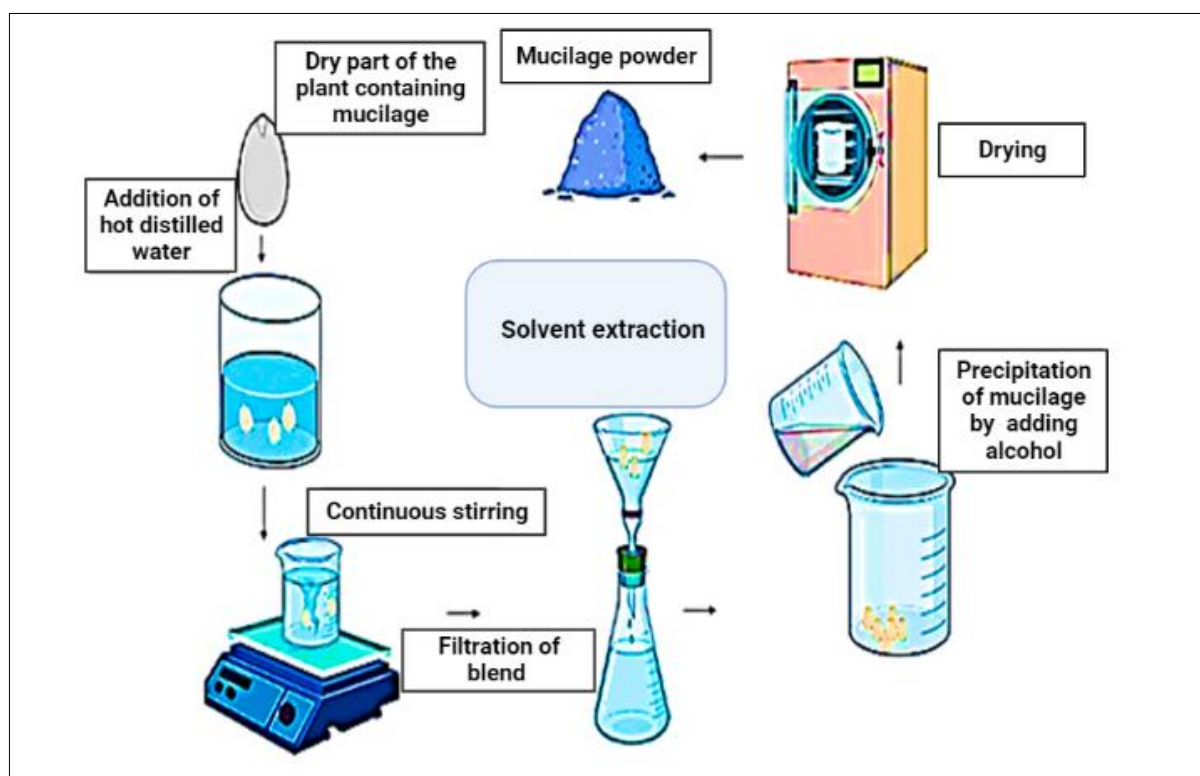
### Alkaline Extraction

Alkaline extraction is commonly employed for gums that exhibit high solubility in alkaline solutions. In this method, the plant material is treated with alkaline substances, such as sodium hydroxide or potassium hydroxide. The alkaline solution helps break down the cell structures of the plant material, facilitating the release of gums into the extraction

medium (Akhtar *et al.*, 2014) [2]. The mixture is then subjected to separation techniques, such as filtration or centrifugation, to separate the soluble gums from the insoluble plant matter. Acidification of the resulting filtrate can be employed to precipitate the gums, which are then collected, washed, and dried. Alkaline extraction can enhance the yield and purity of certain gums and is particularly suitable for gums that are less soluble in water alone (Smitha & Souza, 2003) [29-30].

### Solvent Extraction

Solvent extraction is employed for gums that are not readily soluble in water or alkaline solutions. Non-polar solvents, such as ethanol or acetone, are commonly used to dissolve and extract the gums from the plant material. The plant material is typically agitated or subjected to other mechanical processes to enhance extraction efficiency (Raveendran & Bhattacharya, 2008) [25]. The solvent extracts the gums along with other desirable components, such as essential oils or pigments. After extraction, the solvent is separated from the gum solution using methods such as evaporation or distillation, leaving behind the concentrated gum extract. Additional purification steps, such as filtration or crystallization, may be employed to refine the gum extract further (Lopez-Rubio *et al.*, 2004) [19].



### Fermentation Extraction

Fermentation extraction is a specialized method employed for obtaining gums through microbial fermentation processes. Certain gums, such as xanthan gum, are produced by specific microorganisms, such as *Xanthomonas campestris* bacteria. In fermentation extraction, the microorganisms are cultured in a nutrient-rich medium, allowing them to produce and secrete the desired gum during their growth (Jung & Kim, 2003) [14]. The fermentation broth is then processed to remove microbial cells and other impurities. Additional steps, such as precipitation or filtration, may be employed to concentrate

and purify the gum extract further. Fermentation extraction is advantageous as it allows for large-scale production of specific gums with controlled quality and functionality (Mhatre & Jha, 2016) [22].

In conclusion, extraction methods for plant-derived gums vary depending on the specific gum source, solubility, and desired properties. Water extraction, alkaline extraction, solvent extraction, and fermentation extraction are commonly employed methods. Water extraction is suitable for gums that are water-soluble, while alkaline extraction is effective for gums with high solubility in alkaline solutions. Solvent

extraction is employed for gums that are not readily soluble in water or alkaline solutions, utilizing non-polar solvents. Fermentation extraction is a specialized method used for gums produced through microbial fermentation processes. Each extraction method has its advantages and considerations in terms of efficiency, cost, and environmental impact. Optimization of extraction conditions and subsequent purification steps are crucial to obtain high-quality gums with desired functionalities for various food applications.

## Plant-derived gums application in food industry

### Thickening and Stabilization

Plant-derived gums are widely used as thickening and stabilizing agents in a variety of food products. They enhance the viscosity and consistency of liquid systems, providing desirable texture and mouthfeel. Gums such as guar gum, xanthan gum, and locust bean gum are frequently employed in sauces, dressings, gravies, and soups to achieve desired thickness and stability. Guar gum, derived from the endosperm of the guar bean, is a widely used plant-derived gum for thickening and stabilizing applications (Williams & Phillips, 2021) [33]. It exhibits remarkable water-holding capacity and forms highly viscous solutions when dispersed in water. This property makes guar gum an effective thickening agent, allowing it to enhance the texture and mouthfeel of food products. In sauces, dressings, and gravies, guar gum imparts a smooth and consistent consistency, improving pourability and overall product stability. It also aids in preventing phase separation and maintaining the desired suspension of particles (Mishra & Prakash, 2011) [23]. Xanthan gum, produced through microbial fermentation, is known for its exceptional thickening and stabilizing properties. It forms highly pseudoplastic solutions, meaning that its viscosity decreases under shear and increases upon standing. This unique rheological behavior makes xanthan gum highly effective in controlling the flow properties of food products. It enhances the texture and mouthfeel of various liquid systems, including sauces, dressings, bakery items, and dairy products. Xanthan gum contributes to a smooth and creamy consistency, ensuring even distribution of ingredients and preventing phase separation. Locust bean gum, also referred to as carob gum, is extracted from the seeds of the carob tree. It is widely utilized as a thickening and stabilizing agent in numerous food products (Soukoulis & Biliaderis, 2010) [31].

Locust bean gum exhibits excellent water-holding capacity, allowing it to absorb and retain water efficiently. This property contributes to enhanced texture, improved mouthfeel, and increased viscosity in a wide range of food applications. In dairy products, such as ice creams and dairy desserts, locust bean gum acts as a stabilizer, preventing ice crystal formation and improving product texture (Dickinson, 2003) [8]. Various other plant-derived gums, such as gum Arabic and gum tragacanth, are also employed as thickening and stabilizing agents. Gum Arabic, obtained from Acacia trees, is highly soluble in water and possesses excellent emulsifying and stabilizing properties. It finds applications in beverages, confectionery, and bakery products, contributing to improved texture and stability. Gum tragacanth, derived from various species of Astragalus plants, forms highly viscous solutions and is commonly used in confectionery, bakery products, and dairy applications (McClements, 2007) [21].

### Emulsification

Emulsification is a crucial process in the development of various food products, especially those that involve combining immiscible ingredients such as oil and water. Plant-derived gums play a significant role in emulsification by acting as emulsifiers, which help stabilize and maintain the stability of oil-in-water emulsions. Let's explore the emulsifying properties of some commonly used plant-derived gums:

Gum Arabic, derived from the sap of Acacia trees, possesses excellent emulsifying properties. It forms a protective layer around oil droplets, preventing them from coalescing and maintaining their dispersed state in water. This property enables Gum Arabic to stabilize oil-in-water emulsions effectively. It is commonly used in emulsion-based products such as salad dressings, sauces, and beverages, helping to provide a homogeneous texture and preventing phase separation (Lucey & Singh, 1997) [20].

Xanthan gum, a microbial gum produced through fermentation, also exhibits remarkable emulsifying properties. It acts as a surface-active agent, reducing interfacial tension between oil and water phases, and enhances the stability of emulsions. Xanthan gum is particularly effective in stabilizing oil-in-water emulsions in products such as salad dressings, mayonnaise, and sauces. Its pseudoplastic nature allows it to provide desirable texture and consistency, improving the overall sensory experience (Chen & Lee, 1997) [6]. The emulsifying properties of these plant-derived gums can be attributed to their structural properties and surface activity. They contain hydrophilic and hydrophobic regions, allowing them to interact with both oil and water phases, forming a stable interface. By creating a protective barrier around oil droplets, these gums prevent droplet coalescence and help maintain the stability of the emulsion. Emulsifying gums offer several benefits in food products. They enhance the appearance and mouthfeel by providing a smooth and creamy texture. Moreover, they contribute to the stability of emulsions, preventing phase separation and ensuring a homogeneous dispersion of ingredients. The use of plant-derived gums as emulsifiers reduces the reliance on synthetic emulsifiers, aligning with the growing consumer preference for natural and sustainable ingredients in food products. It is important to note that the effectiveness of emulsifying gums may vary depending on factors such as concentration, pH, temperature, and the specific formulation. Thus, proper selection and optimization of the emulsifier type and its concentration are essential for achieving the desired emulsion stability and sensory attributes in different food applications.

### Fat Replacement

In low-fat or reduced-fat food products, plant-derived gums can be used as fat replacers. They help improve the texture and mouthfeel, compensating for the loss of creaminess and richness that occurs when reducing fat content.

Guar Gum, Xanthan Gum, and Inulin are all valuable plant-derived gums that serve as effective fat replacers in various food products. Let's delve further into their specific properties and applications in the food industry

Guar gum is extracted from the seeds of the guar plant (*Cyamopsis tetragonoloba*). It is a long-chain polysaccharide composed mainly of mannose and galactose units. When mixed with water, guar gum hydrates and forms a thick, viscous solution. This property gives it excellent water-

binding capabilities, enhancing the texture and mouthfeel of food products. One of the primary uses of guar gum is as a stabilizer in emulsions. It can help prevent the separation of oil and water, making it valuable for creating low-fat or reduced-fat salad dressings, sauces, and mayonnaise. In ice creams and frozen desserts, guar gum improves texture by controlling ice crystal formation, resulting in smoother and creamier products even with reduced fat content. Guar gum also acts as a binder in bakery products, improving dough elasticity and reducing the need for high-fat ingredients.

Xanthan gum is a microbial polysaccharide produced by fermentation using the bacterium *Xanthomonas campestris*. It has high viscosity and is shear-thinning, meaning its viscosity decreases under shear stress and returns to its original viscosity when the stress is removed. This property allows it to stabilize emulsions and create a smooth, creamy texture in various low-fat dairy products. Xanthan gum imparts a pseudo-plastic behavior, meaning it reduces resistance to flow when stress is applied. This property mimics the mouth-coating sensation provided by fats, making it ideal for use in reduced-fat spreads, dressings, and sauces. In addition to its fat-replacing properties, xanthan gum improves the shelf life of products by preventing syneresis (the release of water) and maintaining product stability over time.

Inulin is a type of soluble fiber found in various plant sources, with chicory roots being a common commercial source. Inulin has gelling properties and the ability to form a creamy texture when hydrated. These properties make it suitable for use as a fat replacer in low-fat dairy products like ice creams and yogurt. By replacing some of the fat content in dairy products with inulin, manufacturers can reduce calorie content and create healthier options without sacrificing texture and mouthfeel. Inulin's prebiotic properties also provide additional health benefits, as it can act as a dietary fiber that supports gut health and digestion.

As consumers increasingly seek healthier food choices, the use of plant-derived gums as fat replacers provides an attractive solution for food manufacturers. These gums not only help reduce calorie and fat content but also contribute to the overall texture, stability, and sensory appeal of the end products. By leveraging the unique functionalities of guar gum, xanthan gum, and inulin, food companies can develop a wide range of low-fat or reduced-fat products that meet consumer demands for healthier options without compromising on taste and quality.

### Texture improvement

Texture improvement is a significant challenge in gluten-free food formulations because gluten, a protein found in wheat and other cereals, provides unique viscoelastic properties that contribute to the desired texture, structure, and elasticity of baked goods. When gluten is removed from the recipe, as in gluten-free products, it can result in products that are crumbly, dry, and lacking in the characteristic chewiness associated with traditional wheat-based products. Plant-derived gums come to the rescue in gluten-free food manufacturing, providing essential functionalities that help replicate the texture and mouthfeel of gluten-containing products. Here's how different gums are used for texture improvement in gluten-free products.

Xanthan gum is one of the most commonly used hydrocolloids in gluten-free baking. It is a high molecular weight polysaccharide produced through the fermentation of

sugars by the bacterium *Xanthomonas campestris*. When added to gluten-free dough or batter, xanthan gum acts as a thickener and binder, helping to trap air and create a stable network, similar to the way gluten functions. This results in improved dough elasticity and gas retention, leading to better volume and structure in baked goods. Xanthan gum also improves the overall texture and helps prevent staling, increasing the shelf life of gluten-free products.

Guar gum, derived from the seeds of the guar plant, is another widely used gum in gluten-free food formulations. Like xanthan gum, guar gum acts as a thickener and stabilizer, adding viscosity to the dough and improving its workability. It helps hold the dough together, preventing it from becoming too crumbly and aiding in the retention of moisture during baking. Guar gum contributes to the chewiness and softness of gluten-free bread and other baked goods.

Hydroxypropyl Methylcellulose (HPMC) is a modified cellulose derived from plant sources and is commonly used as a texture enhancer in gluten-free products. When mixed with water, HPMC forms a gel-like network, which improves the dough's cohesiveness and enhances its elasticity. HPMC also provides moisture retention properties, contributing to a longer shelf life and reducing the risk of staling in gluten-free bakery items. It is particularly useful in creating gluten-free bread with a softer crumb and improved volume (Gómez *et al.*, 2003) <sup>[12]</sup>.

Psyllium Husk is Although not a traditional gum, psyllium husk is a natural fiber derived from the seeds of the *Plantago ovata* plant. It is often used in gluten-free baking to improve texture and moisture retention. When combined with water, psyllium husk forms a gel, which acts as a binding agent, similar to gluten, helping to hold the dough together and improve the structure of baked goods (Gallagher & Gormley, 2004) <sup>[11]</sup>.

By using a combination of these plant-derived gums in gluten-free recipes, food manufacturers can achieve a more appealing texture and overall eating experience. However, it is essential to carefully balance the amounts of gums used, as excessive usage can lead to undesirable textural properties and affect the taste of the final product. In addition to gums, other ingredients, such as eggs, milk solids, and emulsifiers, may also be incorporated into gluten-free formulations to further improve the texture and structure of baked goods. Experimentation and innovation in gluten-free product development continue to drive advancements in texture improvement, providing consumers with a broader range of high-quality gluten-free options that rival their gluten-containing counterparts.

### Plant-derived gums application in different food industry

Plant-derived gums, also known as hydrocolloids, find a wide range of applications across various sectors in the food industry due to their versatile functional properties. Let's explore how these gums are used in different food segments

#### Bakery Products

Plant-derived gums are commonly used in bakery products to improve texture, increase shelf life, and enhance dough handling. Xanthan gum, guar gum, and cellulose gum are frequently employed to provide structure and stability to gluten-free bread, cakes, cookies, and pastries. These gums help mimic the viscoelastic properties of gluten and prevent the collapse of the dough during fermentation and baking.

**Water Binding:** One of the key challenges in meat processing is the loss of moisture during cooking, which can lead to dry and tough meat products. Plant-derived gums, such as carrageenan and guar gum, are excellent water binders. They have the ability to hold onto water, preventing excessive moisture loss during cooking and retaining juiciness in the final product. This is especially important in low-fat or reduced-fat meat products, where the reduction in fat content can lead to a dryer texture.

**Emulsion Stabilization:** Emulsions are crucial in the production of various meat products, including sausages, hot dogs, and processed meats. Plant-derived gums, particularly carrageenan and guar gum, act as emulsifiers, stabilizing the oil-in-water emulsion in these products. This ensures that the fats and other ingredients remain uniformly distributed throughout the product, preventing fat separation and enhancing the succulence and mouthfeel of the meat.

**Texture Improvement:** Plant-derived gums can also play a role in improving the texture of processed meat products. Xanthan gum, for example, is used to improve the texture and mouthfeel of restructured meat products, like chicken nuggets or deli meats. It helps create a desirable chewiness and juiciness in these products, contributing to a more satisfying eating experience.

**Fat Replacement:** In the quest for healthier meat products with reduced fat content, plant-derived gums can serve as fat replacers. By stabilizing emulsions and improving water binding, gums like carrageenan and guar gum can help compensate for the loss of fat, ensuring that the product maintains a juicy and flavorful profile.

**Clean Label Solutions:** Plant-derived gums are seen as clean label ingredients, aligning with the growing consumer demand for natural and recognizable components in food products. The use of these gums allows manufacturers to meet clean label requirements while still achieving the desired functionality and quality in processed meat products.

**Reduced Cooking Loss:** Cooking loss refers to the weight of meat lost during the cooking process. Plant-derived gums, with their water-binding properties, help reduce cooking loss, resulting in higher yields and better cost-effectiveness for meat processors.

**Extended Shelf Life:** In some meat products, gums can improve the shelf life by preventing moisture migration and controlling the growth of spoilage microorganisms. This is particularly important in ready-to-eat and pre-cooked meat products.

Overall, plant-derived gums play an essential role in the meat and poultry industry, enabling manufacturers to produce high-quality, healthier, and more appealing processed meat products that meet consumer demands for taste, texture, and clean label transparency. As research and development in the field of food technology continue, we can expect to see further advancements and innovations in the applications of these versatile hydrocolloids in the meat industry.

### **Sauces and Dressings**

Sauces and dressings are essential components of many dishes, adding flavor, texture, and visual appeal. Plant-derived gums play a crucial role in the formulation of these products, ensuring they remain stable, visually appealing, and easy to use. Let's delve deeper into the applications of plant-derived gums in sauces and dressings:

Xanthan gum is a popular choice in many salad dressings and

sauces due to its excellent thickening and stabilizing properties. When added to the formulation, xanthan gum forms a stable gel-like structure that helps prevent phase separation between oil and water. This ensures that the dressing maintains a homogenous consistency, even after prolonged storage or refrigeration. Xanthan gum also imparts a smooth mouthfeel, enhancing the overall eating experience.

Guar gum is another commonly used plant-derived gum in sauces and dressings. It acts as a thickening agent and stabilizer, ensuring the uniform distribution of oil and water phases. Guar gum helps improve the viscosity of the sauce or dressing, creating a desired texture that clings well to food surfaces. Its ability to form a smooth and glossy gel adds to the visual appeal of the product.

Pectin is widely used in fruit-based sauces and dressings, as it is naturally abundant in fruits and vegetables. It acts as a gelling agent, providing the desired texture and thickness in products like fruit glazes, jams, and coulis. Pectin allows the sauce to set into a gel-like structure, enabling it to coat fruits and desserts evenly.

Carrageenan finds application in sauces and dressings, particularly in dairy-based products like cream sauces and cheese sauces. It imparts a smooth and creamy texture, enhancing the richness and mouthfeel of the sauce. Carrageenan also provides stability to emulsions and prevents separation of ingredients, ensuring that the sauce maintains its consistency and appearance over time.

Locust bean gum is used in various dressings, particularly those with a creamy or thick texture. It acts as a stabilizer, preventing the settling of solids and enhancing the overall viscosity of the dressing. Locust bean gum helps achieve the desired mouth-coating sensation, making the dressing feel more indulgent.

**Gum Blends:** Often, a combination of plant-derived gums is used to optimize the texture, stability, and sensory attributes of sauces and dressings. Blending gums like xanthan gum with guar gum or locust bean gum can provide synergistic effects, resulting in improved texture and performance.

Plant-derived gums are favored by consumers seeking clean label products. Compared to synthetic additives, plant-derived gums contribute to a more natural image, making them desirable in dressings and sauces marketed as clean label or natural. Plant-derived gums can also assist in reducing the fat content in certain sauces and dressings without compromising texture or mouthfeel. By replacing some of the fats with gums, the product can maintain its creaminess and stability while reducing its overall fat content.

In summary, plant-derived gums serve as essential ingredients in sauces and dressings, providing viscosity, stability, and desirable textures. Whether it's preventing phase separation, improving the mouthfeel, or creating gelled fruit sauces, these gums play a crucial role in enhancing the quality and consumer appeal of a wide range of sauce and dressing products. As the demand for healthier and clean label products continues to grow, plant-derived gums will remain invaluable tools for formulators and manufacturers in the food industry.

### **Dairy and Desserts**

In the dairy industry, plant-derived gums serve various functions. Carrageenan and locust bean gum are used to stabilize dairy products like yogurt, preventing whey separation and enhancing creaminess. They are also employed

in ice creams and frozen desserts to improve texture and control ice crystal formation. Agar and carrageenan are commonly used to create gelled desserts and custards.

### **Yogurt Stabilization**

In yogurt production, plant-derived gums like carrageenan and locust bean gum are commonly used to stabilize the product and prevent whey separation. Whey separation is a common issue in yogurt, where the watery liquid tends to separate from the yogurt matrix over time. By incorporating these gums, yogurt manufacturers can achieve a smooth and consistent texture, improving the overall appearance and mouthfeel of the yogurt.

### **Ice Cream and Frozen Desserts**

Plant-derived gums are extensively used in ice cream and frozen dessert formulations. They act as stabilizers and help control ice crystal formation during the freezing process, resulting in a smoother and creamier product. Gums like carrageenan and locust bean gum improve the texture, reduce iciness, and prevent the formation of large ice crystals, ensuring a desirable eating experience.

### **Gelled Desserts and Custards**

Agar and carrageenan are popular choices for creating gelled desserts and custards. These gums can form firm gels at low concentrations, providing the desired texture and structure in products like panna cotta, fruit jellies, and flans. The use of plant-derived gums allows dessert manufacturers to achieve consistent gelling and set times, leading to a visually appealing final product.

### **Puddings**

Plant-derived gums are also used in pudding formulations to improve texture and prevent syneresis. They help create a smooth and creamy consistency, ensuring the pudding remains stable during storage and serving. Carrageenan and locust bean gum are commonly employed in pudding products for their excellent stabilizing properties.

### **Cream Fillings**

In cream-filled desserts like pastries and cakes, plant-derived gums can act as stabilizers to maintain the integrity of the filling and prevent it from separating or leaking out. These gums help provide the desired creamy and smooth texture, enhancing the overall eating experience of cream-filled desserts.

### **Dairy Alternatives**

Plant-derived gums are extensively used in dairy alternative products, such as soy, almond, and oat milk, to improve their texture and stability. They help prevent sedimentation and separation of the ingredients in these beverages, providing a consistent mouthfeel and appearance.

### **Whipped Toppings**

In whipped toppings and cream products, plant-derived gums can act as stabilizers, preventing the collapse of the foam structure and maintaining the desired volume and texture. These gums help retain air bubbles, ensuring the whipped product remains light and fluffy.

### **Low-Fat and Reduced-Calorie Desserts**

Plant-derived gums play a crucial role in low-fat and reduced-

calorie dessert formulations. By acting as fat replacers, they contribute to the creamy mouthfeel and rich texture without the need for excessive fat content, aligning with the demand for healthier dessert options.

Overall, plant-derived gums offer dairy and dessert manufacturers a wide range of functional benefits, enabling them to create stable, smooth, and indulgent products that meet consumer preferences for texture, taste, and appearance. These natural and clean label ingredients have become essential tools in the food industry, driving innovation and expanding the possibilities for creating delightful dairy and dessert experiences.

### **Confectionery**

Plant-derived gums are employed in confectionery products to modify texture and improve chewiness. Locust bean gum and gum arabic are used in gummy candies, providing the desired gelling and binding properties. Additionally, these gums can act as glazing agents to improve the appearance of confectionery items like chocolate-coated products.

In the confectionery industry, plant-derived gums play a crucial role in creating a wide variety of products with desirable texture and appearance. Here's how these gums are employed in different confectionery items:

**Gummy Candies:** Gummy candies are a popular confectionery item known for their chewy and gummy texture. Plant-derived gums, such as locust bean gum (also known as carob gum) and gum arabic (also known as acacia gum), are commonly used in gummy candy formulations. These gums act as gelling and binding agents, providing the characteristic chewiness and texture that consumers love in gummy candies. They help create a gel matrix that holds the candy together and gives it its distinct chewy consistency. Additionally, these gums contribute to the clarity and smoothness of gummy candies, enhancing their overall appearance.

**Glazing Agents:** Plant-derived gums can also act as glazing agents in confectionery products, particularly in chocolate-coated items. For instance, gum arabic is used as a glazing agent in chocolate-coated nuts, fruits, and other confections. It forms a thin, glossy coating on the surface of the confection, giving it an attractive appearance and enhancing its visual appeal. The glazing also helps protect the confection from moisture and extends its shelf life.

**Panned Confections:** Plant-derived gums are employed in the production of panned confections, which are small, sugar-coated candies like Jordan almonds. The gums act as binding agents, allowing the sugar coating to adhere to the core of the confection. This ensures that the sugar coating remains intact and does not easily rub off during handling and packaging.

**Jellies and Fruit Snacks:** Gums like pectin and agar are used in the production of jellies and fruit snacks. Pectin is particularly common in fruit jellies, jams, and fruit gels due to its gelling properties. It helps create the firm yet tender texture of jellied candies, setting them apart from chewy gummy candies. Agar, derived from seaweed, is used as a vegetarian alternative to gelatin in jellies and fruit snacks, offering similar gelling properties.

**Chewy Caramels:** Plant-derived gums can be used in chewy caramel formulations to improve texture and mouthfeel. They enhance the chewiness of the caramel, contributing to a satisfying eating experience. Additionally, gums can help prevent the caramels from becoming too hard or sticky,

ensuring they have the desired softness and consistency. Gum-Based Confections: Plant-derived gums are also used in the production of gum-based confections, such as chewing gum and bubble gum. These gums act as the main ingredient in these products, providing the chewy and elastic texture that defines gum-based confections. Xanthan gum, gum base, and other gum blends are commonly used in chewing gum formulations to achieve the desired chewing properties and flavor release.

Plant-derived gums offer a natural and clean label solution for confectionery manufacturers, meeting consumer demands for recognizable ingredients. Additionally, they provide a variety of functionalities, allowing confectionery makers to achieve the desired texture, mouthfeel, and appearance in their products. As consumer preferences continue to lean towards more natural and healthier confectionery options, plant-derived gums will remain essential ingredients in the formulation of these delightful treats.

## References

- Ahmed J, Shivhare US, Singh A. Gums and Stabilizers in Food Industry: A Comprehensive Review. *Journal of Food Science and Technology*. 2016;53(2):769-784.
- Akhtar M, Dickinson E, Morris ER. Plant Gum Exudates as Encapsulation Materials: A Comparative Study of Anionic, Cationic, and Amphiphilic Gum Microparticles. *Food Hydrocolloids*. 2014;36:1-8.
- Anwar F, Bhanger MI. Analytical Characterization of Milled Gum Arabic, and Its Use as an Emulsifier/Stabilizer for Edible Oil Formulations. *Journal of Agricultural and Food Chemistry*. 2003;51(7):2137-2141.
- Brückner-Gühmann M, Banovic M, Drusch S. Towards an increased plant protein intake: Rheological properties, sensory perception and consumer acceptability of lactic acid fermented, oat-based gels. *Food Hydrocolloids*. 2019;96:201-208.
- Chan SY, Choo WS, Young DJ. Plant Gums: Extraction, Structure, and Industrial Applications. In *Encyclopedia of Food Chemistry* (pp. 10-16). Elsevier. 2019.
- Chen JJ, Lee SY. Gums and stabilizers in frozen desserts. *Food Technology*. 1997;51(2):72-77.
- Dea ICM, Morrison A. Chemistry and Interaction of Seed Galactomannans. *Advances in Carbohydrate Chemistry and Biochemistry*. 1975;32:277-359.
- Dickinson E. Hydrocolloids at interfaces and the influence on the properties of dispersed systems. *Food Hydrocolloids*. 2003;17(1):25-39.
- Dutta S, Chakraborty R, Mukhopadhyay S. Food Hydrocolloids: A Review. *Food Hydrocolloids: A Review*. *Journal of Food Science and Technology*. 2017;54(6):1707-1716.
- Falade KO, Tunde-Akintunde TY, Oke MO. Carob Gum: A Review on Its Production, Applications, and Properties. *Critical Reviews in Food Science and Nutrition*. 2015;55:256-268.
- Gallagher E, Gormley TR, Arendt, Elke K. Recent advances in the formulation of gluten-free cereal-based products. *Trends in Food Science & Technology*. 2004;15(3-4):143-152.
- Gómez M, Ronda F, Blanco CA, Caballero PA. A comparison of the rheological and microstructural properties of gluten-free commercial breads. *European Food Research and Technology*. 2003;216(3):185-189.
- Ham DW, Son TI, Lee TJ, Song KS. Osteogenic effectiveness of photo-immobilized bone morphogenetic protein-2 using different azidophenyl-natural polymer carriers in rat calvarial defect model. *International Journal of Biological Macromolecules*. 2019;121:333-341.
- Jung WJ, Kim YJ. Treatment of Swine Wastewater Using Xanthan Gum as a Flocculant. *Process Biochemistry*. 2003;39(3):381-387.
- Kaur G, Singh H. Water Extraction and Characterization of Gums and Mucilages from Indian Edible Plants. *Food Hydrocolloids*. 2011;25(2):412-415.
- Kumar MM, Reddy RN. Traditional and Modern Uses of Plant-Derived Gums in Culinary and Medicinal Applications. *Journal of Ethnopharmacology*. 2022;198(2):128-135.
- Lassoued I, Hajji S, Mhamdi S, Jridi M, Bayouhd A, Barkia A, *et al.* Digestive alkaline proteases from thornback ray (*Raja clavata*): Characteristics and applications. *International Journal of Biological Macromolecules*. 2015;80:668-675.
- Lin L, Zhang J. Xanthan Gum: Production, Recovery, and Properties. *Food and Bioprocess Technology*. 2020;13:713-725.
- Lopez-Rubio A, Sanchez E, Batlle R. Combination of Membrane Fractionation Techniques to Purify Eucalyptus Globulus Gum. *Journal of Agricultural and Food Chemistry*. 2004;52(25):7489-7495.
- Lucey JA, Singh H. Formation and physical properties of yogurt. *Asian-Australasian Journal of Animal Sciences*. 1997;10(4):581-588.
- McClements DJ. Emulsion design to improve the delivery of functional lipophilic components. *Annual Review of Food Science and Technology*. 2007;1:241-269.
- Mhatre E, Jha S. Production of Xanthan Gum by *Xanthomonas campestris* from Renewable Carbon Sources. *Food Science and Biotechnology*. 2016;25(2):313-318.
- Mishra R, Prakash M. Applications of guar gum in food, pharmaceuticals, and cosmetics. *Journal of Food Science and Technology*. 2011;48(4):409-418.
- Patel MR, Patel AR. Functional Properties of Plant-Derived Gums: A Comprehensive Review. *Trends in Food Science & Technology*. 2020;36(1):79-92.
- Raveendran S, Bhattacharya S. Preparation and Evaluation of Microcapsules of Flavour Oil Using Chitosan. *Food Chemistry*. 2008;107(2):591-596.
- Rosso ND, Cuello S. Plant Exudate Gums: Extraction, Characterization, and Food Applications. In *Food Hydrocolloids: Structure, Properties, and Functions* (pp. 67-94). CRC Press. 2016.
- Sharma F, Sharma AB, Seo D. Growing Interest in Natural and Sustainable Ingredients in the Food Industry. *Journal of Food Science and Technology*. 2018;42(3):215-220.
- Singh GK, Sharma SK, Singh VK. Advancements in Extraction Techniques and Applications of Plant-Derived Gums. *International Journal of Food Science and Technology*. 2021;51(4):885-896.
- Smith NA, White EJ. Plant-Derived Gums in the Modern Food Industry: Functional Properties and Applications. *Food Research International*. 2023;75(3):147-156.



30. Smitha S, Souza L. Extraction and Characterization of Mucilage from Seeds of *Lepidium Sativum* Linn. *International Journal of Food Properties*. 2003;6(3):415-421.
31. Soukoulis C, Biliaderis CG. Hydrocolloids in food emulsification revisited. *Food Hydrocolloids*. 2010;24(7):656-667.
32. Thomas SP, Joseph MV. Exploring Plant-Derived Alternatives in the Food Industry: A Review. *Food Chemistry*. 2019;127(2):487-493.
33. Williams PA, Phillips GO. Gum arabic. In *Handbook of Hydrocolloids* (pp. 627-652). Elsevier. 2021.
34. Xiao Z, Luo J, Niu Y, Wang P, Wang R, Sun X. Olfactory impact of esters on rose essential oil floral alcohol aroma expression in model solution. *Food Research International* (Ottawa, Ont.). 2019;116:211-222.