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Extraction of plant gums and study of their Organoleptic, Functional properties and Detection of Phytochemicals

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ABSTRACT

The present study aimed to extract gums from Quince seeds, Tamarind seeds, and psyllium, and to evaluate their sensory and functional properties, as well as to identify the active chemical compounds present within them. Results indicated that all the plant gums exhibited favorable sensory characteristics; specifically, the gums derived from quince seeds and psyllium appeared as fine powder with a creamy coloration and were tasteless and odorless. In contrast, Tamarind seed gum was a light brown powder, also tasteless and odorless, but with a coarse, non-crystalline form. The minimum concentration required for gel formation from quince seed gum was found to be 0.5%, producing a firm, non-fracturable gel at 1%. Gels from Tamarind seed and psyllium gums formed at concentrations of 3% and 1%, respectively, with psyllium gum exhibiting a non-fracturable, firm texture at 2%. Tamarind seed gum did not form a firm, non-fracturable gel within the tested concentration range. All extracted plant gums demonstrated high emulsifying stability at concentrations of 0.8% and 1%, along with excellent water solubility, reaching up to 90% for both Tamarind seed and psyllium gums. Oil-binding capacity varied among the gums depending on the type of oil used, ranging from 1.01 to 4.17 grams of oil per gram of dry sample, with statistically significant differences ($p<0.05$). Phytochemical analysis revealed the presence of reducing sugars, steroids, proteins, and tannins in all the extracted gums, with a small amount of protein that may enhance fat-binding, emulsification, and other functional properties. In conclusion, the plant-derived gums demonstrated excellent sensory and functional attributes, including high solubility, water and oil retention, emulsification, and foaming capacity, making them suitable for applications in food, pharmaceutical, medical, and other industrial fields.

KEYWORDS: Extraction, plant gum, Mucilage, Functional properties, phytochemicals.

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INTRODUCTION

Gums and mucilages have numerous applications across food, pharmaceutical, and medical industries. They are considered safe for health, as they are non-toxic, harmless, and biodegradable. This bio-compatibility is due to their chemical structure, which consists of repetitive units of monosaccharides [1].

Mucilages and gums have been employed in medical applications such as soothing coughs and treating skin conditions. They also help alleviate intestinal pain when included in pharmaceutical coatings for tablets. Additionally, they are used to prepare various drug formulations, including medications for colon disorders, because of their properties as binders, thickeners, emulsifiers, crystallization agents, and laxatives, which contribute to maintaining the stability of pharmaceutical environments [2]. Furthermore, a mixture of gum and silica has been utilized in water purification processes to remove contaminants, including heavy metals, from polluted wastewater using Arabic gum [3, 4].

Quince (Cydonia oblonga) a large shrub belonging to the Rosaceae family. According to [5], the powder of quince seeds contains complex carbohydrate substances composed of various sugars, including rhamnose, arabinose, galactose, glucose, xylose, and mannose, along with acids such as chlorogenic acid, glucuronic acid, and manuronic acid. The molecular weight (Mw) of these compounds is about 237 kilodaltons. They are ionic and hydrophilic, making them suitable for use as bioactive edible components in the food industry based on their functional, physical, chemical, and rheological properties [6]. This gum displays expectorant and antitussive properties [7].

Tamarind (Tamarindus indica L.) commonly known as tamarind, belongs to the Fabaceae family and is classified as a dicotyledon. The seeds primarily consist of endosperm, which constitutes around 70–80% of their content. The seed powder is a branched carbohydrate substance composed of complex polysaccharides made up of glucose, galactose, and xylose, linked together through strong bonds in a molar ratio of 1:2:3, with xylose being the predominant sugar in these seeds [8]. These polysaccharides make up about 65% of the total seed composition and have a high molecular weight of approximately 1735 kDa. They are nonionic, hydrophilic, branched, and capable of forming gels [1]. When dispersed in water, the gum derived from tamarind seeds forms viscous solutions with excellent thermal and chemical stability. It is also biodegradable, non-toxic, non-carcinogenic, biocompatible, and considered safe for consumption. Moreover, this gum contains significant amounts of essential amino acids such as isoleucine, leucine, lysine, methionine, phenylalanine, and valine, making it a valuable ingredient in food applications [9]. Psyllium (Plantago ovata), belonging to the Plantaginaceae family, One of psyllium's most notable nutritional

features is its high fiber content [10]. Due to its abundance of soluble fiber, primarily composed of arabinoxylans, psyllium forms a gel-like substance upon hydration [10]. Psyllium also helps stabilize blood glucose levels, lowers cholesterol, and exhibits laxative properties [11]. Its water-soluble fiber is particularly effective in reducing levels of low-density lipoprotein (LDL), commonly referred to as "bad" cholesterol [10]. In addition to its therapeutic uses in traditional medicine, psyllium is incorporated into functional foods and dietary supplements. This study aimed to extract gums plant from different sources (quince seeds, tamarind seeds, plantain seeds) and study their sensory and functional properties and detect phytochemicals.

MATERIALS AND METHODS

Plant Sources: The fruits of quince and tamarind plants, as well as psyllium seeds, were procured from local markets in Baghdad during September 2024. The seeds of quince and tamarind were identified and authenticated by the Seed Testing and Certification Department – Ministry of Agriculture. The fleshy parts of the quince and tamarind fruits were separated from the seeds. The seeds were then thoroughly washed and air-dried at room temperature. Tamarind seeds were crushed to remove the hard brown seed coats, isolating the inner white portions of the seeds.

Quince Seed Gum Extraction:
The extraction of gum from quince seeds was carried out with some modifications to the procedure outlined by [12]. The seeds were combined with deionized water in a 1:5 ratio (w/v; seeds to water), then heated in a water bath at 50 °C for 30 minutes. After cooling at room temperature for one hour, the mucilage was filtered using cotton cloth. The gum was precipitated by adding 99.9% ethanol to the filtrate in a 1:2 ratio (v/v; filtrate to ethanol). The resulting precipitate was dried in an oven at 40 °C and stored in a clean, sealed container at 4 °C.

Extraction of Tamarind Seed Gum:
Tamarind seed gum was extracted based on the procedure outlined by [1], with some adjustments. The white inner parts of the seeds were blended with deionized water at a ratio of 50:1 (w/v) and heated at 80 °C for two hours. Afterward, the mixture was left to cool at room temperature for one hour. The gum was then precipitated by combining the filtrate with 99.9% ethanol in a 2:1 ratio (v/v; ethanol to filtrate). The resulting precipitate was dried in an electric oven at 40 °C and stored in an airtight, clean container at 4 °C.

Extraction of Psyllium Seed Gum:
The extraction of psyllium seed gum was carried out based on the procedure outlined by [13], with certain modifications. The seeds were immersed in distilled water at 40 °C for 30 minutes using a 50:1 (w/w) ratio. The mucilage was then separated using a centrifuge. To isolate the gum, the supernatant was combined with 99.9% ethanol at a 2:1 (v/v) ratio (ethanol:filtrate). The resulting precipitate was dried in an oven at 40 °C and stored in an airtight plastic container.

Sensory Evaluation of Extracted Plant Gums:
The gums derived from quince seeds, tamarind seeds, and psyllium seeds were assessed based on their color, aroma, taste, texture, and appearance, following the methodology described by [14].

Determination of Least Gelation Concentration
The least gelation concentration was assessed following the method described by [15]. Solutions of gum powder were prepared at concentrations of 0.5%, 1.0%, 2.0%, and 3.0% by suspending the gum powder in distilled water. A fixed volume of each concentration was transferred into clean, dry test tubes and heated in a boiling water bath for one hour. After heating, the tubes were cooled under running tap water and then placed in an ice bath for one hour. The lowest concentration at which the gum solution formed a gel was recorded as the least gelation concentration.

Estimation of Emulsion Ability:
The emulsion ability was evaluated following the method described by [9] with some modifications. Samples weighing 0.8 and 1 gram were mixed with 10 ml of corn oil. The mixture was then homogenized using an electric homogenizer at 7000 rpm for 3 minutes. The emulsion ability was calculated using the following formula:

$$\text{Emulsifying Capacity (\%)} = \left(\frac{\text{Volume of formed emulsion}}{\text{Total volume of mixture}}\right) \times 100$$

Foam Capacity Measurement:
The foam capacity was evaluated following the method described by [9], with slight modifications. The gum solution, prepared at concentrations of 0.8% and 1% using distilled water, was homogenized using a high-speed homogenizer at 7000 rpm for one minute. Afterward, the foam volume was measured at room temperature using a 100 ml graduated cylinder. Foam capacity was calculated using the formula:

$$\text{Foam Index (\%)} = \left(\frac{\text{Volume of foam}}{\text{Total volume}}\right) \times 100$$

Viscosity Measurement:
The viscosity of the plant gums was measured using a Brookfield viscometer. Gum solutions were prepared by dissolving the gums in distilled water at various concentrations (0.5%, 1%, 1.5%, 2%, 2.5%, and 3%) and maintained at 25°C. Measurements were taken using Spindle numbers 5 and 10 for quince seed gum, tamarind seed gum, and psyllium seed gum, following the method described by [14].

Solubility of Gums in Water and Organic Solvents
The solubility of quince, tamarind, and psyllium seed gums powders was visually assessed using various solvents (diethyl ethyl ether, Acetone, Ethanol, Chloroform), following the method described by [14].

Solubility Estimation:
The solubility was determined following the method described by [16]. Initially, 0.1 g of the plant gums was placed into a pre-weighed centrifuge tube. Then, 10 mL of distilled water was added to the sample. The tubes were incubated in a shaker incubator at 25°C, shaking at 240 rpm for 30 minutes. After that, the samples were heated in a boiling water bath for 10 minutes. Once cooled to 25°C, the tubes were centrifuged at 10,000 × g for 10 minutes. The supernatant was discarded, and the insoluble residue was washed with distilled water and centrifuged again at the same speed. The supernatant was removed once more, and the remaining insoluble material was dried at 60°C for 24 hours.

Oil Holding Capacity (OHC)
The oil holding capacity was measured following the method described by [17]. In brief, 0.2 g of gum powder was mixed with 10 ml of various vegetable oils, including sunflower oil, corn oil, and olive oil. The mixture was thoroughly blended using a vortex mixer for one minute, then centrifuged at 2200 × g for 30 minutes. After discarding the supernatant, the oil-absorbed samples were weighed. The oil holding capacity was calculated as the grams of oil absorbed per gram of dry sample using the following formula:

$$\text{Oil Holding Capacity (g/ g)} = \left(\frac{\text{Weight of sample with tube after oil absorption} - \text{Weight of tube}}{Weight\ of\ dry\ sample}\right)$$

Water Holding Capacity (WHC)
The water holding capacity was determined following the method described by [17]. In brief, 0.2 g of the sample was mixed with 10 mL of distilled water using an electric stirrer for one minute. The mixture was then centrifuged at 2200 × g for 30 minutes. After discarding the supernatant, the wet sample was weighed. The water holding capacity was calculated as the grams of water retained per gram of the dry sample using the formula:

$$\text{Water Holding Capacity (g/g)} = (\ ) \frac{wet\ sample\ weight - Weight\ of\ dry\ sample}{Weight\ of\ dry\ sample}$$

Qualitative Detection of Active Chemical Compounds in Extracted Plant Gums:
Chemical tests were performed to identify the active compounds present in the powdered extracted plant gums. These tests included the detection of anthraquinones, reducing sugars, phlobatannins, and cardiac glycosides as described by [18]. Additionally, steroids, saponins, phenolic compounds, tannins, and flavonoids were examined following the methods of [19]. Protein presence was also assessed according to [20].

Statistical Analysis:
The Statistical Analysis System- SAS [21], program was used to detect the effect of difference treatments in study parameters. Least significant difference-LSD (ANOVA: Completely randomized design-CRD) was used to significant compare between means in this study.

RESULTS AND DISCUSSION

Table 1 presents the sensory characteristics of the extracted plant gums. The quince seed gum stood out with a light creamy color, while the psyllium gum also showed a creamy hue. In contrast, the tamarind seed gum appeared light brown. All extracted gums were odorless and tasteless. The tamarind seed gum had a coarse, non-crystalline powder texture, unlike the quince and psyllium gums, which were finely powdered. The distinct qualities of quince seed gum and psyllium gum, being flavorless, odorless, and light creamy in color, make them suitable for various food and industrial applications where maintaining the original color and taste of the final product is important. [1] described tamarind seed gum as light brown with a noticeable odor and rough texture. The findings also align with those of [14], who noted that tamarind seed gum has a non-crystalline powder form, irregular shape, no odor, a distinct bitter taste, and brown color.

Table (1): sensory characteristics of the extracted plant gums.

Type Gum	Color	Taste	Odor	Texture	Shape
Quince seed gum	Light creamy	Tasteless	Odorless	Fine powder	Spherical or nearly spherical
Tamarind seed gum	Light brown	Tasteless	Odorless	Coarse, amorphous powder	Irregular
psyllium seed gum	Creamy	Tasteless	Odorless	Smooth powder	Irregular

Assessment of Functional Properties of Extracted Plant Gums

Table 2 illustrates the gelation properties of the extracted plant gums. These gums demonstrated varying abilities to form gels, with the minimum gelation concentrations for quince seed gum, Tamarind seed gum, and psyllium seed gum being 0.5%, 3%, and 1%, respectively. The concentrations at which the gels formed by quince seed and psyllium seed gums remained intact without breaking were 1% and 2%, respectively. However, the Tamarind seed gum did not produce a firm gel at these concentrations but exhibited a high viscosity. The gel from quince seed gum stood out due to its strong gel-forming ability compared to the other two gums, which could be attributed to its superior water-binding capacity and distinct chemical composition. At a 1% concentration, quince seed gum formed a firm, cohesive gel with a cylindrical disc shape and a light creamy color. This gelation is likely linked to the high capacity of the repeating monomers within its polymer structure to form gels, along with a greater degree of branching in its chemical structure, leading to the development of an efficient and dense three-dimensional network [22].

Table (2): Minimum Gelation concentrations of Extracted Plant Gums.

Type of Gum	Minimum Gelation concentrations (%)	Concentration which Gel Does Not Break (%)
Quince seed gum	0.5	1
Tamarind seed gum	3	Not applicable
psyllium seed gum	1	2

Table 3 shows the emulsification capacity of the extracted plant gums. The gums exhibited high emulsification abilities, with the highest emulsification observed for Tamarind seed gum at a 1% concentration, reaching 92.72%, while the lowest was for psyllium seed gum at the same concentration, recording 90.18%. The emulsification capacity of Tamarind seed gum at 1% was similar to the value reported by [9], who found it to be 92.4%. No significant differences were noted in emulsification values among quince seed gum, Tamarind seed gum, and psyllium seed gum at concentrations of 0.8% and 1%. According to [23], the stability of emulsions depends on particle size, surface tension, and storage duration. [9] observed that the emulsification capacity increases with the ratio of spray-dried Tamarind seed gum to oil volume. This is attributed to the rise in gum content, which increases the branched chains that absorb oil droplets, reducing surface tension. Quince seed gum, Tamarind seed gum, and psyllium seed gum are among the gums applied in food and pharmaceutical industries, showing a high emulsification rate of 94.89% compared to other food emulsifiers [24].

[17] reported strong emulsification for garden cress seed gum, reaching 86%. The high emulsification capacity and stability may be attributed to the protein content in the extracted gums. The presence of hydrophobic proteins and hydrophilic carbohydrates contributes to the stability and emulsification properties of the gums due to their fat-attracting characteristics. Proteins are considered natural surfactants [25].

Table (3): emulsification capacity of the extracted plant gums.

Concentrations Gum (%)	Type of Gum			
	Quince seed gum	Tamarind seed gum	psyllium seed gum	L.S.D
0.8	91.63	92.00	92.36	N.S. 4.09
1	91.63	92.72	90.18	N.S. 4.88
L.S.D.	N.S. 3.87	N.S. 2.69	N.S. 3.58	---
N.S: not significantly				

Table 4 shows the foam capacity of the extracted plant gums. It was found that quince seed gum, Tamarind seed gum, and psyllium seed gum could all form foam at a 1% concentration. Among them, quince seed gum exhibited the highest foam capacity at 4.0%, compared to 1.2% and 0.4% for Tamarind and psyllium seed gums, respectively, with statistically significant differences at $P < 0.05$. The foam capacity of Tamarind seed gum was lower than the 3.70% reported by [9, 24] at the same concentration. also observed that increasing the concentration of Tamarind seed gum enhances foam capacity, which is linked to the gums flexible structure that reduces surface tension. This effect is attributed to the greater amount of gum migrating to the interface, forming viscous and flexible films that improve foam formation. Good foam properties are closely related to the elastic structure of the gel and depend on several factors, including the presence of additional compounds in the aqueous colloidal material, molecular weight, protein content, structure, and carbohydrates.

Table (4): Foam Capacity of Extracted Plant Gums at 1% Concentration.

Type of Gum	Foam capacity (%)
Quince seed gum	a 4.0
Tamarind seed gum	b 1.2
psyllium seed gum	c 0.4
*0.705	L.S.D.
.($P \leq 0.05$) *	

Viscosity Estimation

Table 5 illustrates the relationship between the concentration of extracted plant gums and their viscosity at room temperature. The viscosity values for quince seed gum were (4.6, 4.8, 5.8, 6.3, 10.3, 10.8) centipoise, for Tamarind seed gum (3.9, 5.1, 6.2, 8.1, 18.1, 20.8) centipoise, and for camelthorn seed gum (4.9, 6.4, 7.5, 10.7, 12.9, 15.8) centipoise, corresponding to concentrations of 0.5%, 1%, 1.5%, 2.5%, and 3%, respectively, at 25 °C. It was observed that viscosity increased proportionally with gum concentration, with statistically significant differences at $P < 0.05$. [26] reported a viscosity of 38.53 centipoise for Tamarind seed gum at 1% concentration. The highest viscosities recorded at 3% concentration were 10.8, 20.8, and 15.8 centipoise for quince, Tamarind, and psyllium seed gums, respectively, while the lowest viscosities at 0.5% concentration were 4.6, 3.9, and 4.9 centipoise in the same order. Viscosity differences at 0.5% concentration were not statistically significant ($P < 0.05$), whereas significant differences ($P < 0.05$) appeared at higher concentrations (1%, 1.5%, 2%, 2.5%, and 3%). An increase in gum concentration was consistently linked to higher viscosity values. This effect can be attributed to the high molecular weights of the extracted gums, as well as their porous structures, which promote liquid absorption and provide a large surface area facilitating dissolution [7].

Furthermore, [27] noted that gum viscosity decreases with rising temperature and increased ionic strength of the gum solution, which reduces apparent viscosity.

Table (5): Relationship between the concentration of extracted plant gums and their viscosity (centipoise) at 25 C.

Concentration (%)	Quince seed gum	Tamarind seed gum	psyllium seed gum	L.S.D
0.5	4.6 B a	3.9 C a	4.9 D a	N.S. 1.17
1	4.8 B b	5.1 BC ab	6.4 CD a	* 1.37
1.5	5.8 B b	6.2 BC ab	7.5 CD a	* 1.51
2	6.3 B b	8.1 B ab	10.7 BC a	* 2.07
2.5	10.3 A b	18.1 A a	12.9 AB b	* 2.89
3	10.8 A c	20.8 A a	15.8 A b	* 3.22
L.S.D	* 2.52	* 4.18	* 4.06	---
.(P≤0.05) *				

Solubility in Water and Some Organic Solvents

Table 6 shows the solubility of the extracted plant gums in water and various organic solvents. The results indicate that both carom seed gum and quince seed gum dissolved completely in hot distilled water at 80°C, forming a true solution. In contrast, tamarind seed gum was only partially soluble at the same temperature. Neither carom seed gum nor tamarind seed gum dissolved in cold distilled water at 4°C, while quince seed gum exhibited partial solubility under these conditions. All extracted plant gums were insoluble in the tested organic solvents, which included diethyl ether, acetone, ethanol, and chloroform. These findings align with those reported by [28], who observed that Babool and Karaya gums were insoluble in several organic solvents such as ethanol, acetone, and chloroform. Similarly, [14] found that tamarind seed gum gel was partially soluble in distilled water, soluble in hydrochloric acid, and insoluble in ethanol, acetone, and methanol.

Table (6): Solubility in Water and Some Organic Solvents.

Solubility	Quince seed gum	Tamarind seed gum	psyllium seed gum
Hot distilled water (80 C)	Completely soluble (true solution)	Partially soluble	Completely soluble (true solution)
Cold distilled water (4 C)	Partially soluble	Insoluble	Insoluble
Diethyl ether	Insoluble	Insoluble	Insoluble
Acetone	Insoluble	Insoluble	Insoluble
Ethanol	Insoluble	Insoluble	Insoluble
Chloroform	Insoluble	Insoluble	Insoluble

Solubility Estimation:

Table 7 illustrates the percentage solubility of the extracted plant gums. The results show that quince seed gum exhibited the lowest solubility at 80%, in contrast to tamarind and psyllium seed gums, both of which showed higher solubility levels of 90%. These differences were statistically significant at $P < 0.05$. Among the tested gums, quince seed gum produced the clearest solution.

Moreover, the solubility of tamarind and psyllium seed gums was higher than that reported by [29] for flaxseed gum extracted by various methods, which recorded solubility values of 70.1% and 70.4%, respectively.

These variations may be attributed to the significant influence of drying processes on the monosaccharide composition within the main and side chains of the gum's molecular structure. Furthermore, the linear configuration of polymer chains being less soluble than branched onesand the presence of branching points, galactose units, and ionic groups within the polymer may contribute to the observed high solubility [30].

Table (7): Solubility Percentage of the Extracted Plant Gums.

Type of Gum	Solubility (%)
Quince seed gum	b80
Tamarind seed gum	a90
psyllium seed gum	a90
L.S.D.	*5.922
.(P≤0.05)*	

Oil Holding Capacity

Table 8 presents the oil holding capacity of the extracted plant gums, showing variation depending on both the type of gum and the kind of oil used. Quince seed gum demonstrated a greater ability to retain oil compared to tamarind and psyllium seed gums across all tested oils. This may be attributed to differences in gum polarity, as tamarind and psyllium gums are more polar than quince gum [24]. Quince seed gum exhibited the highest oil retention with olive oil (3.732 g/g), followed by corn oil (3.47 g/g) and sunflower oil (3.158 g/g). In contrast, psyllium seed gum showed its highest oil affinity with corn oil (4.176 g/g), then olive oil (3.58 g/g), and sunflower oil (2.542 g/g). Tamarind seed gum retained sunflower oil the most (2.19 g/g), followed by olive oil (1.63 g/g) and corn oil (1.014 g/g). Statistically significant differences ($P<0.05$) were observed among the gums' oil binding capacities for the various oils. Oil retention is considered one of the most important functional properties of hydrocolloids, reflecting their ability to absorb and retain oils. This is likely due to enhanced interaction between non-polar regions of the oil and the hydrophobic hydrocarbon chains in the gums, which become more accessible with increased molecular mobility [24]. The presence of non-polar molecules in seed gums likely contributes to oil entrapment, helping prevent fat and flavor loss during food processing [25].

Table (8): oil holding capacity of extracted plant gums.

Type of Gum	Oil holding capacity (g oil/ g gum powder)			L.S.D.
	Sunflower Oil	Corn Oil	Olive Oil	
Quince seed gum	3.158 A a	3.47 A a	3.732 A a	0.696 N.S.
Tamarind seed gum	2.19 B a	1.014 B b	1.63 B ab	* 0.714
psyllium seed gum	2.542 AB b	4.176 A a	3.58 A ab	* 1.49
L.S.D.	* 0.679	* 1.246	* 1.207	---
.(P≤0.05) *				

Water Holding Capacity (WHC) a crucial property in food technology, affecting stability, productivity, texture, and sensory evaluation. WHC refers to the amount of water that a hydrated sample can retain and absorb after being subjected to an external force [9]. Table 9 shows the WHC of extracted plant gums, highlighting that quince seed gum demonstrated a notably high water holding capacity of 91.24 g water per gram of gum powder. This value was significantly greater ($P < 0.05$) than those of Tamarind and psyllium seed gums, which were 14.16 and 34.56 g water/g gum powder, respectively. Differences in water retention ability can be attributed to variations in the chemical composition of the extracted gums as well as the extraction methods used. Factors such as gum purity, protein and fiber content, and cultivation conditions also influence WHC. WHC varies based on several factors, including the balance between hydrophilic and hydrophobic amino acids within protein molecules, as well as the proportions of fats and carbohydrates bound to proteins. The ability to retain water is also linked to the presence of insoluble non-cellulosic polysaccharides (CWPs) in the plant cell wall [30]. [17] found that garden cress seed gum has a WHC of 34 g water/g gum powder. The high water retention ability of gums is mainly due to hydroxyl groups and protein content in their structure.

Table (9) Water Holding Capacity of Extracted Plant Gums.

Type of Gum	Water Holding Capacity (g water/ g gum powder)
Quince seed gum	a 91.24
Tamarind seed gum	c 14.16
psyllium seed gum	b 34.56
L.S.D.	* 13.902
.(P≤0.05) *	

Qualitative Detection of Active Chemical Compounds in Extracted Plant Gums

Table 10 presents the qualitative analysis of active chemical compounds found in the extracted plant gums. Positive results were observed for all gums when tested for proteins and reducing sugars. Steroids tested positive in quince seed gum and psyllium seed gum, whereas Tamarind seed gum showed a negative result. Tannins were detected in Tamarind seed gum and psyllium seed gum, indicating their presence, while quince seed gum was free of tannins. Negative results were recorded for anthraquinones, phlobatannins, saponins, phenolic compounds, cardiac glycosides, flavonoids, and alkaloids, indicating their absence in the tested gums. Similarly, [2] reported the absence of active compounds in basil seed gum, confirming its purity. [26] also found Tamarind seed gum to lack alkaloids, tannins, and proteins, but to contain carbohydrates. Phytochemicals are naturally occurring chemical compounds found in plants that possess various medicinal uses. They play a crucial role in combating a range of diseases such as asthma, arthritis, cancer, and more. Unlike synthetic pharmaceutical chemicals, these plant-based compounds do not cause side effects in humans and can be regarded as beneficial medicines [20]. However, their functions extend beyond the basic cellular needs, as they contribute to the overall survival of the plant. Many of these compounds act as natural pesticides and can also provide natural colors or scents that serve as signals in interactions with other living organisms. Additionally, some phytochemicals exhibit pharmacological effects [31].

Table (10) Qualitative Detection of Active Chemical Compounds in Extracted Plant Gums

Test Type	Quince seed gum	Tamarind seed gum	psyllium seed gum
Anthraquinone (Borntrager s test)	-	-	-
Phlobatannins	-	-	-
Reducing Sugar (Fehling s test)	+	+	+
Steroids (Salkowski s test)	+	-	+
Saponins test	-	-	-
Phenolics test	-	-	-
Tannins test	-	+	+
Cardiac glycosides (Keller-Killani test)	-	-	-
Flavonoids test	-	-	-
Alkaloids test	-	-	-
protein test	+	+	+

CONCLUSIONS

The plant gums extracted from quince seeds, Tamarind seeds, and psyllium seeds exhibited favorable sensory characteristics, being tasteless, odorless, and having an acceptable color. These qualities make them suitable for various pharmaceutical and food applications. Additionally, they showed functional properties such as water and oil retention capacity, viscosity, and swelling ability, along with containing certain bioactive chemical compounds with biological efficacy.

REFERENCES

1. Malviya R., Jha S., Fuloria N.K., Subramaniyan V., Chakravarthi S., Sathasivam K., Kumari U., Meenakshi D.U., Porwal O., Sharma A., Kumar D.H., Fuloria S. Determination of Temperature-Dependent Coefficients of Viscosity and Surface Ten- Sion of Tamarind Seeds (Tamarindus indica L.) Polymers: 2021; 18, 13, 610.
2. Al-Aubadi I. M., Al-Ani M.T. Determination of the physicochemical and organoleptic properties of Iraqi basil seeds gum (Ocimum basilicum) and detection of phytochemicals. J. Biotechnology Research Center. 2017; 11(1): 10-16.
3. Al-Aubadi I.M., Hashim L.Q. Purification of turbid water using orange peel extract and luffa mucilage. Basrah Journal of Agricultural Sciences, 2022; 35(2), 259-270.
4. Majeed M.R., AL-Qaysi W.W., Abdulla F.H. The efficiency of gum-silica cmposite for removing of wastewater turbidity. Iraqi Journal of Agricultural Sciences. 2024; 55(1): 329- 341.
5. Naseer B., Fatima T., Qadri T., Bhat T.A. Quince (Cydonia oblonga)—Morphology, Taxonomy, Composition and Health Benefits. 2021. DOI: 10.1007/978-3-030-75502-7_4.
6. Cai X.S., Ning Y.Y., Qin Z., Liu H.M., Wang X.D., Hou, L.X.. Evaluation of functional properties and freeze-thaw stability of Chinese quince (Chaenomeles sinensis) seed gum. Arabian Journal of Chemistry. 2023; 16(9), 105088.
7. Lataran M.J., Poureini F., Mohammadi M., Najafpour G.D., Hamedi S. Extraction of mucilage from quince (Cydonia oblonga M) seed and investigation of its biological activities. Biointerface Research in Applied Chemistry. 2023; 13(6): 514–522. https://doi.org/10.33263/BRIAC136.514
8. Sharma P., Rana R., Devi P. A review on tamarind gum, modifications and pharmaceutical applications: a novel polymer. International Journal of Pharma Research and Health Sciences. 2024; 12(2): 1-9.
9. Reddy M.K., Goud P.B.T., Priya S, M., Kumar K.R., UV G. Extraction and evaluation of tamarind kernel mucilage powder for hydrocolloidal properties. International Journal of Advanced Engineering Research and Science. 2018; 5(11):

10. Geremew Kassa M., Alemu Teferi D., Asemu A.M., Belachew M.T. Satheesh N., Abera B.D., Erku E.G. Review on psyllium husk: nutritional, functional, health benefits, food industry applications, waste treatment, and potential negative effects. CyTA-Journal of Food. 2024; 22(1), 2409174.
11. Addoun N., Boual Z., Delattre C., Ursu A.V., Desbri`eres, J., Le Cerf D., et al. Structural features and rheological behavior of a water-soluble polysaccharide extracted from the seeds of Plantago ciliata Desf. International Journal of Biological Macromolecules, 2020; 155, 1333–1341. https://doi.org/10.1016/j. ijbiomac.2019.11.106
12. Ghumman S.A,. Mahmood A,. Noreen S,. Rana M,. Hameed H,. Ijaz B,. Hasan S,. Aslam A., Rehman M.F. Formulation and evaluation of quince seeds mucilage – sodium alginate microspheres for sustained delivery of cefixime and its toxicological studies. Arabian Journal of Chemistry. 2022; pages1-16.
13. Keisandokht S. Extraction of Hydrocolloids from Vegetable Seeds and Identification of their Physicochemical Properties Compared with Selected Commercialized Gums. 2028; 1-204.
14. Chaudhari S., Dhuppad U. Isolation of gum from tamarind and fenugreek plants and its evaluation as pharmaceutical excipients. Research Article. 2023; 13(4): 1509-1513.
15. Bin Zamri A. I., Poh L.S. Extraction and physicochemical properties of mucilage from Carica papaya seed, UMT Annual Seminar. Permai Park Inn Kuala Terengganu. 2011.
16. Martinez M.C., Antonio J.V., Juan C. P., Beltran A.M. Physicochemical and functional properties of bototo tree gum exudates (Cochlospermum vitifolium). International Journal of Food and Allied Sciences. 2017; 2(2): 42-48.
17. Al Mahdawi A.A.R., Al-Aubadi A.H.A. Functional characteristics of the Iraqi garden cress seeds (Lepidium Sativum L.) gum. Biochem. Cell. Arch. 2020; 20(1): 359-367.
18. Mathe E., Sethoga L., Mapfumari S., Adeniran O., Mokgotho P., Shai J., Gololo S. Phytochemical Screening and Characterization of Volatile Compounds from Three Medicinal Plants with Reported Anticancer Properties Using GC-MS. Life, 2024; 14(11), 1375. https://doi.org/10.3390/life14111375
19. Dubale S., Kebebe D., Zeynudin A., Abdissa N., Suleman S. Phytochemical Screening and Antimicrobial Activity Evaluation of Selected Medicinal Plants in Ethiopia. Journal of Experimental Pharmacology. 2023; 51-62.
20. Banu K.S., Cathrine L. General Techniques Involved in Phytochemical Analysis. International Journal of Advanced Research in Chemical Science. 2015; 2(4): 25-32.
21. SAS. Statistical Analysis System, User's Guide. Statistical. Version 9.6th ed. SAS. Inst. Inc. Cary. N.C. 2018; USA.
22. Guan, L., Ma, Y., Yu, F., Jiang, X., Jiang, P., Zhang, Y., ... Liu, L. The recent progress in the research of extraction and functional applications of basil seed gum. Heliyon. 2023; 9(9).
23. McClements D.J. Food Emulsions: Principles, Practices, and Techniques (3rd ed.). 2015; CRC Press . https://doi.org/10.1201/b18868.
24. Tosif, M.M., A. Najda, A. Bains, R. Kaushik, S.B., Chawla D.P., Janusz M.W. A comprehensive review on plant-derived mucilage: characterization, functional properties, applications, and its utilization for nanocarrier fabrication. Polymers, 2021; 13(7): 1066. https://doi.org/10.3390/polym13071066
25. Nevara G. A., Syed Muhammad S. K., Zawawi, N., Mustapha N. A., & Karim R. Physicochemical and functional properties of carbohydrate–protein gum extracted from kenaf (Hibiscus cannabinus L.) seed. International Journal of Food Science and Technology, 2022; 57(1), 258-267.
26. Mali K.K,. Dhawal S.C., Dias R.J. Extraction Characterization and Functionalization of Tamarind Gum. Research Journal Pharmacy and Technology, 2019; 12(4): 1745-1752.
27. Hadi, M.T., Al-Aubadi I.M.K. Studying the effect of some heat treatments and chemical compounds on the viscosity of Iraqi Basil (Ocimum basilicum) Gum. IOP Conf. Series: Earth and Environmental Science.2025; 1-6. doi:10.1088/1755-1315/1487/1/012134
28. Saraugi S.S., Patel S., Sahu C., Sahu P. Comparative study of physico-chemical properties of Babool (Acacia nilotica) and Karaya (Sterculia urens Roxb) gums. Article Environment and Ecology. 2023; 41(4B): 2609- 2617. https://doi.org/10.60151/envec/TAWO4514
29. Shaker K.A., Al-Jobouri A.H., Al-Aubadi I.M. Chemical composition of extracted flaxseed mucilage and its application in yoghurt processing. Iraqi Journal of Agricultural Sciences, 2014; 45(7). https://jcoagri.uobaghdad.edu.iq/index.php/intro/article/view/407
30. Sarkar P.C., Sahu U., Binsi P.K., Nayak N., Ninan G., Ravishanker C.N. Studies on physico- chemical and functional properties of some natural Indian gums. Asian J. Dairy & Food Res. 2018; 37(2): 126-131.
31. Maheshwaran L., Nadarajah L., Senadeera N.N., Ranaweera C.B., Chandana A.K., Pathirana R.N. Phytochemical Testing Methodologies and Principles for Preliminary Screening/ Qualitative Testing. Asian Plant Research Journal. 2024; 12(5): 11-38.