Al-Qadisiyah Journal For Agriculture Sciences (QJAS)
ISSN : 2618-1479 Vol.10, Issue. 2 ,(2020), pp.304-307
https://jouagr.qu.edu.iq/

Studying Some The Functional Properties of Tamarind Tamarindus indica L. Mucilage

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Received : 2/6/2020
Final Revision : 6/7/2020

Abstract: **The present study aimed to extract the mucilage from Tamarind Tamarindus indica L and studying some the functional properties . The values of solubility , water binding capacity and viscosity for tamarind seed mucilage were: 87.4 , 17.54 and 13.7 respectively . The tamarind seed mucilage showed varied oil binding capacity from 0.42-0.73 (g oil / g dry mucilage) due to the type of oil used . The results showed a higher emulsification stability from tamarind seed mucilage. This results indicated the ability of using tamarind seed mucilage as stabilizer and emulsifier in food industry .**

Keyword : **Tamarind; mucilage; solubility; water binding capacity; fat binding; Emulsion stability.**

I. Introduction

Tamarindus indica L. is an important medicinal plant, and it is distinguished as a fast growing evergreen tree with a height of three meters with complex leaves and yellow-colored cluster flowers and fruits are pods and use the fleshy and sour pulp that covers the cores [1]. He belongs to the legendary family Fabaceae and is known by several names, including ardeb, humer and the red [2]. It contains many active substances and volatile oils that make it an antibiotic capable of exterminating many different bacterial strains [3]. Recent studies have shown that the aqueous extract of tamarind nuclei is very effective in reducing sugar level in male diabetic mice [4]. The mucilage extracted from it has a great importance and a positive effect on the immune system [5] Tamarind syrup is used as a laxative and refreshing coolant in the summer and is useful in cases of constipation, intestinal disturbances and laziness, due to its content of organic acids and minerals, it is useful in ridding the blood of its excess acid and expelling its toxins [6]. Cores are used to treat burns, aid in healing and an anti-amoebic dysentery [7]. Tamarindus indica L. is extracted from the endocrine mucilage of the seeds of trees. The seeds can be dried and ground, forming a thick powder with high thickness [8].

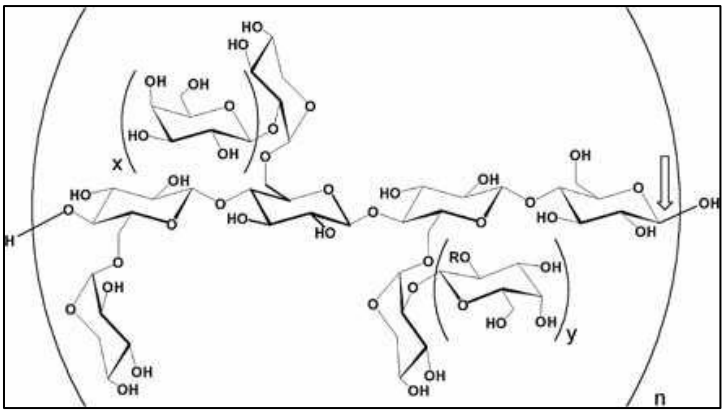

Fig.1. The chemical composition of Tamarindus indica L. Mucilage [8]

The Tamarind mucilage is a multi-sugar with a high molecular weight estimated at 52,350 Dalton. This multi sugar consists of three basic sugars are D-glucose and D-calcotase and D-xylose in molar proportions 1: 2: 3, and the main chain is units

D- Clocopyranose with a cocktail (B1-4) connected to it units of D-clactopyranose with a cocktail (B1-6) and branched chain of one or more D-Xylopyranose units as shown in Figure 1. [9]
The mucilage of India dates, in addition to its complex structure and high molecular weight, have important functional properties in food processing, as it acts as a thickening agent and emulsifying agent. , Stabilizer, and link factor in pharmaceutical applications. As it gives good emulsifying properties and very little concentration compared to the emulsion prepared from mucilage Arabic [10].

II. Material and Methods

A. Prepare the tamarind powder

Indian dates were obtained from local markets in Baghdad and the nuclei were extracted from the fleshy part of the fruit and washed with lukewarm water to remove the leftover fruits and put the cores in a bowl for drying. A core milling process was performed using a Global Grain Mixer (FM-300) electric mill to obtain the cores, then sift the powder with a mesh of 40 mesh to remove the unmilled parts.

B. Fat removal

The fat was removed from the tamarind kernel powder using the Soxhlet Apparatus intermittent extraction method by placing 5 g of the sample in Thumble thimble and using hexane with a boiling point of 40-60 m º type (GCC) in the 6-hour extraction process [11] .

C. Tamarind gel extract

The tamarind gel was extracted according to the method mentioned [10]. Soak 200 g of tamarind nuclei powder and boiled distilled water for 5 hours to remove the outer dark layer of the cores. The amount of distilled water was doubled with constant stirring in a water bath to reach a thicker texture. Cool the resulting solution and store in the refrigerator for the next day. Centrally discard at a speed of 500 r / min for 20 minutes. Separate the leachate formed and concentrate in a water bath at a temperature of 60 ° C until its volume drops to one third of its original volume. Leave the leaching solution aside and reduce its temperature to room temperature. Add acetone as much as three sizes of leachate volume with continuous stirring. Dry under vacuum at a temperature of 50 - 60 ° C. Keep the resulting powder in tight containers.

D. Estimating gel functional properties

The solubility was estimated according to the method mentioned [12] and the ability to bind water to the method followed was estimated [13] and the percentage of water bindings was calculated from the following equation:

Water connectivity (g / g dry gel weight) = wet gel weight - dry gel weight / dry gel weight

The viscosity was estimated using the Ostwald viscometer, where the gel solution was prepared at a concentration of 1% in distilled water and the time required for the fluid to flow during a certain distance at a temperature of 25 ° C [11] was the amount of fat binding in the manner mentioned [13]. The percentage of fat binding was calculated from the following equation:

Fat absorption (gm fat / gm dry gel weight) = absorbed gel weight - dry gel weight / dry gel weight

The stability of emulsification was estimated by mixing 1 g of gel powder with 50 ml of distilled water and 10 ml of castor oil, transferring the mixture to a graduated cylinder and the time required to break the creamy layer formed and follow the volume of the emulsion layer and the water layer [14] [15] was observed.

III. Results and discussion

The results are shown in Table 1. The tomato nuclei mucilage was characterized by good solubility and the method of its extraction had a clear effect on this susceptibility. The date palm nucleus gel was distinguished by its high solubility, as it reached 87.4%. The solubility of large molecules depends on their chemical composition and molecular flexibility, as well as their surface properties, and to a lesser extent, on the size and shape of the molecule. Dissolvency is often influenced by gel extraction and purification processes and solvents used [16].

Table 1: Percentage of solubility and susceptibility to water, fat and viscosity of tamarind mucilage.

Functional properties of tamarind mucilage		
Solubility (%)		87.4
Water binding capacity (gm water / gm dry mucilage)		17.54
Viscosity (Centipoise)		13.7
Sunflower oil	Fat binding capacity (gm oil / gm dry mucilage)	0.73
Olive oil		0.42

Corn oil		0.64
Almond oil		0.43

He stated [17] that the solubility increases with increasing the extraction temperature, and the variation in the solubility of the various mucilages by the methods of extraction is sometimes due to their protein content and their contain of amino acids that are water-loving and which, when present at high levels, increase the solubility and clearly. The results indicate a high value of water binding ability of the gel, as it reached 17.54 (gm water / gm dry gel), which is higher than the water connectivity capacity of the chitosan gel, which ranges between 6.21 and 7.88 gm water / gm dry gel [18]. It was found [19] that the gels extracted in different methods were characterized by a high ability to bind the water, which ranged between 16-30 g water / g of solid, and is similar to glue of quar. The high water carrying capacity (water binding) is attributed to the high concentration of hydroxyl (OH) groups in monosaccharides of gels, which have an important role in relation to water transfer to the plant [1]. It only has proteins in the gels, because it has functional groups that can bind to water molecules [20]

The viscosity value of mucilage nuclei was 13.7 cents. The increase in viscosity may be due to an increase in molecular weight. Viscosity is mainly affected by concentration, pH, temperature, mechanical parameters, ionic strength, and the presence or absence of electrolytic and non-electrolytic materials. Polymers have a viscosity property that reflects the hydrodynamic volume the polymer occupies. The presence of the remaining protein with the extracted gel causes a decrease in the viscosity of the gel [19]. Table 1. shows the lipid binding potential of the tamarind nuclei mucilage. As a difference was observed in the susceptibility to fat binding according to the type or source of oil, the highest rate of binding of sunflower oil was 0.73 g oil / gm dry gel, followed by corn oil as it reached 0.64 g oil / gm dry gel then sweet almond oil as it reached 0.43 g Dry gel oil / g and finally olive oil 0.42 g dry gel oil / g. This variation may be attributed to protein gels. That indicated [21] the variation in susceptibility to fat binding is due to the variation in the protein content and the presence of amino acids containing hydrophobic groups. The high susceptibility to fat binding increases the retention of flavoring substances because they are fat soluble and thus increase their acceptability, and this characteristic is of great importance in food processing. It increases the sensation of the mouth in foods, in addition to reducing the proportion of triglycerides and cholesterol [22]. The results in Table 2. indicate the consistency of emulsification of the gel of the nuclei of dates, as the time of refraction of the creamy layer reached 32 seconds. Solubility, as solubility increases the stability of their emulsions through a balance between hydrophilic and hydrophobic proteins.

Table 2. indicate the consistency of emulsification of the gel of the nuclei of dates.

	Arabic gum		**Tamarind mucilage**	
Time (hr)	**Water layer (ml)**	**Emulsion Layer (ml)**	**Water layer (ml)**	**Emulsion Layer (ml)**
0	0	60	0	60
1	47	13	48	12
2	49	11	48	12
3	49	11	48	12
4	49	11	48	12
24	49	11	48	12
*	35		32	

***Creamy layer breakdown time (sec)**

The role of the tamarind nucleus gel in the stability of emulsification is due to its protein content in addition to the viscosity of the gel solution as it acts as a stabilizer similar to multiple polysaccharides. Results showed that when monitoring the stability of the emulsion after every hour, the size of the emulsion layer decreases with the passage of time

and the volume of the water layer increases, and that the time of refraction of the creamy layer formed reached a few seconds, Table 2. Also shows the stability of the emulsions after an hour of their formation, where these emulsions maintained Its stability and its refraction time for the entire period of its storage. We conclude from this the possibility of using tamarind kernel gel as an emulsion and stabilizer in the food industry.

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