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The Effect of Added Papain on the Encapsulated of Liquid Lemon Oil Emulsion Particle with Gum Arabic

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Abstract: The aim of this study is to evaluate the addition of papain from Carica papaya as enzyme (active) and as protein (non active) to three samples of Gum Arabic on the encapsulated of liquid lemon oil emulsion particle. The encapsulated was prepared as the gum: papain ratios which were 1:1, 1:3, 3:1, 1:7 and 7:1 respectively. The oil water emulsions were prepared by using mixer for 1 minute at 18000rpm. The emulsion stability was determined. The calculated emulsifying stability of crude gum was equal to that of inactive papain (protein) but higher than that of active papain (as enzyme). As the concentration of Acacia Senegal decrease by addition of active papain, the emulsifying stability increase slowly. That becomes clear when gum and papain were used in the ratio of 3:1. In case of Acacia Seyal , the emulsifying stability decrease by addition of papain enzyme , the lowest value obtain when the ratio is 1:3 and 1:7 for variety Fistula and variety Seyal respectively. Our study showed that the addition of papain enzyme to Gum Arabic enhances the emulsifying stability of solute of Gum Arabic. This increase in emulsifying stability is appreciable when inactive papain is used even at low concentration.

Key words: Gum Arabic, Papain, Enzyme, Protein, Emulsion, Emulsifying Stability

Introduction

The term "papain" is used commercially to refer to crude papain, the dried latex of *Caricapapaya*, which is actually a mixture of several closely related proteolytic enzyme though the precise number and nomenclature is a matter of some disagreement among experts[1,2]. Cooks in tropical countries had used certain plants to tenderize meat long before the active principle in one such plant, Carica Papaya L, was recognized to be a proteolytic enzyme. Beside other tropical plants such as Figs, Pine apple and Calotropis spp. [3], but only papain has become established on a significant scale. Latex is traditionally collecting by making a series of longitudinal incisions on the surface of the green, unripe fruit, using a sharp a razor blade. The latex is found in the lactiferous ducts only 1-2mm below the surface, and cuts must not be deep in order to avoid infection of the fruit and contamination of the latex by the fruit juice[4]. Crude extracted of papaya was inactivated in the temperature range of 60-90°C. at pH
7.

Optimum drying temperature was 5-55°C., addition of sodium chloride had anti coagulating effect on latex and accelerated the later stage of drying. Addition of EDTA or sodium bisulphate protected latex activity [5]. Papain is used to degrade protein. Other potential uses in the food industry include baking, dough conditioning, cheese preparation, production of protein enriched cereals and instant food. In the animal feed industry papain has been used in the production of fish protein concentrates and the treatment of oil seed cake to increase the nitrogen solubility index and protein dispersibility index [6].

Specific activity of papain ca. $2.8x10^3$ ug^{-1} for fresh papain , that of powder = $2.8x10^3$ ug^{-1} Gum Arabic is a natural polysaccharide derived from exudates of *A. Senegal* and *A. Seya* trees.[7& 8] Gum Arabic is unique among the natural hydrocolloids because of its extremely high solubility in water. Most common gums cannot be dissolved in water at concentration higher than about 5% because of its high viscosities. Gum Arabic can yield a solution up to 55%concentration [9].

Gum is particularly suited to serve in Food stuffs[10] as a thickener for beverages, stabilizer for oil and water emulsion and as protective colloids which function is to prevent agglomeration. The ability of Gum Arabic to form highly concentrated solution account for excellent stabilizing emulsifying properties which it processes when incorporated with larger amount of insoluble materials. The addition of electrolytes to gum solution results in a reduction in the viscosity, even in a very dilute solution and is accompanying by a lowering of the interfacial tension producing favorable emulsifying conditions. The addition of electrolyte produces a concentration in the molecule as a result of charge screening which takes place [11]

Materials and Methods

Origin of Papain

Papain was obtained from fresh fruits of trees grown at Shambat Demonstration Farm.

Origin of Gum Samples

All gum samples were obtained through Sudan National Forest Corporation in Khartoum. Acacia Senegal from Sinnar (Wad degni Forest), while Acacia Seyal (va Fistula) from South Kordofan season 1993-1994, Acacia Seyal (varSeyal) from Buri on the Blue Nile, 1992.

Preparation of Samples for Analysis Crude Gum

The gum was finely ground using a mortar and Pestele, and sieved through a mesh No. 16.To prepare gum solution, three grams of ground gum were dissolved in 100mL distilled water to give 3% aqueous gum solution.

Enzymatic Treatment [12]

Gum was dissolved in distilled water and the pH. of the solution adjusted to 5.0 with HCl. Papain was like wise dissolved and added to the gum solution. Usually 1mL Of papain(1.5mg) was added to 9mL Of gum(1%) and incubated over night at 37˚C.

Activity of the Papain [13]

The method is called the rate of digestion of casein at pH 5 was determined by titration in alcohol. 0.1g Papain added to 1g casein then incubated for 20 minutes at 40 ˚C. The increase over the zero time titration (the difference in volume) has been divided by weight of the enzyme sample that produced it. Activity of the papain – difference in volume / weight of enzyme U/g

Emulsifying stability [14]

Acacia gum solution 20% concentration was mixed with oil in a ratio of 80: 20 w/w, respectively. They were mixed using an emulsifier for 1 minute at 18000rpm. Then the mixture was diluted in a ratio of 1:10000, it was read at V_{max}520nm . The second reading was taken after one hour. The reading represented emulsifying index. Emulsifying stability was calculated as fallow:

Emulsifying stability (E.S) = First reading / reading after one hour

Results and Discussion

Table (1) Analytical Data of Gums from Acacia senegal , Acacia seyalvar Fistula and Acacia seyalvarSeyal

Sample	Moisture%	Ash%	Nitrogen%	Specific rotation	pH	Intrinsic viscosity
Acacia Senegal gum	9.525	3.0775	0.480	-35.89	4.05-4.33	14.0
Acacia SeyalvarSeyal	7.25	2.50	0.056	+48.72	4.35-4.40	12.6
Acacia SeyalvarSeyal	8.90	2.13	0.056	+43.59	4.45-4.55	15.5

Table (1) showed the physiochemical parameter of the three acacia gums as raw materials and the results are in agreement with that in the literature review.

Table (2-1) Emulsifying Stability of Gum samples using active Papain

Ratio of gum to papain(active)	Acacia Senegal	Acacia Seyalvar Fistula gum	Acacia SeyalvarSeyal gum
10:0	0.979	1.640	1.25
7:1	1.067	1.006	0.984
3:1	1.487	1.100	0.955
1:1	1.014	0.977	0.855
1:3	0.987	1.202	0.759
1:7	1.277	0.476	0.829

Emulsifying stability of active papain= 0.9535

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Table (3-2) Emulsifying Stability of Gum samples using inactive papain

Ratio of gum to papain(active)	Acacia Senegal	Acacia Seyalvar Fistula gum	Acacia SeyalvarSeyal gum
10:0	0.979	1.640	1.25
7:1	1.240	1.099	2.470
3:1	1.029	1.040	1.004
1:1	0.723	1.020	0.908
1:3	0.980	1.004	1.132
1:7	0.585	1.011	1.002

Emulsifying stability of inactive papain= 0.9765

The calculated emulsifying stability was shown in table(2-1) that of crude Acacia Senegal gum (ca0.979) was equal to that of inactive papain (ca 0.976), but these values were slightly higher than emulsifying stability of active papain (ca 0.955). As the concentration of Acacia Senegal decreased (by addition of inactive papain) the emulsifying stability increased slowly. That becomes clear when gum and papain were used in the ratio 3:1. The emulsifying stability of Acacia Seyalvar Fistula was 1.64. As the concentration of Acacia Seyalvar Fistula increased (by addition of active papain) the emulsifying stability deceased reaching its maximum value when the ratio was one part of the gum to seven parts of active papain. The emulsifying stability of Acacia SeyalvarSeyal was 1.25. As the concentration of Acacia SeyalvarSeyal decreased (by the addition of active papain) the emulsifying stability decreased slowly, the lowest values of the emulsifying stability attained when gum and papain was used in the ratio 1:3 (ca.0.759).

Table(3-2) Showed the initial addition of protein(inactive papain) caused an increase in emulsifying stability for Acacia Senegal , Acacia Seyalvar Fistula and Acacia SeyalvarSeyal However addition of excess protein(eight parts inactive papain :one part gum).caused a sharp decrease in emulsifying stability to any of these gum. This decrease was more conspicuous in case of Acacia Seyalvar Fistula and Acacia SeyalvarSeyal. These results were in agreement with those reported by Prakashetal[15]. Who studied the effect of adding whey protein to gum Arabic.

Conclusion:-

1. Our study shows that addition of papain to gum Arabic enhanced the emulsifying stability of solute of gum Arabic. This increase in emulsifying stability is a appreciable when inactive papain is used even at low concentration.
2. Addition of protein (inactive papain) up to certain concentration increases the emulsifying stability of the three acacia gums studied.
3. The study indicated that the protein component of plant gum plays an important role in their emulsifying stability.

Recommendation

From all the data obtained it is clear that further: Structural studies of gum Arabic after incubation with papain enzyme need to be carried

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