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Isolation and evaluation of mucilage of *Artocarpus heterophyllus* as a tablet binder

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ABSTRACT

Artocarpus heterophyllus found wild in the forest region, fruit are multiple seeded containing mucilage. To Isolate mucilage pulp is removed and the macerated with water then filter. Acetone precipitation method is used to isolate mucilage from filtrate and dried in vacuum dryer at 40^{o} C. The physicochemical characteristic of mucilage has performed such as swelling index, solubility, loss on drying. This study was carried out to compare the binding effects of isolated mucilage with starch. Granule properties such as angle of repose, moisture content, bulk and tapped densities, Hausner's ratio, Carr's index and tablet properties which included weight uniformity, friability, disintegration times, and dissolution rates using standard methods. Mucilage of varying concentrations of 4, 6 and 8%w/w were used to produce paracetamol granules by wet granulation method and compressed into tablets at arbitrary pressure load unit of 6 tons. An increase in binder concentration led to decrease in friability and increase in disintegration time of the tablets. The results indicate that mucilage obtained from Artocarpus heterophyllus fruit possesses comparable binding properties.

Keywords: *Artocarpus heterophyllus*, Binding agent, paracetamol, Mucilage, Swelling index.

INTRODUCTION

Mucilage is a sticky substance used as an adhesive, it is also gummy substance obtained from certain plants. Mucilage is act as a membrane thickener and food reserve. Scientific and technically mucilage is a naturally occurring, high-molecular-weight (200,000 and up), organic plant product of unknown detailed structure. [1]

Chemically, mucilage is closely allied to gums and pectins but differs in certain physical properties. Although gums swell in water to form sticky, colloidal dispersions and pectin

gelatinize in water, mucilage form slippery, aqueous colloidal dispersions.[2] Mucilages occur in nearly all classes of plants in various parts of the plant, including marsh mallows and flaxes and certain seaweeds but it has relatively small percentages and other substances such as tannins and alkaloids. The chief industrial sources of mucilages are Icelandic and Irish moss, linseed, locust bean, slippery elm bark, and quince seed. [3]

Mucilage is thick, glutinous substance, related to the natural gums, comprised usually of protein, polar glycoprotein, Exopolysaccharides, polysaccharides and uranides.[4] Exopolysaccharides are the most stabilizing factor for micro aggregates and are widely distributed in soils. Therefore Exopolysaccharides-producing "soil algae" play a vital role in the ecology of the world's soils. It is produced by most plant and some microorganisms.

In the plant it sometimes serves to check the loss of water to aid germination, to facilitate seed dispersal, and to store food. It is used in medicine as an emollient and a demulcent. Mucilage is employed also as an adhesive, and the term is extended to include other slimy adhesives, especially solutions of gum, such as tragacanth mucilage. [5]

Artocarpus heterophyllus Lam. belongs to the family Moraceae and is known by various names in different countries, but is popularly known as jackfruit or Ceylon jack. It is the national fruit of Bangladesh. Commonly found in Southeast Asia and found occasionally in Pacific island home gardens. [6]

Jackfruit (*Artocarpus heterophyllus* Lam.) is an evergreen tree; it is reaching a height about 10 to 15 m tall at 5 years age, with dark green oval shaped leaves. Its grows 1.5 m/yr in height, slowing to about 0.5 m as tree reach maturity. All parts of it contain sticky white latex. It is a very long-lived tree and generally has a life span of 60 to 70 years. [7]

The tree grows well in equatorial to subtropical Grows in freely draining, acid to neutral soils means soils pH 5.0–7.5. Yields 70–100 kg/tree/yr (150–220 lb/tree/yr) is typical, although much larger yields have been reported. [8, 9]

EXPERIMENTAL SECTION

Collection of plant material:

The Jackfruit (*Artocarpus heterophyllus*) was collected from surrounding area of Valsad district, Gujarat, India. The collected fruit was authenticated by Pharmacognosy department.

Microscopical Evaluation of mucilage:

Mucilage is isolated from seed of *A. heterophyllus* fruit by acetone method. Now take few portion of the mucilage and put into watch glass with ruthenium red reagent, then after some time that portion take onto glass slide and see in microscope.

Isolation of Mucilage:

Firstly take 100 gram mucilage containing part from plant of *Artocarpus heterophyllus* then boiled with 1000 milliliter distilled water for 15 min and the mass was filtered through Buckner funnel without filter paper. The retained residues were boiled with 500 ml distilled water for 15 min and the combined liquid was passed through eight folds of muslin cloth. The mucilage was precipitated from the filtrate by adding ethanol. The precipitated mucilage was dried in an oven at 45^{o}C till it was completely dried. [10-11]

Physico-Chemical properties of Mucilage:
The physicochemical properties such as loss on drying, viscosity, hydration capacity, powder porosity and swelling index [12] were determined according to Indian pharmacopoeia procedure.[13] The pH of the mucilage was determined using a digital pH meter. The swelling index is the volume in milliliter occupied by 1 g of a material, including any adhering mucilage, after it has swollen in aqueous liquid for 4 h. [14]

Preparation of binder solution:
The binder solution was prepared by dissolving the mucilage of *Artocarpus heterophyllus* in water. Standard binder (starch) was prepared by dispersing a 10 g sample of the starch powder in 20 ml of distilled water and adding boiled water whilst stirring with a glass rod to make up to 100 ml. The mucilage was allowed to cool and was used for binding.

Preparation and Evaluation of granules:
Paracetamol was used as a model drug to formulate granules. Starch was used as disintegrant; lactose used as diluents and talc as lubricant respectively. The drug lactose, and Sodium starch glycolate (SSG) were mixed thoroughly and a sufficient volume of 4, 6 and 8 % w/w of mucilage of *Artocarpus heterophyllus* was added slowly to the powder blend and cohesive wet mass was prepared by wet granulation method.[15] For standard used 6%w/v of starch as a binder. The batch size was 100 g. The wet mass was then sieved through sieve number 10 and dried at not more than 60 ^{o}C in hot air oven up to LOD NMT 6%. The dried granules were re-sieved through sieve number 20. The prepared granules were then evaluated for percentage of fines, particle size and flow properties (by measuring angle of repose). [15-16] The bulk and tapped densities were determined using bulk density apparatus. Compressibility index of the granules was determined by Carr's compressibility index. [17-18]

Preparation and Evaluation of Tablets:
The granules were compressed into tablets using Rimek Mini Press-I machine. The batch size of 100 tablets was prepared. The prepared tablets were evaluated for content uniformity, hardness, friability, disintegration time, thickness and average weight. Monsanto hardness tester/ Pfizer type and Roche friabilator were used to test hardness and friability respectively. The disintegration time was determined using disintegration apparatus and distilled water was used as medium.

RESULT AND DISCUSSION

Microscopical Evaluation of mucilage:
Mucilage is isolated from seed of *A. heterophyllus* fruit by acetone method. From that some portions of the mucilage has been stain into ruthenium red reagent then after some time see in microscope Figure: 1.

Preliminary Phytochemical Screening of Isolated Mucilage:
The Phytochemical screening of natural mucilage confirmed polysaccharides in nature table 2. The physicochemical and microbiological properties of mucilage of *A. heterophyllus* were determined, results of mucilage was presented in Table: 3 respectively.

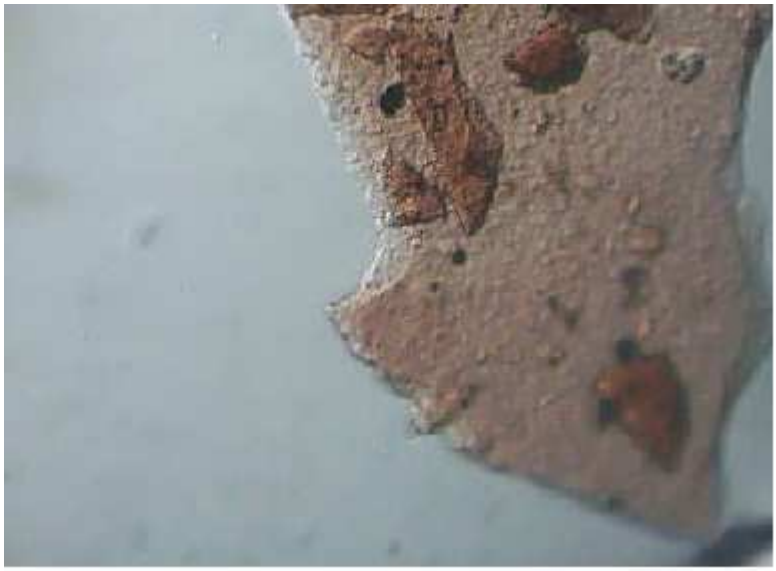

Figure: 1: Mucilage was staining by ruthenium red reagent

Physicochemical properties of dried mucilage:

The prepared granules were evaluated for percentage of fines, flow properties, the result are shown in table 4. It was observed that percentages of fines were reduced as the concentration of mucilage of *A. heterophyllus* was increased. The percentage of fines was little higher in granules prepared using 4.0% of mucilage as binder. The flow properties of granules were determined by angle repose which was found to be 32º to 27º. Hence all the granules exhibited good flow properties. Bulk densities of the prepared granules were found to decrease slightly by increasing the concentration of *A. heterophyllus*. This result may be due to the formation of larger agglomerates and decrease in fines in the granules, as increasing mucilage of *A. heterophyllus* concentration. The result of compressibility index indicates decrease in flow ability with increasing mucilage of *A. heterophyllus* concentration. However, all formulation showed good flow properties. In general compressibility index values up to 21% result in fair to passable flow properties. All these result indicates that the granules possessed satisfactory flow properties and compressibility.

Table 1: Composition of Tablet Formulation

INGREDIENT (mg)	Mucilage of *A. heterophyllus* as binder			
	F1	F2	F3	S1
Paracetamol	500	500	500	500
Lactose	96	96	96	96
Starch	36	36	36	36
Sodium starch glycolate (SSG)	8	8	8	8
A. heterophyllus (%w/v)	4%	6%	8%	6%
Talc	5	5	5	5
Magnesium sterate	5	5	5	5
Total weight	650	650	650	650

Evaluation of tablet:

To understand the release profiles of the drug from the tablets, twelve batch of tablet were prepared using mucilage of *A. heterophyllus* at each three different concentration (4.0, 6.0, 8.0 %w/v); starch gum mucilage (6.0 %w/v) was used as standard binder for comparison. The prepared tablets were evaluated for content uniformity, hardness, friability, disintegration time, dissolution profile shown in Table:5. All the batches of tablet exhibited good uniformity in

content. Hardness of tablet increased with increase in concentration of mucilage. The tablet prepared with 6.0 %w/v *A. heterophyllus* showed the hardness nearly equal to the tablet prepared by using 6.0 % w/v of starch gum. The percentage friability values were slightly decreased as increase in concentration of mucilage. Through increase in hardness of tablet, increase in concentration interestingly showed decreased in disintegration time of tablet.

Table 2: Data Showing, Preliminary Phytochemical Screening of Isolated Mucilage

ACTIVE CONSTITUENT	*A. heterophyllus*
Carbohydrate	+
Protein	-
Flavanoids	+
Tannins	-
Saponins	-
Sterols	-
Alkaloids	-
Triterpenes	-
Glycosides	-
Fats & oil	-
Resins	-
Phenols	-
ditepenes	-

+ Present, - Absent.

Table 3: Physicochemical properties of *A .heterophyllus* mucilage

Parameters	***A. heterophyllus* mucilage**
Test for mucilage (ruthenium red)	Positive
Solubility	Sparingly soluble in cold water and in hot water forming viscous colloidal solution
Moisture content	9.05
Swelling index (%)	12.2
pH	6.2-6.8
Loss on drying	6 %
Total ash	8.56 %
Acid insoluble ash (%)	0.58±0.04
Water soluble ash	6.487±0.07

**All values are mean ± S.D. for n=3*

Table 4: Technological characterization of granules using *A. heterophyllus* as binder

PROPERTIES	***A. heterophyllus***			**Standard**
Concentration (%)	4 (F1)	6 (F2)	8 (F3)	6 (S1)
Percentage of fines (%)	23.22	22.75	21.85	22.68
Angle of repose	29.25	29.15	28.35	29.05
Hausner ratio	1.12	1.117	1.12	1.11
Carr's Index	10.81	10.52	10.81	11.74
Percentage friability (%)	0.78	0.67	0.51	0.57
Disintegration time (min.)	9	10	10	10
Loose bulk density (g/ml)	0.33	0.34	0.33	0.34
Tapped bulk density (g/ml)	0.37	0.38	0.38	0.38
True density (g/ml)	1.53	1.54	1.62	1.55
Compressibility index (%)	22.88	23.32	20.35	22.86
Weight variation (%)	652 ± 1.25	653 ±1.03	651 ± 1.45	653 ± 0.56

TABLE 5: Evaluation of tablet

Batch code	Weight variation		Diameter variation (mm)	Thickness variation (mm)	Hardness (kg/cm2)	Friability (%)	Drug content uniformity (%)
	Average weight (mg)	Highest % deviation					
F1	652 ± 1.25	-1.4759	9.12	6.35	6.2	0.002	98.48
F2	653 ±1.03	+3.6584	9.11	6.40	6.3	0.000	99.52
F3	651 ± 1.45	-2.3659	9.11	6.36	6.8	0.005	98.63
S1	653 ± 0.56	+4.2655	9.13	6.42	6.4	0.003	98.96

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