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Isolation and Evaluation of Starch 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 Starch. To isolate Starch the macerated with water then filter this method is used to isolate Starch from filtrate and dried in vacuum dryer at 40° C. The physicochemical characteristic of Starch has performed such as solubility, loss on drying, pH. Granules 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. Starch 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 Starch obtained from *Artocarpus heterophyllus* fruit seeds possesses comparable binding properties.
Keywords: *Artocarpus heterophyllus*, Binder (Binding agent), paracetamol, Starch, Swelling index.

Introduction:

Starch is a mixture of polysaccharides amlopectin and amylose. Starch is used as an universal binder. It is fine white powder, odorless, and useful in food industry.[1] The present study involves isolation of starch from the seed of plant *Artocarpus heterophyllus* and then evaluated for its binding properties in the formulation of Paracetamol tablet containing 4%, 6% and 8% binding concentration.

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.[2]

Jackfruit (*Artocarpus heterophyllus*) 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. It 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.[1,2]

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.[3,4]

It is reported that *Artocarpus heterophyllus* seeds contain plenty of starch[5], hence this study was carried out to isolate starch from the *Artocarpus heterophyllus* and indentify and evaluation of this starch as a binder in tablet formulation and compare prepared tablet with standard starch as a binding agent.

Material and method:

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 of Smt. B.N.B. Swaminarayan Pharmacy College, Salvav, Vapi.

Isolation of starch:
Wash seed thoroughly with water to remove adhering soil and earthy matter and reduce to fine slurry with water in a blender. Pass the slurry through shaking sieves in order to remove the cell debris and other impurities. Allow the milky liquid to settle down decant the supernatant. Wash starch 2-3 times with distilled water with constant stirring. Centrifuge the milky liquid, dry it in oven at a low temperature.[6, 7]

Physico-chemical properties of starch:
Investigation of Phytochemical has been performed for identification of phytoconstituents. Physical properties such as solubility, viscosity, moisture content, bulk density, tapped density[8] were performed. Microscopical study of isolated starch has been done.

Preparation of binder solution:
The binder solution was prepared by dissolving the starch 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 while stirring with a glass rod to make up to 100 ml.

Preparation and evaluation of granules:
The granules were prepared by wet granulation method. 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 starch of *Artocarpus heterophyllus* was added slowly to the powder blend and cohesive wet mass was prepared. For standard used 6%w/v of starch as a binder.[9] The batch size was 100 g. The wet mass was then sieved through sieve number 10 and dried at not more than 60◦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).[10,11] The bulk and tapped densities were determined using bulk density apparatus. Compressibility index of the granules was determined by Carr's compressibility index.[12,13]

Preparation of granules:
The conventional wet granulation technique was adopted. The binders used were: Starch The formula for the production of the granules is shown in **Table 3.** The specified quantities of lactose and starch were first mixed in a mortar. The binder solution containing into tile powder mix to produce a damp mass. The damp mass was passed through a 1.7 mm sieve and the granules tray-dried at 60°C in a hot air oven for 1 h. The dried granules were passed through a 40 number sieve. The percentage of fines was determined by further passing the granules as through a 20 number sieve. The granules were stored in tightly closed, clean and dry amber coloured powder bottles.

Compression of granules into tablets:
The fine granules were first mixed with 1 % w/w Magnesium Stearate. The coarse were then incorporated. The granules were thoroughly mixed by tumbling in a glass jar for 5 min, Compressibility of the composite particles was compression of powder sample (600 ± 5 mg), using round, flat-faced punch and die assembly (12.7 mm in diameter). All powders were compressed at the force of 8.8 ton. The tablets produced were evaluated as follows. The tablets were collected, and stored in air tight powder bottles.

Uniformity of weight test:
Twenty tablets randomly selected and weighed individually using an electronic weighing balance. The mean weight and coefficient of variation were determined.

Hardness test:
A Hardness Tester was used. Ten tablets from each batch were tested individually. The mean hardness value was determined for all the batches. Hardness, thickness, and diameter of tablets prepared were determined using Tablet Hardness Tester. The results are shown in table.

Friability test:
The friability of 20 tablets was determined using the Roche Friabilator at rotation of 25 rpm for 4 minutes. Percentage of weight loss was determined. The results are shown in table.

Table 1:Data showing,preliminary phytochemical screening of isolated starch

Active constituent	*A. heterophyllus*
Carbohydrate	+
Protein	-
Tannins	-
Alkaloids	-
Glycosides	-
Resins	-
phenols	-

Table 2: Characteristics and specification of isolated starch

PARAMETERS	RESULTS
Description	Fine white powder
Solubility	Sparingly soluble in cold water and in hot water forming viscous colloidal solution
Cold water soluble percent	0.40%
Moisture % max	13
Loss on drying	6 %
Starch % min	98
Total ash	8.56 %

Table 3:Technological characterization of granules using a. heterophyllus as binder

PROPERTIES	*A.heterophyllus*			Standard
Concentration (%)	4(F1)	6(F2)	8(F3)	6
Percentage of fines (%)	23.22	22.75	22.85	22.68
Angle of repose	29.25	29.15	29.05	29.05
Bulk density	0.34	0.36	0.35	0.35
Tapped density	0.38	0.39	0.40	0.39
Carr's index	11.74	10.25	10	10

Table 4 :Evaluation of tablet

Batch code	Weight variation		Diameter variation (mm)	Thickness variation (mm)	Hardness (kg/cm2)	Friability (%)	Drug content uniformity (%)
	Average weight (mg)	Highst% deviation					
B1	652 ± 1.25	-1.4759	9.12	6.35	6.2	0.002	98.48
B2	649 ± 1.03	+3.6584	9.11	6.36	6.3	0.000	99.52
B3	653 ± 1.25	-2.3659	9.11	6.36	6.4	0.005	98.63
Std.	652 ± 1.25	3.1803	9.16	6.30	6.8	0.002	99.50

Result and discussion:

1. Microscopical study of isolated starch

Fig1: Isolated starch of *Artocarpus heterophyllus*

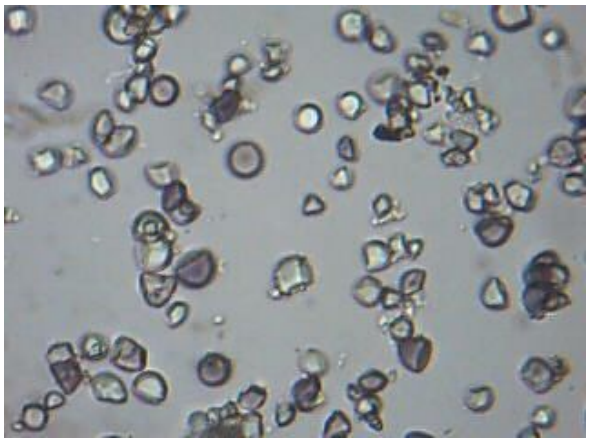

Figure 2: Iodine test of isolated starch.

Microscopical Evaluation of starch:

Starch is isolated from seed of *A. heterophyllus* fruit by Iodine test. From that some portions of the starch has been stain and give blue colouration. microscope Figure: 2.

Preliminary Phytochemical Screening of Isolated starch:

The Phytochemical screening of starch confirmed polysaccharides in nature table 2.The physicochemical and microbiological properties of starch of *A. heterophyllus* were determined, results of starch was presented in Table 2.

Physicochemical properties of dried starch:

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 starch of *A. heterophyllus* was increased. The percentage of fines was little higher in granules prepared using 4.0% of starch 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 starch of A. *Heterophyllus* concentration. The result of compressibility index indicates decrease in flow ability with increasing starch of *A. heterophyllus* concentration.

Evaluation of tablet:

To understand the release profiles of the drug from the tablets, twelve batch of tablet were prepared using starch of *A. heterophyllus* at each three different concentration (4.0, 6.0, 8.0%w/v); starch gum starch (6.0 %w/v) was used as standard binder for comparison. The prepared tablets were evaluated for content uniformity, hardness, friability. Hardness of tablet increased with increase in concentration of starch. The tablet prepared with 8.0 %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 starch. Through increase in hardness of tablet, increase in concentration interestingly showed decreased in disintegration time of tablet.

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