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Evaluation of binder property of Moth bean starch in compressed solid dosage form

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Abstract: Starch obtained from Moth bean (*Phaseolus acontifolius*) was evaluated as a binder in paracetamol based tablets at concentration of 2.5-10.0 %w/w. Properties of the starch evaluated includes: bulk density, tapped density, hausner's quotient and percent compressibility. Compound tablets were evaluated for hardness, friability and uniformity of weight content. Batches of tablets containing equivalent concentration of potato starch were employed as standards. Results obtained indicate that Moth bean starch performed as much better binder in paracetamol tablets as potato starch.

Key Words: Moth bean starch, potato starch, binder, paracetamol.

Introduction and Experimental

Native starches have been used for a long time in food and industrial application, starch continues to be attractive as a binding material because of its abundant supply low cost, biodegrability and ease of chemical modification[1,2]. Starches are used extensively in pharmaceutical industries as disintegrants, binders and lubricants in tablet formulation. Some authors have studied the use of starch obtained from different novel sources like: Godare, ginger and yam as a binder and disintegrant in solid dosage form[3,4,5].

The characterization of pharmaceutical excipients using a material science approach has helped to design drug formulation to obtained a desired set of performance, properties .For tablets a better understanding of the compression properties of the material alone and in combination with other potential components helps in developing desirable formulation as well as acceptable products.When formulating tablets, the choice of excipients is extremely critical. It must fulfill certain requirements such as crystallinity, good binding functionality. Powder crystallinity, flowabilty and acceptable moisture content. Also it is essential to have a well designed particle size distribution for favourable mixing conditions with drugs [6, 7]. Legumes /Beans are important ingredients of a balanced human diet in many parts of the world due to their high protein (15-40%) and starch (35-60%) content .They have been consumed traditionally as a whole seed or as a ground flour. The production of legume protein can be of economical value only if their starch component is made profitable simultaneously. Legume starches have been recognized as a potential food ingredient containing a relatively high proportion of amylose when compared to cereal starches .Legume starches have a higher resistance to swelling and rupture than do cereal starches. The Moth bean (*Phaseolus acontifolius*) is a local plant of many south East Asian countries especially India, Pakistan, and Thailand etc. Moth bean contains nearly 34-40 % starch. Its starch has been used in the food industry for the preparation of noodles, but no studies of its pharmaceutical application have been reported.

This study was designed to evaluate the binder properties of Moth bean starch (*Phaseolus acontifolius*) with comparison to potato starch in paracetamol tablets.

Materials and methods:

Materials:

Moth bean seeds were obtained from Dibrugarh district, Assam, India and starch was isolated in laboratory, potato starch (SD fine chemicals Mumbai, India). Sodium carboxy methyl cellulose, calcium carbonate, magnesium stearate, Talc (Loba chemie, Mumbai, India).Paracetamol power was kindly donated by Comed pharmaceuticals, ltd, Baddi, solan, India.

Methods:

Extraction of moth bean starch:

Seeds of mothbean purchased from a local market in Dibrugarh and the starch was isolated using the method of Singh *et al*[8]. About one kg. of moth bean seeds were cleaned and soaked overnight in water. The seeds were properly grinded using a electric grinder and mixed with 0.05% w/v NaCl solution. The mass was then strained through muslin cloth and washed with saline solution several times to remove soluble substances, sugar and mucilage present. The washed mass was washed repeatedly until the supernatant solution was clear the sediment starch was washed with distilled water until the

pH was neutral. It was then sieved, dried at room temperature and milled to fine powder.

Bulk and Tapped density of starch:
Exactly 50 gm of starch powder was weighed on chemical balance and transferred into a 100 ml measuring cylinder. The cylinder was dropped on a wooden platform from a height of 2.5 cm three times at 2 second interval. The volume occupied by the starch recorded as the bulk volume. The cylinder was then tapped on the wooden platform until the volume occupied by the starch remained constant. This was repeated three times for both the starch powder. The data generated were used in computing the compressibility index and Hausner's quotient for both the starches[9].

Formulation of Paracetamol tablets:
For the evaluation of the starch as binder, sodium carboxymethyl cellulose was used as a disintegrant in the prepared paracetamol tablet. The composition of tablet formulation containing paracetamol is given in Table -2.

Wet granulation and compression:
Wet granulation method was used for all tablet production. The calculation is made for 100 tablets in each batch. In case accurately weighed quantities of each ingredient were mixed in a mortar and an appropriate quantity of the starch mucilage was added as a granulating agent and mixed for 20 min in a mortar. The damp mass was sieved with 1.7mm sieve and dried at 50^0cin oven for 6 hrs.The dried granular mass was passed through a 1.0 mm sieve to obtain uniform sized granules. The different batches of the granules specified amount of the disintegrant i.e. sodium CMC were then mixed with calculated equal quantity of magnesium stearate (0.5%) and talc(0.5%) then compressed into tablets under constant pressure with a ten station rotary tablet machine(Shakti Engineering Ltd.,Gujarat,India).

Table-1: Powder properties of Moth bean and Potato starch

Properties	Moth bean starch	Potato starch
Bulk density (g/ml)	0.5032(±0.02)	0.4688(±0.08)
Tapped density (g/ml)	0.7903(±0.05)	0.6713(±0.02)
Carr's compressibility index(%)	24.86(±0.05)	30.16(±0.12)
Hausner index (%)	1.33(±0.10)	1.43(±0.07)

Table-2: Formula of prepared paracetamol tablets

Serial no.	Ingredients	Tablet formulated with Moth bean starch	Tablet formulated with Potato starch
1	Paracetamol (%)	89-81.5	89-81.5
2	Na CMC (disintegrant %))	7.5	7.5
3	Starch (binder %)	2.5,5,7.5,10	2.5,5,7.5,10
4	Talc (%)	0.5	0.5
5	Magnesium stearate (%)	0.5	0.5

Table-3: Physical parameter of formulated tablets

Properties	**Moth Bean Starch**				**Potato Starch**			
Binder Concentration (%)	**2.5**	**5.0**	**7.5**	**10.0**	**2.5**	**5.0**	**7.5**	**10.0**
Hardness (Kgf)	5.8	6.2	7.2	7.6	4.8	5.0	6.2	6.6
Friability	0.64	0.51	0.30	0.16	1.16	0.94	064	0.38
Weight Uniformity (mg)	510 (±0.08)	523 (±0.05)	517 (±0.02)	509 (±0.03)	522 (±0.05)	513 (±0.02)	520 (±0.06)	513 (±1.2)

Evaluation of tablets:

Hardness test[10]

Five tablets were selected at random from each batch to perform this test. Pfizer hardness tester (Elite, Mumbai, India) was used to measure the hardness. Tablet was placed between spindle and anvil of the tester and the calibrated scale adjusted to zero, then applied a diametric compression force on the tablet and the position on the calibrated scale at which the tablet broke was recorded in kgf units. A mean hardness was calculated for each batch.

Weight uniformity test[10]

Twenty tablets from each batch were selected randomly and weight individually using a highly sensitive electronic balance (Adam analytical balance, UK).Their mean weights were calculated for each batch.

Friability test[10]

Ten tablets were selected at random, dusted and weighed together using electronic balance and then placed in the friabilator (Campbell electronics, Mumbai).The machine was operated for 4 min at 25 rev/min and then stopped. The tablets were dusted and again reweighed. The percentage losses were calculated for each batch of the tablets.

Results and Discussion:

Table-1 shows the various properties of Moth bean starch powder in comparison to the official potato starch powder. The bulk and tapped density is lower in both the starch, it indicates that both materials are not highly porous and poor flowing behavior. The physical and *in vitro* tablet properties are shown in table-3.The hardness of the tablets batches are with in acceptable range but the hardness is higher in tablets prepared with Moth bean starch due to high binding property, its mean that lower concentration of Moth bean could be used to achieve the same level of binding. The variations in weight uniformity are less with tablets prepared using Moth bean starch as binder. It has been reported that starch mucilage as binder, forms a thin film around the granules, with thickness increasing as the quantity of mucilage increases and this retards disintegration.

Conclusion:

It can be observed from the evaluation of tablets that the properties of tablets prepared
using the Moth bean starch as binder are comparable with tablets prepared using potato starch as binder. It can therefore be concluded that the starch obtained from Moth bean starch possesses better binding properties at low concentration when compared with potato starch as standard binder.

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