Available on line www.jocpr.com

Journal of Chemical and Pharmaceutical Research

J. Chem. Pharm. Res., 2010, 2(4):284-290

ISSN No: 0975-7384
CODEN(USA): JCPRC5

Studies on *musa paradisiaca* Starch as a Pharmaceutical Excipient

P.Rajeevkumar*, N. Anilkumar[1], Rekha Rajeevkumar[2]

Department of Pharmaceutics,
Srinivas College of Pharmacy, Mangalore -574143 (K. S) India.
[1]Department of Pharmaceutics,
Mahatma Gandhi University, Kottayam, Kerala, India.
[2]Department of Pharmaceutical Analysis,
Srinivas College of Pharmacy, Mangalore -574143 (K. S) India.

ABSTRACT

A study has been carried out to investigate the physicochemical, binding and disintegrating properties of starch isolated from powder of Musa paradisiaca (Family: Musaceae). The studies indicated that this starch is qualitatively and quantitatively comparable to Corn starch as also the rheological and swelling characteristics. Paracetamol (500mg) tablets prepared using Corn and Musa paradisiaca starch met the requirements of uniformity of weight, assay, friability and hardness. These tablets also conformed to the disintegration and dissolution specifications of Indian Pharmacopoeia. Musa paradisiaca starch showed adequate binding and disintegrating characteristics.

Key Words: Musa paradisiaca Starch, Banana Starch, Corn Starch, Paracetamol, Physicochemical properties, Dissolution, Binding and Disintegrating properties.

INTRODUCTION

Musa paradisiaca is also known as Banana, 'Vazhai pazham' in Malayalam and Tamil. The chief producing states in India are Kerala, Tamilnadu, Karnataka and Andhra Pradesh. The powder contains starch as chief carbohydrate. The powder contains carbohydrate. The powders are edible and contain 20-60% starch [1,2]. Starches are used as multifunctional excipient in the field of pharmaceutical sciences.

The present work deals with isolation of starch from *Musa paradisiaca* powder and comparison of its physicochemical, binding and disintegrating properties with Corn starch which is being abundantly used.

EXPERIMENTAL SECTION

Material:

Paracetamol (Wallace Pharmaceutical Pvt.Ltd, Goa), *Musa paradisiaca* powder (Procured from local market), Corn starch (Durga chemical laboratories). All other chemicals were of analytical grade were obtained from Qualigens fine chemicals, Mumbai.

Method of Extraction:

The method of extraction of starch from the *Musa paradisiaca* powder is reported in literature [1, 2] but in order to improve the quality of starch the method was modified as follows:

i) Fresh unpeeled banana (Musa paradisiaca, family: Musaceae) were collected and washed it thoroughly with water.
ii) Then the banana were cut into small pieces using a sharp knife and minced in mixer using 0.05N sodium hydroxide.
iii) Then slurry was then filtered through muslin cloth. The filtrate was allowed to stand for one hour and settled starch was washed repeatedly with water to remove alkali completely.
iv) It was dried in air. The pulp remaining on cloth was again suspended in 0.05N sodium hydroxide and filtered through muslin cloth till no milky filtrate was obtained.
v) Then the dried powder was then passed through sieve number 40 and stored in an airtight container.

Physicochemical properties:

Extracted starch and Corn starch were studied for microscopic characteristics [3], Loss on drying [4], Acidity[4], pH[5], Ash value[6], Bulk Density[7], Angle of repose [8], and compressibility index[8].

Rheological studies of Starch mucilage:

Starch mucilage (5% and 10%) of *Musa paradisiaca* and Corn were prepared. The rheological characteristics of mucilages were evaluated by using Brookfield viscometer.

Swelling characteristics:

Swelling characteristics of the starches were studied at different temperatures by microscopic method. The extend of swelling was calculated by finding the ratio between grain size at the maximum temperature and at 35°C.

Formulation of Tablets:

Six formulations of Paracetamol (500mg) tablets containing 2.5%, 5.0% and 10% of *Musa paradisiaca* starch and Corn starch as a disintegrant were prepared. Paracetamol granules were prepared using 10% w/w paste of Corn starch as well as *Musa paradisiaca* starch by wet granulation method was found that good charecteristeristic(compactness and binding properties). Lubricated granules were compressed by using single punch tablet machine (Cadmach, Ahmedabad).

Evaluation of Granules

Bulk density (D_b):

It is ratio of total mass of powder to the bulk volume of powder. 10 gm of drug excipient mixture were taken and transferred into a 50 ml measuring cylinder and the volume was noted. The bulk density of the powder were expressed in gm/ml was determined as follows.

$D_b = M/V_o$

Where,

M is the mass of the powder

V_o is the bulk volume of the powder.

Angle of repose:

The frictional forces in a loose powder can be measured by the angle of repose, θ. This is the maximum angle possible between the surface of a pile of powder and the horizontal plane and it is given as,

$\tan \theta = h / r,$

$\theta = \tan^{-1}[h /r]$

Where θ is the angle of repose

h is the height in cm

r is the radius.

The powder mixture was allowed to flow through the funnel fixed to a stand at definite height. The angle of repose was then calculated by measuring the height and radius of the heap of powder formed.

Test for friability and flow properties of granules:

Paracetamol granules prepared with *Musa paradisiaca* starch and Corn starch were tested for friability and flow properties. Friability testing was carried out using Roche friabilator. Friability was calculated from the following formula

$\%\ \text{Friability} = (1-W_1/W_2) \times 100$

Where, W_1 = weight of granules after test.

W_2 = weight of granules before test.

Flow properties of granules were tested by determining angle of repose [8].

Evaluation of Tablets

Hardness and friability tablets [9]**:**

Hardness and Friabilator testing were carried out by using Monsanto hardness tester and Roche friabilator respectively.

Uniformity of weight [10]**:**

The weight variation test of the tablets was performed as per I.P. Twenty tablets of each type were weighed and average weights were calculated.

Thickness of tablets:

The thickness of six tablets was measured using Vernier calipers. The extent to which the thickness of each tablet deviated from ± 5% of the standard value was determined. Six tablets from each batch were selected and evaluated, and the average value with standard deviation was recorded.

Disintegration Test:
All the six formulations were tested for disintegration time as per method prescribed in I.P. for uncoated tablets [10].

Assay:
Assays were carried out by using the method prescribed in I.P [11].

Dissolution studies:
Dissolution studies were performed as per procedure given in I.P [11]. The sampling time specified in I.P. The sampling time specified in I.P. was modified instead of withdrawing a single sample after 30 minutes; serial sampling was done at 5, 10,15,20,25 and 30 minutes.

RESULTS AND DISCUSSION

Starch extracted from *Musa paradisiaca* had a light brownish tinge hence bleaching was carried out with water. On dry basis 20-60% starch was obtained. Grains of *Musa paradisiaca* starch were found to be smaller in size than of Corn starch. They were round, granular in shape. Not much difference was observed in loss on drying, acidity, ash value, pH values of *Musa paradisiaca* starch and Corn Starch. The loss on drying and acidity values was well within official limit Table 1. The bulk density, angle of repose and compressibility index of both starches was comparable Table 1.

Table 1: Properties of Starches

Sr. No.	Properties	M.P. Starch	Corn Starch
1.	Average Grain size (micron)	10.06	23.48
2	Loss on Drying (%)	11.36	10.08
3	Acidity (ml of 0.01 M NaOH)	0.3-0.4	0.3
4	pH	6.15	6.35
5	Ash Value (%)	0.225	0.298
6	Bulk Density (g/c/c)	0.450	0.5
7	Angle of repose (Degree)	27.35	37.34
8	Compressibility index (%)	11.05	9.09

**M.P. - Musa Paradisiaca*

Rheological both starches showed Non-Newtonian behavior with shear thinning properties. Swelling Characteristics studies revealed that swelling ratio of *Musa paradisiaca* starch is slightly greater than that of Corn starch Table 2. It showed that *Musa paradisiaca* starch may exhibit good disintegrating property over corn starch. This disintegrating property may be attributed to the more number of starch grains per mg of sample.

Table 2: Swelling Characteristics of Starches

Temperature (°C)	Average size of starch grain (Micron)	
	M.P. Starch	Corn Starch
35	**10.16**	**23.48**
40	**10.24**	**23.73**
50	**10.46**	**24.02**
60	**11.74**	**25.92**
70	**12.08**	**39.70**
80	**24.16**	**47.85**
Swelling ratio	2.124	2.037

The friability testing of granules showed that the Corn starch had slightly high binding strength than that of *Musa paradisiaca* starch Table 3. In all the cases the values of angle of response were ≤30°, which indicate that both the starches were free flowing. Hardness and % friability of the tablets were found to be well within acceptable limits Table 3.

Table 3: Hardness and Friability of Paracetamol Tablets And Granules

Product	Friability (%)	Hardness (Kg/sq.cm)
Paracetamol Tablets M.P	0.785 ±0.015	3.50±0.325
C	0.595± 0.035	3.50±0.436

Where, M.P – Containing Musa Paradisiaca starch as binder and disintegrant
C- Containing Corn Starch as binder and disintegrant

The tablets prepared with both starches met the pharmacopoeial requirements of uniformity of weight Table 4. Values of maximum percent deviation were well within pharmacopoeial limit. All the tablets conformed to the requirement of assay as per I.P.

Table 4: In vitro Evaluation of Paracetamol Tablets

Paracetamol Tablets	Uniformity of weight		
	Average weight (mg)	Maximum % deviation	Assay (Percent of labeled amount)
M.P	620	+2.5 -3.2	98.20%
C	625	+3.6 -2.5	100.45%

Where, M.P – Containing Musa Paradisiaca starch as binder and disintegrant
C- Containing Corn Starch as binder and disintegrant

The study of disintegrating property of all the formulations showed that the disintegration time for the tablets prepared with *Musa paradisiaca* starch was less than that of Corn starch Table 5

reflecting its good disintegrating characteristic. One point dissolution data of all the tablets prepared with both the starches conform to dissolution specifications of I.P.

Table 5: Disintegration Time of Paracetamol (tablets (n=6)

Paracetamol Tablets	% Disintegrant	Disintegration Time (Sec.)
M.P	10.0 5.0 2.5	165±2.036 245±1.480 375±3.246
C	10.0 5.0 2.5	156±1.260 256±2.656 386±3.797

Where, M.P – Containing Musa paradisiaca starch as binder and disintegrant
C – Containing Corn Starch as binder and disintegrant

CONCLUSION

There is an excellence scope for Musa paradisiaca starch. Hence newer natural substance must be studied for its pharmaceutical application. Musa paradisiaca starch could be used as a promising pharmaceutical excipient in tablet technology as, it showed adequate binding and disintegrating properties.

Acknowledgement
The authors are thankful to Srinivas College of Pharmacy, A. Shama Rao Foundations, Mangalore for providing necessary facilities and to carry over the work.

REFERENCES

[1]Olufunke.D,akin-Ajani.A,Itiola and Oluwatoyin.A,Odeku, *AAPS Pharm Sci Tech*,2005,6(3)
[2]www.Botanical .com
[3] Kokate C.K., Practical Pharmacognosy, 4th Edition, Vallabh Prakashan, New Delhi, **1994**, 112.
[4]Indian Pharmacopoeia, Vol.I, Government of India, Ministry of Health and Family Welfare, New Delhi, **1996**, 711.
[5] The United State Pharmacopoeia, USP XXI, NF XVI, Mack Publishing Co, Easton, **1985**, 1610.
[6] Indian Pharmacopoeia, 2nd Edition, Government of India, Ministry of Health and Family Welfare, New Delhi, **1966**, 692.
[7] Martin A, Physical Pharmacy, 4th Edition, B.I. Waverly, New Delhi, **1993,** 444.
[8] Lachman L, Lieberman H.A, Kanig J.L, The theory and practice of Industrial Pharmacy, 3rd Edition, Varghese Publishing House, Bombay, **1987**, pp.67, 317.
[9] Lachman, L, Lieberman, H.A, King J.L, The theory and practice of Industrial Pharmacy, 3rd Edition, Varghese Publishing House, Bombay, **1987**, pp. 297, 299.
[10] Indian Pharmacopoeia, 3rd Edition, Government of India ,Ministry of Health and Family Welfare , New Delhi, **1985**, pp.480, 501, A-122.
[11] Indian Pharmacopoeia, 4th Edition, Government of India, Ministry of Health and Family Welfare, New Delhi,**1966,** pp.556.
[12] Nakhat PD, Yeole PG, *Int. J. Pharm Exp*.**2004**, 21-24.
[13] Perez E, Lares M, *Plant Foods Hum Nutr*, **2005**, 60(3), 113-116.

[14] Treatise G.E., Evens WC., A Text book of Pharmacognosy, 12th edition, Published by Elsevier science, 202-205.