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Evaluation of Banana Peel Pectin as Excipient in Solid Oral Dosage Form

[1]Jharna Bansal, [1]Rishabha Malviya,
[2]Tanya Malaviya, [3]Vinit Bhardwaj and [1]Pramod Kumar Sharma

[1]Department of Pharmacy, School of Medical and Allied Sciences,
Galgotias University Yamuna Expressway, Greater Noida, Gautam Buddh Nagar, India
[2]Department of Botany, University of Allahabad, Uttar Pradesh
[3]R & D Center, Jubilant Life Sciences, Noida, India

Abstract: Aim of study. Present study includes extraction and characterization of the banana pectin as pharmaceutical excipients in tablet formulation. Material and methods: By using water based extraction in Soxhlet apparatus banana pectin was obtained. For characterization of the extracted banana pectin phytochemical screening was done and micromeritic properties, flow behavior and porosity were calculated. Tablet forming capacity of polymer was also evaluated using diclofenac sodium as model drug. Results revealed that in The result predicts that extracted banana pectin was soluble in warm water while insoluble in cold water and in organic solvents. It was also exhibited that extracted pectin had good flow properties. It was also observed that extracted pectin can be used as excipient in oral solid dosage form. In Conclusions: From the results it was concluded that evaluated parameters showed that banana pectin can be used as pharmaceutical excipient to prepare solid as well as semisolid dosage form.

Key words: Natural Polymer · Extraction · Characterization · Pharmaceutical Excipient · Pectin · Banana · Tablet

INTRODUCTION

Natural polymer are pharmaceutically important polysaccharide with wide range of applications such as thickening gelling agent, binding, disintegrating, suspending, emulsifying, stabilizing and gelling agents. They have been also used as matrices for sustained and controlled release drugs. Naturally occurring polymers are preferred over synthetic materials due to their non toxicity, low cost, emollient and non irritating nature [1].

As a dose formulators essential to develop cost-effective and less tedious procedures for preparation of sustained release formulations on the industrial scale. The most commonly used method for fabricating drugs in a controlled-release formulation is by incorporating them into a matrix containing a hydrophilic rate controlling natural polymer [2].

Pectin is a polymer of α-galacturonic acid with a variable number of methyl ester groups [3, 4]. It is an ingredient of high value of functional food widely used as a stabilizer and gelling agent [5]. It is obtained by extraction in an aqueous medium of appropriate edible plant material such as citrus fruits, banana or apples; no other organic precipitants shall be used than methanol, ethanol and isopropanol; in some types a portion of the methyl esters may have been converted to primary amides by treatment with ammonia under alkaline conditions. Sulfur dioxide may be added as a preservative.

Pectin belongs to a family of polysaccharides present in junctional zone between secondary cell walls including xylem and fiber cells. It is an important constituent in the initial growth and ripening process of fruit. Pectin is a main component of polysaccharide consist of α-1,4-linked D-galacturonic acid units. The galacturonic

Corresponding Author: Jharna Bansal, Department of Pharmacy, School of Medical and Allied Sciences, Galgotias University, Yamuna Expressway, Greater Noida, Gautam Buddh Nagar, India.
Tel: +91-8447674702.

acid polysaccharides consist of various sugars such as, galactose, rhamnose, arabinose, xylose and glucose. The Pectin `s composition can vary based on the sources, for example pectin from citrus or from apple. It is also can be used as an excipient in many types of dosage forms such as, for ophthalmic preparations, for transdermal patches and for film coating.

For standardization purposes commercial product is diluted with sugars. In addition to sugars, pectins may be mixed with suitable food-grade buffer salts required for pH control and desirable setting characteristics. The article of commerce may be further specified as to pH value, gel strength, viscosity, degree of esterification and setting characteristics [6, 7].

MATERIALS AND METHODS

Extraction Procedure: Peel of banana fruit was collected as a waste material from local juice corner then collected peel was washed with distilled water to remove dirt and further dried under shade until constant weight was obtained. Powdered peel was further passed from sieve # 20 and stored in air tight container until used.

Extraction of Pectin Includes Two Steps:

Step1: Extraction of Pectin: As the authors described elsewhere, banana pectin was extracted under reflux in a condensation system using water as solvent. Temperature of extraction media was maintained at 70°C and duration of extraction was adjusted about 6 hrs. The extractor thimble was a Whatman cellulose thimble with 33 mm internal diameter and 80 mm external length [8, 9].

Step2: Isolation of Pectin: As shown by authors in a previous publication, hot water extract was pressed in cheese cloth bag and the concentrated juice was cooled to 4°C. Pectin was precipitated by ethyl alcohol-juice treatment 2:1 (v/v) followed by continuous stirring for 15 min and mixture was further allowed to stand for 2 hrsrs for better pectin precipitation of banana. Pectin coagulate was filtered through cheesecloth, washed with alcohol (95%) and pressed. Pressed banana pectin was further dried to constant weight at 35-45°C in hot air oven. Hard pectin cake of banana was ground and sieved through sieve # 20, stored in desiccators for further used [8, 9].

Physicochemical Characterization of Banana Pectin:

Identification tests for carbohydrates: As the authors described in previous publication, Extracted pectin of banana was mixed with Molish's reagent followed by addition of sulfuric acid. The violet color ring appeared at junction of mixture in test tube that confirms the presence of carbohydrates [9, 10].

Determination of Purity of Pectin: For determine purity of isolated pectin tests for alkaloids, proteins, mucilage, fats, tannins and amino acids were performed as already described by authors in previous publication [9, 10].

Organoleptic Evaluation of Isolated Pectin: As authors described elsewhere, isolated pectin was characterized for organoleptic properties such as color, odor, taste, touch, fracture and texture [9].

Solubility Behavior: As already described by author's one part of dry pectin powder was shaken with different solvents and their solubility was determined [9].

pH of Pectin: Firstly, extracted pectin was weighed and then dissolved in water separately to get a 1%w/v solution. The pH of solution was determined using digital pH meter as described by authors in previous publication [9].

Bulk Density and Bulkiness: It has been described by authors that inverse of bulk density is called as bulkiness. As per previous study accurately weighed quantity of (50 g) was introduced into a graduated measuring cylinder. The cylinder was fixed on the bulk density apparatus and the volume occupied by the powder was noted. Then, the powder was subjected to tapping in a bulk density apparatus until constant volume was obtained. The final volume (bulk volume) was noted [9, 11, 12].

True Density: Among various methods available for the determination of true density, liquid displacement method is the simplest method and was used in the present study. Acetone was selected as the liquid for displacement, because pectin is insoluble and heavy in acetone. This method has been used by authors [9, 11, 12].

Powder Flow Property: Flow characteristics were measured by angle of repose as previous publication of authors. Same study was repeated here. Using the readings and the formula, the angle of repose was calculated [9, 11, 12].

Table 1: Shows different batches of tablet was prepared by using various concentration of pectin such as.

Formulation	Banana Pectin(mg)	Lactose (mg)	Polyvinyl Pyrrolidone (mg)	Talc (mg)
F1	2.06	6.18	12.36	2.06
F2	150	146.4	139.7	150
F3	5	5	5	5

Powder Compressibility (Carr's Consolidation Index): This property is also known as compressibility. As described in previous publication finely powdered pectin (5 g) was transferred into a measuring cylinder and calculations were done using bulk density apparatus [9, 11, 12].

Evaluation of Banana Pectin as Excipient in Tablet Formulation: Banana pectin was used as an excipient in tablet formulation. Various formulations were prepared as Table1.

All the four Formulations were prepared and evaluated as described below:

Weight Variation: All batches of matrix tablets were evaluated for weight variation as per USP XXIV monograph. Twenty tablets of each batch were used to evaluate weight variation among tablets and standard deviation was calculated.

Friability: Tablets of all batches were used to evaluate friability as per USP XXIV monograph. Friability testing was done by Roche friabilator with triplicate readings.

Hardness: Hardness of all batches was determined using Digital Force Gauge (Model: EL=500N, Electrolab).

Thickness and Diameter: Thickness and diameter were measured by Vernier caliper as per USP XXIV monograph. The readings were carried out in triplicate and average value was noted.

RESULTS AND DISCUSSION

The isolated sample was subjected to identification. This showed presence of carbohydrates in sample powder. Confirmation of banana pectin was done when it gave negative test for mucilages, gums, tannins, alkaloids and proteins. Other phyto-constituents were absent in the isolated powder. This can be considered as proof for purity of the isolated pectin as depicted in Table 2.

Physical characterization of pectin was carried out for angle of repose, Carr's index, true density, bulk density and bulkiness for powder flow behavior where as these properties depends on the particle size, particle size distribution their shape and tendency to adhere together. When angle of repose is less than 30°, then it indicates that powder is free flowing and values greater than 40° suggest a poorly flowing powder. When Carr's index values up to 15% generally show good to excellent flow properties of a powder which indicate desirable packing characteristics and when its value above 25% are often sources of poor tableting qualities. So the values lies between these two indices may result in less than the optimum performance and modification of the particle size distribution could be advisable

The bulkiness value indicated that powder is 'heavy in nature. Pectin of banana exhibited good flow characteristics.

Result in Table 3 predicts that pectin has good flow property. So that pectin can be used as excipient in tablet formulation or as a pharmaceutical excipient.

Table 2: Determination of purity of isolated banana pectin

Tests	Present/Absent
Carbohydrates	+
Hexose Sugar	+
Monosaccharides	-
Proteins	-
Fats and oils	-
Tannins and Phenolic Compounds	-
Alkaloides	-
Amino acids	-
Mucilage	-
Gums	-

+ Present; - Absent

Table 3: Micromeritic study data of Banana pectin[#]

Parameters	Values
Angle of repose(^{0})	12.91±0.20
Carr's index	1.09±0.36
True density(gm/ml)	0.77±0.01
Bulk density(gm/ml)	0.71±0.071
Bulkiness	1.40±0.35
Hausner ratio	0.93±0.023
Porosity	0.81± 0.31

[#]value with "±" shows standard deviation of triplicate study

Table 4: Evaluation parameters of formulated tablet using banana pectin[#]

	Formulations		
Parameters	Batch1	Batch2	Batch3
Hardness (N)	21.6±0.11	20.8±0.12	19.4±0.11
Friability (%)	0.52±0.19	0.41±0.23	0.47±0.22
Disintegration(min)	10.20±0.09	9.56±0.08	8.1±0.06
Wt Uniformity (mg)	208±0.24	209±0.31	209±0.36
Diameter (mm)	9.64±0.08	9.53±0.06	9.60±0.04
Thickness (mm)	2.21±0.02	2.02±0.04	2.12±0.03

[#]value with "±" shows standard deviation of triplicate study

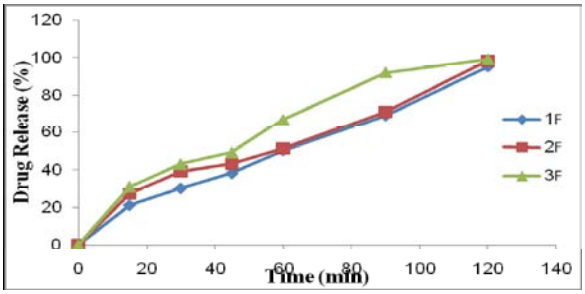

Fig 1: Shows the percentage drug release of diclofenac sodium by using banana pectin

Result in table 4 shows that the hardness of tablets was found to be in the range of 21.6 N to 19.4 N. Friability was obtained between 0.41±0.23 to 0.52±0.19% which was below 1% indicating good integrity of the tablets. Thickness and diameter of tablet was found between 2.02 to 2.24mm and 9.53 to 9.64mm. The disintegration time of matrix table was 10.1 to 8.1minutes

From the fig.1 It has been shown that all the three F1, F2 and F3 batches release 100 % drug in same time at 120 min but among these three batches F3 has been proved as a ideal formulation because it releases maximum drug in less time approx 90% release of drug take place in 90 mins where as F2 and F3 release 70 % of the drug.

CONCLUSION

It can be concluded from the whole study that natural polymer derived banana pectin can be used as a pharmaceutical excipient for oral drug delivery. It is nonirritant in nature. Polymer was also evaluated for their matrix tablet forming capacity and result easily predicts the potential for the same. So this polymer has sufficient potential to be use as pharmaceutical excipient in matrix tablets forming system with lactose, polyvinyl pyrrolidone and talc.

Conflict of Interest: Authors have no conflict of interest.

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