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Isolation of pectin from banana peel waste: Its utilization in formulation of chewable lozenges

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Abstract
Bananas are considered as one of the most important tropical fruits in the world market. Banana fruit peels comprise a significant quantity of wastes products from Saba banana processing. These peels are just left as solid waste at large expense and are not being used for any other purpose. Thus, the operation of food processing wastes in the industry is now becoming a very serious ecological and addition pollution for environment. Fruit peels contain some valuable compounds like pectin. This work aims to develop value added products such as pectin from solid waste by extraction process from unripe banana peels; pectin is widely used as a gelling agent, thickener, emulsifier and stabilizer in different food processing operations. Aim of study, includes banana pectin can be used as pharmaceutical excipients solid as well as semisolid dosage form. In spite of several dosage forms available in the market for effective localized action. The lozenges find a special importance as they are the best dosage forms for formulating large dose medicaments. The anatomy of mouth and cheek favors easy absorption of drug, reducing the systemic absorption thus ensuring a better patient compliance especially for pediatrics and geriatrics. Paracetmol was formulated as lozenges to provide slow release medicament for the management for fever and pain. Pectin was used as polymer. All formulations prepared subjected to various physicochemical parameters like thickness, diameter, content uniformity, weight variation, etc.

Keywords: banana peel, pectin, polymer, chewable lozenges

Introduction

Banana peel is rich in phytochemicals. The antifungal and antibiotic properties of banana peel can be used well. Banana peel remnants are usually disposed of in municipal landfills, which contribute to existing environmental problems. However, the problem can be overcome by using its high value-added compounds, including the fiber fraction, which has great potential in the preparation of functional foods. The use of banana peels as a source of high value compounds such as pectin, cellulose nanofibers and phenolic compounds is of interest not only from an economic point of view, but also from an environmental point of view [1-3]. Pectin is an essentially linear polysaccharide. It is both polydisperse and polymolecular and its composition varies with the source and the conditions applied during isolation [4-5]. Pectin is a complex family of heteropolysaccharides that constitute a large proportion of the primary cell wall plants that use to applications in the pharmaceutical and biotechnology industry [6]. The use of pectin of developing an oral controlled release drug delivery system has been reported: Matrix tablets, gel beads, gel coating, beads, micro particles, film, nanoparticles, mucoadhesive [7]. Characteristic of pectin is related to many factors including the type of fruit, extraction method, process purification, and drying [8]. Most of the edible bananas are cultivated mainly for their fruits, thus banana farms could generate several tons of underused byproducts and wastes [9].

Chewable lozenges have been on the market for a number of years. They are very highly flavored and, many often contain a slightly acidic taste. They are an excellent way of administering drug products as the taste of the drug often can be masked very effectively with fruit-flavored products. They are relatively easy to prepare extemporaneously. These are especially used for pediatric patients and are very effective means of administering medications for gastrointestinal absorption and systemic use. One of the more popular lozenges for pediatric use is the chewable lozenge, or gummy-type candy lozenges. The pectin or gelatin base for these chewable lozenges is similar to the former glycerin suppositories or glycerinated gelatin suppositories, which is considered of 70% glycerin, 20% gelatin or pectin and 10% purified water [10].

The aim of the present study was to isolation of pectin from Banana peel waste and Its utilization in formulation with evaluation of chewable lozenges.

Materials and methods

Materials

Fresh Banana peels, pectin, 0.05%sodium Metabisulfite, glycerin, 95%Ethanol, Distilled Water, Dextrose, Methyl Paraben, Flavoring agent.

Methods

Discoloration of banana peels

Fresh 40gm banana peels was collected and then washed gently to remove dirt, then soaking banana peels into 0.05% sodium Metabisulfite for an hour to prevent discoloration.

Extraction of pectin

Banana peels removed from that 0.05% sodium metabisulfite solution which were subjected to discoloration and boiled into 500ml of distilled water for 1,2,3,4 and 5 hours at stirring on hot plate. Then cooled that solution and filtered through muslin

cheese cloth then filtrate which was in same proportion for better yield (1: 1) Ethanol: Filtrate.
Then the pectin come out and then it set as it was for an hour so, pectin present or come into supernatant layer in precipitated form. So, that residue collected and dried into oven for 3-4 days at 55^0C or sundry and then weighed.

Evaluation of pectin
1. Swelling index
2. Laboratory pectin evaluation compared with obtained pectin

1. Swelling index
Take pectin in dry form and measured its initial weight then it was soaked into distilled water for ½ hour then after ½ hour remove it and measured final weight.

$$Wt-Wo/Wo*100$$

Where, Wt=Final weight of pectin
W_0= Initial weight of pectin [11].

2. Laboratory pectin evaluation compared with obtained pectin

Table 2: Identification test for laboratory and obtained pectin

Sr. No.	Test	Laboratory pectin	Obtained pectin
1	Pectin-Solution+ Ethanol	Yellow-gelatinous ppt	Sandy color gelatinous ppt
2	Pectin-solution+ 2N NaoH	Yellow gel	Sandy color gel
3	Precipitated gel+ Hcl 3N NaoH	Colorless gelatinous ppt	Colorless gelatinous ppt

Preparation of chewable lozenges [12, 14]
It requires silicon mold, sugar base, gelling agent, humectants.

Table 3: Formulation table with their uses

Sr. No.	Ingredients	Uses
1	Paracetmol	Antipyretic
2	Pectin	Gelling agent
3	Glycerin	Humectants
4	Dextrose	Sugar base
5	Methyl Paraben	Preservative
6	Peppermint oil	Flavoring agent

Table 4: Formulation table with their quantities according to their batches:

Ingredients	Batches		
	F1	F2	F3
Paracetmol	100gm	100gm	100gm
Pectin	20gm	25gm	30gm
Glycerin	50ml	50ml	50ml
Dextrose	10gm	10gm	10gm
Methyl Paraben	1.32gm	1.32gm	1.32gm
Peppermint oil	6-7drops	6-7drops	6-7drops

Method for making chewable lozenges
Firstly, into one beaker glycerin was taken and heated. Then isolated pectin was added at small amount with continuous stirring to avoid clump of polymers. When temperature reaches at 117^0C sugar base was added along with drug (Paracetmol) into that beaker. Then removed it from flame and keep it for cooling. When temperature reach at 60-70^0C then added preservative, flavoring agent and stirred well. Then this semisolid mass transferred into relubricated silicon mold and keeps it in refrigerator after ½ hour. Remove lozenges from moulds and spread sucrose or powdered sugar onto their surface to avoid stickiness. Then further packed into polythene bags and keep it in a cool place.

Fig 1: Preparation of lozenges

a. Soaking banana peels into 0.05% sodium Metabisulfite- for discoloration b. boiling into distilled water c. Extraction of pectin d. Large scale pectin e. Collected pectin f. dried pectin g. Formulation of chewable lozenges h. Molding method i. packing of lozenges

Evaluation of lozenges
Weight variation: It was calculated by using analytical balance. The test was performed was performed for 10 lozenges and standard deviation was calculated.
Diameter: Diameter of the chewable lozenges was measured using vernier calipers. The test was performed for 10 lozenges and standard deviation was calculated.
Thickness: Thickness of the lozenges was measured using Vernier Caliper. The test was performed for 10 lozenges and standard deviation was calculated.
$P^{H:}$ According to standard the P^H of chewable lozenge is in between range of 5-6. It was checked by simple litmus paper
In-Vitro Dissolution: In-Vitro release study was carried using paddle type USP-II dissolution Apparatus 900ml of phosphate buffer P^H 6.8 at $37\underline{+}0.5^0$C is taken as dissolution media. The rmp of the paddle fixed at 100.Sample were withdrawing at interval of 5 min. up to 30min and Absorbance recorded at 249nm.
Preparation of phosphate buffer P^H 6.8= 11.45 gm potassium dihydrogen phosphate + 28.8 gm disodium hydrogen phosphate for 1000 ml

Result and Discussion

Percentage yield of Pectin

Pectin yield (%) =P/Bi*100
Where P= pectin extracted in gram
Bi= weight of alcohol-insoluble-residue (AIR) in gram (weight of sample taken)

Normally ripe bananas give better yield otherwise unripe or fully ripe bananas does not gives better yield or fresh pectin it directly affects on quality and quantity. The maximum percentage yield of pectin was 13.5%

Pectin result

Swelling index

Wt-Wo/Wo*100

Wt=0.5gm W_0=0.3
So, 0.5-0.3/0.3*100 =0.6666*100 = 66.66%

Result of chewable lozenges

Weight variation, diameter and thickness

Table 5: Observation of weight variation, diameter and thickness of chewable lozenges

Lozenges	Weight variation in gm			Diameter in mm			Thickness in mm		
	F1 Batch	F2 Batch	F3 Batch	F1 Batch	F2 Batch	F3 Batch	F1 Batch	F2 Batch	F3 Batch
1	9.14	10.24	10.5	18.5	27.40	15.23	15.23	18.60	10.5
2	10.56	10.22	18.2	19.5	27.91	14.39	14.2	19.25	18.2
3	8.28	10.24	13.2	13.65	28.1	11.25	16.2	19.10	13.2
4	11.1	10.23	19.32	12.25	26.61	18.39	10.8	18.95	19.32
5	7.11	10.21	16.28	15.68	27.89	16.55	11.7	19.71	16.28
6	5.12	9.68	17.2	10.92	25.89	15.36	10.12	19.22	17.2
7	4.59	10.22	11.20	16.23	27.32	10.35	8.10	18.98	11.20
8	9.11	10.23	15.2	15.23	27.42	12.3	7.89	18.78	15.2
9	5.20	10.21	12.28	16.35	27.58	13.63	9.11	19.12	12.28
10	6.28	10.9	11.25	10.95	27.42	15.6	11.9	18.58	11.25

P^H: The pH of all the prepared formulations was determined by using pH paper

In-Vitro Dissolution

1. Sample to be withdrawal

100mg=900ml
X=1ml
X=1*100/900=0.11mg/ml
1mg=1000µg
So, 0.11*1000=110µg/ml
If we withdrawal 0.8ml sample then it contains,
0.8*100/900=0.0888mg so, 88.8µg

If, 0.8ml sample diluted to 10ml then, 88/10=8.8µg/ml
This is in between beers lamberts' range is (2-10µg/ml)

2. Dilution factor

= Volume of diluted sample (ml) / volume of sample removed =10/0.8=12.5

3. Calibration curve of lozenges batches

Table 6: Calibration Reading

Concentration (µg/ml)	F1 Batch	F2 Batch	F3 Batch
2	0.205	0.0092	0.0194
4	0.0445	0.0201	0.0204
6	0.0618	0.0285	0.0285
8	0.0919	0.0455	0.0286
10	0.120	0.0919	0.0288
Slope	0.01232	0.0285	0.00135
Intercept	0.00618	0.01452	0.01703

100mg Paracetmol was taken and diluted up to 100ml by Phosphate buffer P^H 6.8. and withdrawal 0.2ml, 0.4ml, 0.6ml, 0.8ml, 1ml and dilute up to 10ml by Phosphate buffer P^H 6.8 to make 2µg/ml, 4 µg/ml, 6µg/ml, 8µg/ml, 10µg/ml.

4. In-Vitro Drug Release Profile of different formulations

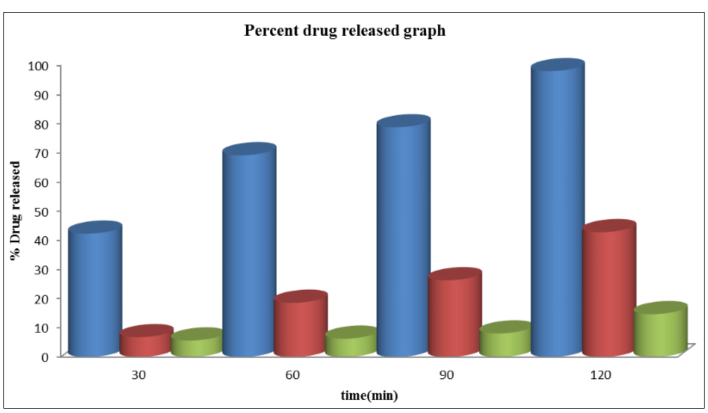

Fig 2: In-Vitro Drug Release Profile of different formulations

Conclusion

It can be concluded from the above study, that the natural polymer pectin derived from banana peel waste can be used as a pharmaceutical excipient for extended drug delivery and also to avoid the wastage of banana peels to control the environment pollution. It is nonirritant in nature. Also incorporating polymer like pectin can be used to formulate effective medicated lozenges.

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