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Extraction, Characterization and Evaluation of Pectin from Orange Peels as Pharmaceutical Excipient

Sonia Tyagi

Department of Pharmacy, School of Medical and Allied Sciences,
Galgotias University, Greater Noida, Gautam Buddha Nagar, Uttar Pradesh, India

Abstract: This manuscript deals with extraction, characterization and evaluation of pectin from orange peels as pharmaceutical excipient. Orange peels were extracted out as crude material, purified and further characterized in terms of organoleptic properties. Furthermore micromeritic studies were also carried out to characterize polymer as pharmaceutical excipients. The results has shown that the extracted pectin possess optimum organoleptic as well as micromeritic properties. Pectin was extracted from orange peels at different temperature i.e. 40°, 70°, 100° and characterized. Bulk density and Tapped density of F1 (0.75±0.06, 0.88±0.09) g/cm^3 were less than that of other batches i.e. F2, F3. Lowest Surface tension was found to be of F2 (63.86±0.35dyne/cm) of pectin among all the other batches. Viscosity of F1 pectin (10.18±0.35poise) was found to be highest among all the other batches.

Key words: Natural polymer · Orange Peels · Pectin · Extraction · Characterization

INTRODUCTION

Natural polymers are utilized in most of the preparation and are more effecient over synthetic polymers as they are economically beneficial and non-toxic. They are available at low cost and used in the sufficient quantity [1]. Natural polymers are biodegradable in nature so, they do not cause any pollution. Natural polymers have many pharmaceutical applications such as diluents, binder, disintegrant in tablets, thickness in oral liquid, protective colloids in suspension, gelling agents in gels and bases in suppository. Natural polymers are also used in cosmetic, textiles, paints and paper making [2-4]. Pectin is a biopolymer which is used in the food as well as in pharmaceutical industries [5]. It is described as a family of oligosaccharides and polysaccharides that have common features but are different in their fine structures [6]. Pectin is the methylated ester of polygalacturonic acid, contains 1, 4-linked α-D-galacturonic acid residues [7]. Pectin is one of the most valuable products which can be obtained from various sources. Commercial pectins are primarily extracted from citrus peel such as lime peel, guava extract, apple pomac, oranges [8]. It is widely used as a thickener, emulsifier, texture and stabilizer in food industry. In food industry, pectin is used as gelling agent for making jams and jellies and also used for fruit preparations, fruit drink concentrates, fruit juice and desserts and fermented dairy products [9]. The pectin is divided on the bases of Degree of Esterification i.e. high methoxyl (HM) pectins and the low methoxyl (LM) pectins which are either the conventionally demethylated or the amidated molecule. High methoxyl (HM) pectins have more than half the carboxyl groups as methyl esters and it forms gels in the presence of high sugar concentrations and acid (e.g. jams, jellies, marmalades). Low methoxyl (LM) pectins have less than half the carboxyl groups as methyl esters [10]. These are found in the cell walls and middle lamellae of higher plants. These polysaccharides consist of 300-1,000 chains of galacturonic acid units [11]. Nutritionally, pectin also shows health benefit to lower blood cholesterol levels and low-density lipoprotein cholesterol fractions [12].

MATERIALS AND METHODS

Collection, Identification and Purification of Plant Material: Crude plant material (orange peels) was purchased from local shop of Greater Noida, India. Collected plant material was identified by Department of

Corresponding Author: Sonia Tyagi, Department of Pharmacy, School of Medical and Allied Sciences, Galgotias University, Plot No. 2, Sector 17-A, Yamuna Expressway, GreaterNoida, Gautam Buddha Nagar, Uttar Pradesh, India. Tel: +91 8882285549.

Biotechnology, Gautam Buddha University (State Govt. University) Greater Noida. Furthermore plant material was purified as follows:

As described by the author elsewhere, the crude material (orange peels) was dried in shade for 12-24 hours, powdered, passed through sieve # 20. Crude material was boiled for 5 hours at different temperature i.e. 40°, 70°, 100° and squeezed in a muslin bag to remove the mark from the filtrate. To isolate the pectin, equal volume of acetone was added. The pectin was separated, dried in oven at about 45°C, powdered. The powdered pectin was stored in desiccators until further use [13].

Physicochemical Characterization of Isolated Gum: Identification tests for carbohydrates, proteins and tannins: As described by the author elsewhere, aqueous solution (1%) of extracted pectin was used for chemical characterization. Test for carbohydrates, proteins, starch, fats and tannins were performed according to standard procedure [13].

Solubility: As described by the author elsewhere, solubility of the pectin was identified by taking one part of dry pectin powder and it was shaken with different solvents and the solubility was determined [13].

Organoleptic Evaluation of Isolated Pectin: As studied elsewhere, the isolated pectin was characterized for organoleptic properties such as colour, odour, taste and fracture [13].

pH of Pectin: As described by the author elsewhere, the pH of 1% w/v solution of gum was measured using digital pH meter [13].

Swelling Index of Pectin: As studied by the author elsewhere, the swelling index of pectin was calculated by weighed a butter paper of size 2x2cm, then the butter paper dipped into a petridish containing water of 15 ml. 0.1gm of the powdered sample was kept in a butter paper placed in a petridish and the swelling index was taken out at different interval i.e. 15, 30, 45, 60, 120, 240, 300 and 1440min. and final results was calculated using formula [13].

$$\text{Swelling weight} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

Viscosity of Pectin: As described elsewhere, viscosity of 1% w/v solution of different batch of pectin was measured using an Ostwald's viscometer [14].

Surface Tension of Pectin: As described elsewhere, surface tension of 1% w/v solution of pectin was measured using a Stalagmometer [14].

Bulk Density and Bulkiness: As described by the author, bulkiness is the inverse of bulk density. For determination of bulk density accurately weighed quantity of 5 g was introduced into a graduated measuring cylinder and the cylinder was fixed on the bulk density apparatus. The volume occupied by the powder was noted down. Tapped density was calculated by tapping powder in a bulk density apparatus until constant volume was obtained. The final volume was calculated [13].

Powder Flow Property: As described by the author elsewhere, flow property of powder was calculated by measuring angle of repose. Angle of repose was calculated thrice by using formula [13].

$$\tan \theta = h/r$$

Powder Compressibility: As described by the author elsewhere, compressibility of powder is determined by Carr's Index. Powder (5g) was transferred into a measuring cylinder and using the bulk density apparatus calculations were done [13].

Particle Size Analysis: As described elsewhere, the particle size of powdered pectin was determined using microscopy [14].

Ash Value: As described by the author elsewhere, ash value was calculated by weighing 2gm of pectin powder in a tared silica crucible. It was then incinerated in a muffle furnace upto 450 °C till the powder completely changes to ash. The crucible was then kept in dessicator after complete incineration. Weight of ash was noted and total ash was calculated in terms of percentage [15].

RESULTS AND DISCUSSION

As described by the author elsewhere, after isolating pectin from orange using acetone the percentage yield of pectin was found to be 15%. Phytochemical investigation

Table 1: Chemical characterization of isolated pectin

Tests	Present/Absent
Carbohydrates	+
Hexose Sugar	+
Glucose	-
Tannins	-
Proteins	-
Polysaccharides (starch)	-
Fats	-
Volatile oils	-

+Present; –Absent

Table 2: Solubility profile of pectin

Solvents	Solubility
Cold water	Swells to form gel
Hot water	Soluble
Methanol	Insoluble
Ethanol	Insoluble
Diethyl ether	Insoluble
Petroleum ether	Insoluble
Acetone	Insoluble

Table 3: Parameters of pectin

Parameters	F1(40° pectin)	F2(70° pectin)	F3(100 °pectin)
pH	4.56 ± 0.05	4.56±0.05	4.36±0.05
Swelling Index (%)	77.26±35.53	104.56±49.31	188.18±81.21
Viscosity (poise)	10.18± 0.35	9.39±0.26	8.43±0.47
Surface tension (dyne/cm)	65.14± 0.78	63.86±0.35	67.3±0.44
Bulk density (g/cm^3	0.75± 0.06	0.79±0.06	0.79±0.06
Tapped density (g/cm^3)	0.88 ± 0.09	0.94±0.09	0.94±0.09
Bulkiness (cm^3/g)	1.33 ±0.11	1.26±0.11	1.26±0.11
Hausner's ratio	1.17±0.01	1.26±0.11	1.18±0.01
Carr's index (%)	15.81±1.39	20.66±6.87	15.89±1.39
Angle of repose (°)	13.73±2.43	14.62±2.01	14.82±1.54
Particle size (µm)	80.30± 34.27	79.30±26.64	73.23±25.87
Total Ash (%)	5.6 ± 0.76	6.3±0.28	9±0.5

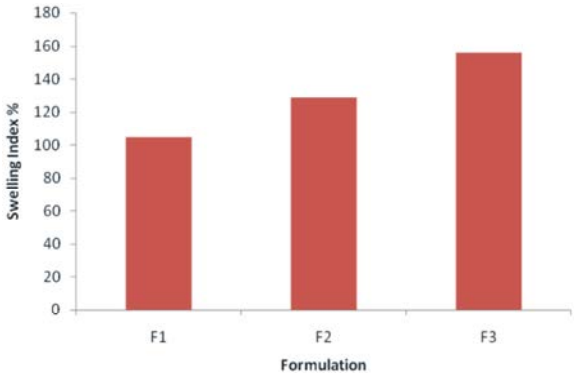
showed the presence of carbohydrates and hexose sugar but glucose, tannins, proteins and polysaccharides were absent. Results after phytochemical test are summarized in Table 1.

Organoleptic properties of pectin were observed and were found to be acceptable. The colour of powdered pectin was brown. The odour and taste was found to be characteristic and agreeable. The fracture was rough. Solubility profile of pectin is shown in Table 2.

Solubility analysis has showed that pectin was soluble in hot water, swells to form gel in cold water and insoluble in most of the organic solvents.

Different parameters of pectin were evaluated and are shown in Table 3.

Swelling Index:



The Ash content of F3 batch of pectin was higher than the other batch.

The pH of 1% solution of F3 batch found more acidic.

Bulk density and Tapped density, Carr's index, Hausner's ratio of F1 batch found less than that of other batches but bulkiness of F1 batch of pectin found more than that of other batches. It showed a better compressibility. Angle of repose of F1 batch of pectin was found less so it has show excellent flow property and F2,F3 also have excellent flow property but little less than F1.

The F3 batch of pectin had higher swelling power. Lowest Surface tension was found to be of F2 batch of pectin among all the other batches. Viscosity of F1 batch of pectin was found to be highest among all the other batches.

CONCLUSION

It is concluded from the result that the extracted pectin from orange peels showed presence of carbohydrates, hexose sugar. All the organoleptic properties evaluated were found to be acceptable. The pH was found to be acidic. Swelling Index reveals that the pectin swells well in water. Total ash value was in the limits. The values of angle of repose and Carr's Index of powdered pectin showed excellent flow property.

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