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Extraction and Characterization of Okra Mucilage as Pharmaceutical Excipient

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Abstract: This study deals with extraction and characterization of okra (*Abelmoschus esculentus*) mucilage as pharmaceutical excipients. Using water based extraction method, the yield of mucilage was found to be 11.44%. Characterization of the extracted mucilage was done by various parameters such as micromeritic studies, flow behaviour, organoleptic properties, surface tension, viscosity, loss on drying, ash value and swelling index. The result showed that extracted okra mucilage exhibited good flow properties (Angle of repose 27.29°), the surface tension of 0.25% w/v solutions of mucilage was found to be 0.0405 joule/m^2, total ash was 7.53% w/w, loss on drying was 9.917% and pH was found to be 7.5. Extracted mucilage was soluble in warm water while insoluble in organic solvents. This showed that this can be safely used in dosage form without causing any adverse effect.

Key words: Okra · Mucilage · Pharmaceutical Excipient · Natural Polymer

INTRODUCTION

Natural polymers are generally obtained from plant. They are high molecular weight; water soluble polymers made up of monosaccharide unit and joined by glucosidic bond [1]. Gummy excaudate of natural polymers such as protein, enzyme, muscle, fibre, polysaccharide have been used to formulate various pharmaceutical product [1, 2]. The well known natural polymers are aloe mucilage, guar gum, karaya gum, bhara gum, sodium alginate, locust bean gum, okra gum and linseed mucilage [3, 4]. These natural polymers are applicable in different pharmaceutical dosage form like matrix controlled system, microsphere, nanoparticle, buccal film and viscous liquid formulation [2, 4]. The specific application of natural polysaccharide in pharmaceutical preparation is to help in the processing of drug delivery system during its manufacturing, protection, enhancement of stability, bioavailability and patient acceptability [5-7]. Gum has obtained from hydrocolloids of plant and can be classified into two groups' i.e. anionic and non ionic polysaccharides. Hence by modification gum can alter their physicochemical properties [6, 7]. Mucilage is a metabolised product which is intracellularly formed without injury to the plant [4]. Gums are readily soluble in water while mucilage forms slimy mass in the presence of water. Gum and mucilage are translucent, amorphous substances which are produced by plants as a protective during injury [1, 3]. Gum, cellulose, mucilage and mucilage are distinguished by the condensation of hexane and pentose [7]. Gum and mucilage can be obtain from middle lamella as in algae, cell wall as in the seed epidermis as well as endodermis, some secretary cells as in squill and also present in the schizogenous sacs [8]. Gum has various pharmaceutical applications such as suspending agent for insoluble solid component in mixture, emulsifying agent for resin oil and adhesive in troche masses and pill. They can be used as a thickener, emulsifier, sweetener, viscosity enhancer in pharmaceutical preparations [7-9]. The natural polymers has applicable in the households, agriculture, food industries and in packaging and it help in decreasing the environmental pollution and resulting in disposal in landfills [8, 10]. Natural polymers are used as an

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environment cleaner, renewable and also help in recycling of global carbon [10, 11]. Okra gum, obtained from the fruits of *Abelmoschus esculentus,* is a polysaccharide consists of D-galactose, L- rhamnose and L-galactouronic acid.

MATERIALS AND METHODS

Extraction Procedure: Okra (*Abelmoschus esculentus*) was obtained from local market of Greater Noida, India. Collected okra was carefully washed and dried under shade for 24 h, further dried at 30–40°C until constant weight was obtained. Size was reduced through grinder. Powdered fruit passed through sieve no. #22 and stored it in air tight container for further use. Extraction of mucilage includes two steps.

Step1: Extraction of mucilage: As the authors described elsewhere, powdered fruit kept in 500ml of distilled water. Heated with stirred continuous at 60°C for approximately 4h. Concentrated solution has filtrated through muslin cloth and cool at 4°C-6°C [12].

Step2: Isolation of Mucilage: Extracted gum has isolated in acetone. This allows filtration through muslin cloth. Washed with acetone and the mucilage filtrated through muslin cloth. Pressed mucilage was further dried to constant weight at 35–45°C in hot air oven. Hard mucilage cake was grinded and sieved through sieve # 22, stored in dessicator for further used [13].

Physicochemical Characterization of Okra Mucilage: As the authors described in previous publication, aqueous extract was mixed Molish's reagent followed by addition of sulphuric acid. The violet colour ring appeared at junction, showing presence of carbohydrates [13, 14].

Determination of Purity of Okra Mucilage: To determine purity of extracted mucilage tests for alkaloids, proteins, mucilage, fats, tannins and amino acids were performed as already described by authors in previous publication [13, 14].

Organoleptic Evaluation of Isolated Mucilage: As authors described elsewhere, isolated mucilage was characterized for organoleptic properties such as colour, odour, taste, fracture and texture [13].

Ash Values: As discussed by authors in previous publication ash values such as total ash, acid insoluble ash and water- soluble ash were determined using equation 1, 2, 3 respectively [15].

$$Total\ ash\ value\ =\ \frac{weight\ of\ ash}{weigh\ of\ polymer}\times 100 \quad (1)$$

$$Acid\ insoluble\ ash\ =\ \frac{weight\ of\ acid\ insoluble\ ash}{weight\ of\ dried\ powder}\times 100 \quad (2)$$

$$Water\ soluble\ ash\ =\ \frac{weight\ of\ water\ soluble\ ach}{weight\ of\ dried\ powder}\times 100 \quad (3)$$

Solubility Behaviour: As already described by author's one part of dry mucilage powder was shaken with different solvents and further solubility was determined [13].

pH of Mucilage: The mucilage was weighed and 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 [13].

Swelling Index: As described by authors in previous publication swelling index were calculated as per equation 4 [16].

$$Swelling\ index = \frac{Final\ volume - initial\ volume}{Final\ volume}\times 100 \quad (4)$$

Surface Tension: The surface tension of the selected mucilage was determined by drop count method, using a stalagmometer [13, 17]. The surface tension of the polymer has been reported to influence the binding quality of the polymer. Surface tension was calculated as per equation 5.

$$\sigma_{solution} = \sigma_{water}\frac{m(solution)}{m(water)} \quad (5)$$

where,

$\sigma_{solution}$ = Surface tension of solution
σ_{water} = Surface tension of water
m (solution) = Weight of solution
m (water) = Weight of water

Viscosity: As described by authors viscosity of okra mucilage was determined using Oswald viscometer were calculated using equation 6.

$$s = w \times \frac{t_s \rho_s}{t_w \rho_s} \quad (6)$$

where,
s = Viscosity of solution
w = Viscosity of water
t = Time
ρ = Density

Loss on Drying: The test was carried out according to the procedure described by authors elsewhere. One gram of powder was weighed accurately in a weighing bottle and was dried in a hot air oven at 105°C and the weight was checked at intervals of 10min, until a constant weight was obtained. The percentage of weight lost by the powder was calculated using equation 7 [13, 14].

$$Loss\ on\ drying\ =\ \frac{initial\ weight\ -\ final\ weight}{initial\ weight} \times 100 \quad (7)$$

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 [13, 17, 18]. Bulk density, tapped density and bulkiness were calculated using equations 8-10 respectively.

$$Bulk\ density = \frac{weight\ pf\ powder\ blend}{weight\ of\ apparent\ volume} \quad (8)$$

$$Tapped\ density\ =\ \frac{weight\ of\ powder\ blend}{tapped\ volume} \quad (9)$$

$$Bulkiness = \frac{1}{bulk\ density} \quad (10)$$

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, mucilage is insoluble and heavy in acetone. This method has been used by many authors [13, 18].

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 using equation 11 [13, 17, 18].

$$Tan\theta = \frac{h}{r} \quad (11)$$

where,
θ = Angle of repose
h = Height of pile
r = Radius of pile

Powder Compressibility (Carr's Consolidation Index): This property is also known as compressibility. As described in previous publication finely powdered mucilage (5 g) was transferred into a measuring cylinder and calculations were done using bulk density apparatus [13, 18].

Particle Size Analysis: The particle size was determined by microscope.

RESULTS AND DISCUSSION

After extraction and further precipitation by ethyl alcohol the yield of mucilage was 11.44% w/w obtained. The isolated sample was subjected to identification; this showed presence of carbohydrates in sample powder. Confirmation of mucilage was done when it gave negative test for tannins, alkaloids and proteins. This can be considered as proof for purity of the isolated mucilage as depicted in Table 1.

The results for loss of drying showed value of 9.917%. This indicated that mucilage is hygroscopic in nature and need to be stored in air-tight containers. In solubility behaviour of okra mucilage was found to be soluble in warm water, slightly soluble in cold water and insoluble in benzene, ether, chloroform, n-butanol, ethanol, acetone, glycerine, paraffin. Surface tension of 0.25% w/v solutions of mucilage was found to be 0.0405 joule/m^2. Other phyto-constituents were absent in the isolated powder, pH of 1% solution was found to be 7.5. Irregular particles size was found to be 52.50µm. Result obtained of okra mucilage and observed that mucilage is brownish colour, odourless, tasteless, rough and irregular in shape. Ash values were calculated to characterize mucilage; total ash, acid insoluble ash and water soluble ash were found 7.53%, 0.93% and 4% respectively. Physical characterization of mucilage was carried out for bulk density and bulkiness, true density, total porosity, powder flow behaviour. The bulkiness value indicated that powder is 'heavy' in nature. Result obtained in micromeritic characterization of mucilage was shown in Table 2.

Table 1: Determination of purity of isolated mucilage

S. No.	Test	Present/absent
1.	Carbohydrates	+
2.	Hexose Sugar	+
3.	Monosaccharides	-
4.	Proteins	-
5.	Fats and oils	-
6.	Tannins and Phenolic Compounds	-
7.	Alkaloides	-
8.	Amino acids	-
9.	Mucilage	+
10.	Gums	-

+ Present, - absent

Table 2: Micromeritic study data of mucilage

S No.	Parameters	Values
1.	Angle of repose (°)	27.29
2.	Carr's index (%)	76.42
3.	True density (gm/ml)	3.05
4.	Bulk density (gm/ml)	0.690
5.	Bulkiness (ml/g)	1.46
7.	Mean particle size (μ)	52.50

CONCLUSION

Results of evaluated parameters showed that okra derived mucilage can be used as pharmaceutical excipient to formulate solid oral dosage form. It has acceptable pH and organoleptic properties, so can be easily used to formulate various dosage form.

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Conflict of Interest: Authors have no conflict of interest.

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