ISSN: 2455-2631 © April 2020 IJSDR | Volume 5, Issue 4

Extraction and Characterization of Okra Mucilage as a Pharmaceutical Aid

Pratibha Kale

Assistant Professor
Department of Quality Assurance,
Rajesh bhaiyya Tope college of Pharmacy,
Nipani-Bhalgaon. Aurangabad 431001

***Abstract*: This study deals with extraction and characterization of okra (Abelmoschus esculentus) mucilage as pharmaceutical excipients. Characterization of the extracted mucilage was done by various parameters such as micromeritic studies, flow behavior, organoleptic properties, ash value and swelling index, Carr's index, Housner ratio. The result showed that extracted okra mucilage exhibited good flow properties (Angle of repose 32.25), the total ash was 0.56% w/w, Carr's index was found to be 71.10% and Housner ratio was found to be 3.46. pH was found to be 6.9.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.**

***Keywords*: Okra Mucilage, Pharmaceutical excipients, Carr's index, swelling index etc.**

I. Introduction

Today, the whole world is increasingly interested in natural drugs and excipients. In recent years, plant derived polymers have evoked tremendous interest due to their diverse pharmaceutical applications such as diluent, binder, disintegrant in tablets, thickeners in oral liquids, protective colloids in suspensions, gelling agents in gels and bases in suppository.[1] These mucilage are biocompatible, cheap and easily available and are preferred to semi synthetic and synthetic excipients because of their lack of toxicity, low cost, availability, soothing action and non irritant nature. What are mucilages? Mucilages are generally normal products of metabolism, formed within the cell (intracellular formation) and/or are produced without injury to the plant.[1] The Okra is a bulky annual plant cultivated throughout the tropical and subtropical areas of the world, particularly in India. The fresh green pods are rich in mucilage. Okra is widely harvested and does not require toxicology studies. It has been investigated as a binding agent for tablets and has also been shown to produce tablets with good hardness, friability, and drug release profiles. Natural materials have advantages over synthetic materials because they are non toxic, less expensive and freely available.[2] It has advantages over most commercial synthetic polymers as it is safe, chemically inert, non irritant, biodegradable, biocompatible, and eco-friendly.[2]Okra mucilage contains polysaccharides such as galactose,galacturonic acid, rhamnose and when extracted in water these polysaccharides produce highly viscous solution.[2,6]

Fig 1: Okra pods

Fig 2: Okra Mucilage

ii. Materials and methods

Extraction Procedure:

Okra (Abelmoschus esculentus) was obtained from local market of Pune, 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.[7]

Step1:

Extraction of mucilage: 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.

Step2:
Isolation of Mucilage: Extracted Mucilage has isolated in acetone. This 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 no 22, stored in desiccator for further used.

Physicochemical Characterization of Okra Mucilage:
Aqueous extract was mixed Molish's reagent followed by addition of the of sulphurics acid. The violet colour ring appeared at polymer. Surface tension was calculated as per equation junction, showing presence of carbohydrates.

I. Ash Values:
Ash values are helpful in determining the quality and purity of crude drugs, especially in powder form. The total ash is the residue remaining after incineration. The acid insoluble ash is the part of the total ash which is insoluble in diluted hydrochloric acid. The ash or residue yielded by an organic chemical compound is as a rule, a measure of the amount of inorganic matters present as impurity.[3, 6]

Acid insoluble ash =weight of acid insoluble ash/weight of dried powder×100
Water soluble ash =weight of water soluble ash /weight of dried powder×100

ii. Solubility study:
Solubility of the extracted mucilage was evaluated qualitatively by stirring 10 mg of Okra powder in 10 mL water, acetone, chloroform, and ethanol (1% dispersion). Solubility was determined by visual observation of the solute.[3, 6]

iii. 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 calibrated digital pH meter at room temperature [3, 6, 7]

iv. Swelling Index:
One gram of mucilage was placed into a 25ml glass Stoppard measuring cylinder. 25 ml of water was added into the cylinder containing mucilage and mixture was shaken thoroughly at intervals of every 10 min for 1 h. The sample was allowed to stand for 3 h at room temperature and volume occupied by mucilage was measured. The mean value was calculated, related to 1 g of mucilage.[3, 6]

Swelling index= Final volume -initial volume/ Final volume×100

v. Bulk Density and Bulkiness:
Inverse of bulk density is called as bulkiness. 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.[3, 6] The final volume (Bulk volume) was noted. Bulk density, tapped density and bulkiness were calculated using following equations.

Bulk density =weight of powder blend/weight of apparent volume
Tapped density =weight of powder blend/tapped volume
Bulkiness =1/bulk density

vi. Powder Flow Property:
The angle of repose, of a granular material is the steepest angle of descent or dip relative to the horizontal plane to which a material can be piled without slumping. At this angle, the material on the slope face is on the verge of sliding. The angle of repose can range from 0° to 90° and calculated by using equation. [3, 6]

$$\tan \varphi = h/r$$

Where, φ = Angle of repose
h = Height of pile
r = Radius of pile

vii. 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.[3, 6]

Carr's index = Tapped density- Bulk density /Tapped density
Hausner ratio = Tapped density/ Bulk density

viii. Particle Size Analysis:
The particle size distribution was conventionally. The mucilage Powder was sprinkled on the glass slide. The particle size of mucilage was carried out using calibrated eye piece micrometer.[7]

ix. Fourier Transform Infrared Spectroscopy (FTIR)

An FTIR spectrum was recorded of Okra mucilage. The samples were analyzed by Brucker IR spectrophotometer. The spectra were scanned over a frequency range 4000-400 cm−1.

iii. Results and discussion

1.2. Isolation Evaluation of Okra Mucilage:

Okra Mucilage isolated from okra fruit and evaluated for various official and non-official test.

1.2 Evaluation of Okra Mucilage:

1.2.1 Solubility:

In solubility behavior of okra mucilage was found to be soluble in warm water, slightly soluble in cold water and insoluble in benzene, methanol, acetone and result was depicted in table no.1.1

Sr. No.	Name of Solvent	Solubility Parameter
1	Warm Water	Solubility
2	Cold Water	Slightly soluble
3	Benzene,	Insoluble
7	Ethanol,	
8	Acetone,	
9	Glycerine,	
10	Paraffin	

Table 1.1 Solubility Behavior of Okra Mucilage

1.2.2 Physico-chemical characterization of Okra Mucilage:

Organoleptic evaluation of isolated mucilage was characterized for organoleptic properties such as colour, odour, taste, fracture and texture. Ash values such as total ash, acid insoluble and water- soluble ash were determined and result was depicted as follows (Table No. 1.2).

Sr.No	Parameters	Observations
1	Odour	Characteristics
2	Taste	Mucilaginous
3	Appearance	Amorphous
4	pH (1% solution)	6.9
5	Swelling Index	29.23
6	Ash value-Total ash	0.56%
7	Acid insoluble ash	0.15%
8	water insoluble ash	0.13%

Table 1.2 Physiochemical characterization of Okra mucilage.

8.3.3 Viscosity of Okra Mucilage:

Viscosity of isolated Okra mucilage was determined by using Brookfield viscometer using spindle no.64 and result was depicted in table No. 1.3

Sr.No.	Speed (rpm)	Spindle used	Viscosity(cps)
1	10	64	120.3
2	20	64	116.8
3	30	63	93.8

Table 1.3 Viscosity of Okra Mucilage

2. FTIR Spectra of Okra Mucilage:

The infrared spectrum of Okra mucilage was recorded using IR- spectrophotometer (Bruker) by the conventional KBr pellet method (Figure 1.4). The spectrum was scanned over a frequency range 4000-400cm^{-1} with a resolution 4cm^{-1} and result was depicted in table no.1.5.The finger print region of the spectrum consists of two characteristic peaks between 700 and 1316 cm-^{1}, attributed to the C-O bond stretching. The band at 1604 cm-^{1} was assigned to the O-H bending of water. Contribution from carbonyl stretches in the 1521.98 cm-^{1} region indicates the presence of ester linkages. Weak stretches in the 1650-1690 cm-^{1} region would mean that this is mostly from lignin.

No	Functional Group	Frequencycm^{-1}
1	OH Stretching	3530.65
2	OH bending of water	1521.98
3	CO (Carboxylic acid)	1236.82

Table 1.4 Interpretation of FTIR Spectra of Erlotinib hydrochloride

Discussion:

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.

Okra powder was swelled and formed viscous dispersion when dispersed in water. The slightly soluble behavior of Okra gum is useful in controlled release formulation development as the swellable and viscous dispersion represents a strong matrix polymeric system that is able to control the release of Drug molecule. pH of 1% solution was found to be 6.9. The pH of Okra gum was found to be 6.7 and Okra gum is known to have greatest viscosity at a neutral pH range, which facilitates in the controlled effect of release of drug molecule, hence can be use as release retardant for the development of sustained release tablet. Neutral pH also shows minimum irritation to the gastrointestinal tract and is suitable for uncoated tablets (Malviya et al., 2011).

Irregular particles size was found to be 49.50 µm. 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 0.56%, 0.15% and 0.13% 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.

Conclusions

The Okra gum used as a binding agent in tablet formulations with good hardness, friability, and dissolution rate. From the study it is clear that the binding property of fruit polymer of Abelmoschus esculentus (okra) is much better. Natural gums are promising biodegradable polymeric materials. Many studies have been carried out in fields including food technology and pharmaceuticals using gums and mucilage. It is clear that gums and mucilage have many advantages over synthetic materials. Therefore, in the years to come, there will be continued interest in natural gums and their modifications aimed at the development of better materials for drug delivery systems. The results presented here shows that the mucilage obtained from Abelmoschus esculentus can be used as a binder in tablets formulations with good physical properties. Tablets of long disintegration times were produced; hence it's potential in binding and prepares the granules for pharmaceutical formulation. 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.

Acknowledgments

The authors thankful to Prof. T .J. Sawant, JSPM, Pune for his kind co-operation and also thankful to Dr. S. B. Wankhede , Principal, JSPM's Charak College of Pharmacy & Research for providing necessary facilities to carry out the research work

References

[1] Umeshkumar M.Deogade, Vilas N. Deshmukh, Dinesh M. Sakarkar et al. Natural Gums And Mucilage's In Ndds: Applications And Recent Approaches. International Journal Of Pharmtech Research. (2012), (4):799-814.
[2] Narahari N. Palei, Santosh K. Mamidi, Jayaraman Rajangam et al. Formulation And Evaluation Of Lamivudine Sustained Release Tablet Using Okra Mucilage.Journal Of Applied Pharmaceutical Science. (2016), (6):69-075.
[3] Uzma Farooq, Rishabha Malviya and Pramod Kumar Sharma et al. Extraction And Characterization Of Okra Mucilage As Pharmaceutical Excipient. Academic Journal Of Plant Sciences, (2013), 6(4): 168-172.
[4] Ilango K B, Manisha M And Brinda P. et al. Investigation Of Colon Specificity Of Novel Polysaccharide Okra Mucilage-Film Coated With Enteric Materials.International Journal Of Pharma And Bio Sciences,(2012),(3):53-62.
[5] Suja C. Jayan And Navaneet Krishna Manoj, et al. Isolation And Evaluation Of Mucilage Of Abelmoschus Esculentus As A Suspending Agent. International Journal Of Pharmaceutical And Chemical Sciences,(2013),(2):1311-1315.
[6] Ikoni Ogaji, Obiageli Nnoli, et al. Film Coating Potential Of Okra Gum Using Paracetamol Tablets As A Model Drug. Asian Journal Of Pharmaceutics,(2010):130-134.
[7] Prakash pawan and kumar Nitin ,et al. Design and Devlopment of suntained relese matrix tablet of diclofenac sodium using natural polymer.International Research Journal of Pharamcy.(2013);(4):169-176.
[8] Biswajit Biswal, Nabin Karna and Rashmika Patel et al. Okra mucilage act as a potential binder for the preparation of tablet formulation. Der Pharmacia Lettre.(2014), (3): 31-39.
[9] Ashwini Rajendra, Bushetti S.S. And Archana Giri, et al. Design And Evaluation Of Compression Coated Formulations For An Anti-Inflammatory Drug Based On Modified Okra Mucilage. Journal Of Applied Pharmaceutical Science 02,(2012),(7):238-245.
[10] P.Nazni And P.Vigneshwar, et al. Study On Extraction And Organoleptic Evaluation Of Okra And Hibiscus Mucilage Incorporated Products. International Journal Of Food And Nutritional Sciences,(2014),(3):99-103.
[11] L.Naga Vamsi Krishna, P.K. Kulkarni, Mudit Dixit, D.Lavanya, Prudhvi Kanth Raavi, et al. Brief Introduction Of Natural Gums, Mucilages And Their Applications In Novel Drug Delivery System Review. International Journal Of Drug Formulation And Research, (2011),(2):54-71.
[12] Rohit Rajendra Bhosale, Riyaz Ali M. Osmani, Afrasim Moin, et al.Natural Gums And Mucilages: A Review On Multifaceted Excipients In Pharmaceutical Science And Research. International Journal Of Pharmacognosy And Phytochemical Research,(2014-15),(6): 901-912.
[13] Nilesh Jain1, Ruchi Jain, Vaibhav Jain And Surendra Jain, et al. A Review On: Abelmoschus Esculentus. Pharmacia.(2012),(1):85-89.
[14] Darekar Avinash Bhaskar, Kahane Jyoti Uttam, Ashawat Mahendrasingh,Chavan Machhindra Jayram, Saudagar Ravindranath Bhanudas, et al. Plant Exudates And Mucilage As Pharmaceutical Excipients. Journal Of Advanced Pharmacy Education & Research. (2013),(3):387-402.
[15] Satyajit Panda1, Girish Babu Botta, Snigdha Pattnaik, Laxmidhar Maharana, et al. A Complete Review On Various Natural Biodegradable Polymers In Pharmaceutical Use. Journal of Pharmacy Research. (2012),(5): 5390-5396.
[16] Saurabh Dilip Bhandare, Ekta Kavade And Sunita Surse, et al. Natural Polymers: As Pharmaceutical Excipients And Their Applications In Different Pharmaceutical Formulations – A Review. (2015)(4): 626-644.
[17] Vilas A. Arsul [1], Dr. S. R. Lahoti [2] et al. Natural Polysaccharides As Pharmaceutical Excipients .Journal Of Pharmaceutical Research. (2014),(3):3776-3790.
[18] Bindu R. Nair And Fahsa K. S., et al. Isolation And Characterization Of Mucilage From Some Selected Species Of Abelmoschus Medik. (Malvaceae) And Their Application In Pharmaceutical Suspension Preparation. (2013),(5): 398-402.
[19] Sujitha.B, B.Krishnamoorthy, M.Muthukumaran, et al. A Role Of Natural Polymers Used In Formulation Of Pharmaceutical Dosage Forms: A Review. International Journal of Pharmacy Technology. (2012),(4) 2347-2362.
[20] Krishna, L.N.V., P.K. Kulkarni, M. Dixit, D. Lavanya And P.K. Raavi, et al. Brief Introduction Of Natural Gums, Mucilages And Their Applications In Novel Drug Delivery Systems. International Journal Of Drug Formulation And Research. (2011), 2(6): 54-71.
[21] Malviya, R., P. Srivastava And G.T. Kulkarni, et al.Application Of Mucilage In Drug Delivery. Advances In Biological Research. (2011),5(1): 1-7.
[22] Malviya, R., et al Extraction and Characterization of Selected Mucilage as a Pharmaceutical Excipients. Polim. Med.41 (3): 39-44.
[23] Lala, P.K., et al. Practical Pharmacognosy. Calcutta, Lina Guha, Pp: 135.
[24] Indian Pharmacopoeia [Cd-Rom] FDA Maharashtra, Mumbai. (1996)Version 1.
[25] Morkhade, D.M., S.V. Fulzele, P.M. Satturwar And S.B. Joshi, et al. Novel Matrix Forming Materials For Sustained Drug Delivery. Indian J. Pharm. Sci., 68(1): 53-58.
[26] Ogaji, I.J., E.I. Nep And J.D. Audu-Peter et al. Advances In Natural Polymers As Pharmaceutical Excipients. Pharmaceutica Analytica Acta,(2011), 3(1): 6
[27] Kalu V. D., Odeniyim. A., Jaiyeoba K. T.et al. Matrix Properties Of A New Plant Gum In Controlled Drug Delivery. Arch. Pharm. Res. (2007), (30): 884-889.
[28] Wahis. P., Sharma V. D., Jain V. K., et al. Studies On Suspending Property Of Mucilage Of Hygrophilaspinosa T. Anders And Hibiscus Esculents Linn. Indian Drug, (1985), (22): 500-502.
[29] P.Nazni And P.Vigneshwar et al. Study On Extraction And Organoleptic Evaluation Of Okra And Hibiscus Mucilage Incorporated Products. International Journal Of Food And Nutritional Sciences.(2014),(3):99-103.