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EXTRACTION AND CHARACTERIZATION OF *CORDIA DICHOTOMA* MUCILAGE AS PHARMACEUTICAL ADJUVANT

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ABSTRACT

The objective of the study was characterization and evaluation of Indian cherry (*Cordia dichotoma*) mucilage as pharmaceutical adjuvant. The mucilage was drawn out using distilled water and isolated by acetone. Various parameters such as tests for carbohydrates, protein, fat, reducing and non-reducing sugars, alkaloids, tannins, phenolic compounds, and other parameters like micromeritic properties, surface tension, swelling index and viscosity were evaluated for characterizing the extracted mucilage. The result revealed that water based extraction of mucilage has excellent flow properties. It has a good swelling index of 74.51 ± 0.503%. The gum was examined for purity by carrying out various phytochemical tests and showed that carbohydrates, alkaloids and amino acids were found to be present. The pH and surface tension of 1% solution of mucilage was found to be 8.10 ± 0.140 and 66.37 ± 0.968, respectively. The total ash value was found to be 6.23 ± 0.251 %. Extracted mucilage was insoluble in cold water and this property can be utilized for controlled drug delivery. The results of evaluated parameters showed that *Cordia dichotoma* mucilage has satisfactory pH and physicochemical properties, which can be used as pharmaceutical adjuvant in formulating various dosage forms.

KEYWORDS: *Cordia dichotoma*, Mucilage, Adjuvant, Isolation, Characterization.

INTRODUCTION

Pharmaceutical excipients may be defined as the additives used to convert pharmacologically active substances into pharmaceutical dosage form suitable for administration to the patients. [1] These pharmaceutical excipients obtained from the natural sources, play a more important

role as compared to the synthetic pharmaceuticals. These natural polysaccharides are being widely used in the pharmaceutical industry due to their advantageous properties such as low cost, relative abundance and biocompatibility as compared to their synthetic ones. These are used as gelling agent, binding agent, bulking agent, lubricating agent, sweetening agent, flavouring agent, and suspending agent.[2] Polymers derived naturally can be used in the formulation of sustained release dosage form by which desired properties can be obtained for the finished drug product.[1]

In sustained release dosage forms, release of drug is sustained due to the swelling property of these polymers by making a gel like thick layer which retard the release of drug. These polymers can be hydrophilic or hydrophobic in nature.[3]

Natural Gums are naturally occurring polysaccharides found in plants to which multiple sugar units are linked together to form large molecules. These gums are pathological products formed by breakdown of cell following injury to the plant (extracellular formation**:** Gummosis). Hence, Natural gums has its application in the pharmaceutical and food industries which are considered to be safe for human consumption.[4]

Mucilage is the metabolized product, produced within the cell and/or produced without injury to the plant. Mucilage is composed of polysaccharide uranides and proteins. Gums are pathological products, while mucilage is the physiological product which is the main difference between the gum and mucilage.[5] Gum has the property of swelling in aqueous media forming a highly viscous solution while mucilage forms slimy mass in water. Both gum and mucilage are produced by plants during injury which are amorphous, translucent. Mucilage, resin, cellulose and gum are differentiated by the condensation of hexane and pentose.[6-8]

Furthermore, natural gums can be used in food industry in which xanthan gum, flaxseed mucilage and mixture have been used to prepare reduced fat mayonnaise and they can be helpful in reducing fat, sugar, cholesterol etc.[9]

This article focuses on the extraction and characterization of mucilage from the seeds of *Cordia dichotoma* commonly known as Indian cherry, obtained from cordia oblique willed which is water soluble belonging to the family boraginaceae.[10] Seeds of cordia are used as

anthelmintic, astringent, diuretic, purgative, expectorant and having much more medicinal properties.[11]

MATERIAL AND METHODS

Plant Material: Seeds of *Cordia dichotoma* were collected from Kanpur (Uttar Pradesh, India) in the month of May-June, 2014. The plant was identified by Biotechnology Department, Gautam Buddh University, Gr. Noida and voucher specimens were deposited in that Department.

Extraction procedure: *Cordia dichotoma* (Indian cherry) was procured from the local market of Kanpur, India. Collected seeds was carefully washed and dried under shade for 24 h, and then further dried in oven at 30-40°C. Size was reduced with the help of grinder. Powdered seeds were passed through sieve no. #22 and then used for further evaluation.
Extraction of mucilage includes 3 steps.

Step 1: Extraction of mucilage:- Powdered seeds of *Cordia dichotoma* were used for the extraction of mucilage. The powdered seeds were added in 1000ml beaker containing 500ml of distilled water, and allowed it to boil for at least 3-4 h with continuous stirring and heating at 60°C for sufficient release of mucilage in water. Concentrated solution was then filtered through muslin cloth in order to separate marc from the filtrate and refrigerated for cooling (3-4°C).[12]

Step 2: Isolation of mucilage:- To the extract, equal quantity of ethyl alcohol was added for precipitation of mucilage to occur. The precipitated mucilage was washed with ethyl alcohol and then collected through filtration by muslin cloth. Mucilage was further dried in hot air oven at a temperature less than 40°C. The obtained dried mucilage was grinded and passed through sieve #22 and finally stored in air tight container.[13]

PHYSICOCHEMICAL CHARACTERIZATION OF ISOLATED MUCILAGE

Organoleptic characterization of isolated mucilage: mucilage extracted was characterized for various parameters like color, odor, taste, texture, and fracture.[14]

Identification Tests: aqueous extracts of the mucilage was prepared and mixed with Molish's reagent followed by addition of sulphuric acid. Appearance of violet color ring at junction, showing presence of carbohydrates.[15]

Determination of purity of mucilage: Purity of extracted mucilage was measured by performing tests like alkaloids, proteins, gum, fat, tannins and amino acids.[12, 13]

Swelling Index: swelling index of the powdered mucilage was calculated by weighing a butter paper of size 2X2 cm. then the butter paper was dipped in a petridish containing water and reweighed. After this 10 mg of the powdered sample was kept in a butter paper placing this on a petridish containing 15 ml of water and the swelling index was calculated at different intervals i.e. 15, 30, 45, 60, 120, 240, 360 minutes and the final result was calculated using the formulae (1).[14]

$$\text{Swelling Index} = \frac{\text{Initial Weight} - \text{Final weight}}{\text{Initial Weight}} \times 100 \quad (1)$$

pH of mucilage: Extracted mucilage was weighed to prepare 1%w/v solution in water. pH of the solution was determined using digital P^H meter.[14]

Solubility of Mucilage: Solubility was determined by shaking the powdered mucilage in different solvent such as acetone, ethyl alcohol, benzene, chloroform, and glycerine.[16]

Micromeritic properties

A) Bulk density and Bulkiness

Bulkiness is the inverse of bulk density. Fixed quantities of the isolated mucilage were transferred into a graduated measuring cylinder. The cylinder was placed on the bulk density apparatus and the volume covered by the mucilage was noted down. Then, the powder was tapped in a bulk density apparatus until a constant volume was obtained. The final bulk volume was noted.[17] Bulk density, tapped density, and bulkiness were calculated using the equation 2, 3, 4.

$$\text{Bulk density} = \frac{\text{Weight of powder}}{\text{Weight of apparent volume}} \quad (2)$$

$$\text{Tapped Density} = \frac{\text{Weight of powder}}{\text{Tapped volume}} \quad (3)$$

$$\text{Bulkiness} = \frac{1}{\text{Bulkiness}} \quad (4)$$

b) Angle of repose: angle of repose was determined by fixed height funnel method. The height (h) of the heap formed was measured and the radius (r) of the cone base was also observed and calculated.[18]

As, angle of repose was calculated using the equation 5

$$\tan \theta = h/r \quad (5)$$

θ = Angle of repose

h = Height of pile

r = Radius of pile

c) Carr's Consolidation Index (Compressibility) and Hausner's Ratio: Both the properties are calculated from the bulk density and tapped density. Finely powdered mucilage (5gm) was transferred into a measuring cylinder and compressibility, hausner's ratio were calculated using bulk density apparatus.[19]

$$\text{Carr's Index} = \frac{\text{Tapped density} - \text{Bulk density}}{\text{Tapped density}} \times 100 \quad (6)$$

$$\text{Hausner's Ratio} = \frac{\text{Tapped Density}}{\text{Bulk Density}} \quad (7)$$

Particle Size Determination: Particle size of the powdered mucilage was determined using optical microscope; and calculated using the equation (8),(9).

$$\text{Size of the particles} = \text{No. of particles in eye piece} \times \text{calibration Factor} \quad (8)$$

$$\text{Calibration Factor} = \frac{\text{Stage reading}}{\text{Ocular reading}} \times 0.01 \quad (9)$$

Surface tension: surface tension of the powdered mucilage was measured using stalagmometer, using drop weight method.[13] Binding property of the polymer is influenced by the surface tension.

Viscosity: Ostwald viscometer was used to determine the viscosity of isolated mucilage. In which, viscosity of 1% polymer solution was measured by comparing the flow times of isolated polymer solution with that of liquid whose viscosity is known.[14]

Ash Value: 2 g of powdered mucilage was weighed accurately in a china dish and kept in muffle furnace (500 °C) until the powdered sample is converted into ash and then reweighed.[13] Ash value was calculated using the equation (10).

$$\text{Total Ash value} = \frac{\text{Weight of ash}}{\text{Weight of polymer}} \times 100 \quad (10)$$

RESULTS AND DISCUSSION

Isolated mucilage was subjected to various evaluation parameters. Various chemical tests were performed for confirmation of various phytoconstituents. *Cordia dichotoma* mucilage gave positive test for carbohydrates, hexose sugar, alkaloids and amino acids and negative test for tannins, protein, fat and oils. Thus, it confirms that the mucilage contains carbohydrates, hexose sugar, alkaloids and amino acids. Other phytoconstituents as proteins, gum, fat, and tannins were absent in isolated mucilage as depicted in table No. 1.

Isolated mucilage was evaluated for organoleptic properties. It is tasteless and has characteristic odour. Fracture and texture was found to be rough and irregular. The results are shown in table No.2. The mucilage isolated from *Cordia dichotoma* was soluble in warm water and slightly soluble in cold water and insoluble in benzene, ether, chloroform, n-butanol, ethanol, acetone, glycerine, paraffin.

Various micromeritic studies was done for the mucilage as carr's index, angle of repose, bulk density, true density, bulkiness for flow behaviour. The angle of repose of the isolated mucilage was found to be 1.56 ± 0.160. It shows that it has excellent flow property, indicating that powder is free-flowing.

The bulkiness and carr's index value indicate that powder is heavy in nature and shows excellent flow properties as value of carr's index is 3.59 ± 0.150. The results are shown in table No. 3.

pH of 1% solution was found to be 8.10 ± 0.140 which is non-irritating to the mucous membrane. This shows good compatibility of the mucilage. Swelling index of isolated mucilage was found to be 74.51 ± 0.503% describing high swelling property and this property can be utilized in retarding the drug release up to desired time period and can be used in formulating controlled release drug delivery.

Surface tension of 1% solution was found to be 66.37 ± 0.968. It shows better penetrating and wetting ability of mucilage dispersion over the powder mass. Viscosity of 1% solution was found to be 8.47±0.315. The ash value of isolated mucilage was done to characterize the gum and comes out to be 6.23 ± 0.251 as shown in table no. 3.

A bruker ATR (Model – ALPHA, laser class- I, serial No. 200301, made in Germany) spectra showed that *Cordia dichotoma* mucilage contains amide, carboxylic acid, alkenes, allenes etc. as shown in fig.No.1 and the peak of these groups are shown in table No. 4.

Table 1: Phytochemical tests of isolated mucilage

S.No.	Test	Present/absent
1.	Carbohydrates	+
2.	Hexose sugar	+
3.	Monosaccharides	-
4.	Protiens	-
5.	Fats and Oils	-
6.	Tannins and Phenolic compounds	-
7.	Alkaloids	+
8.	Amino acids	+

+ Present, - Absent

Table 2: Organoleptic characterization of *Cordia dichotoma*

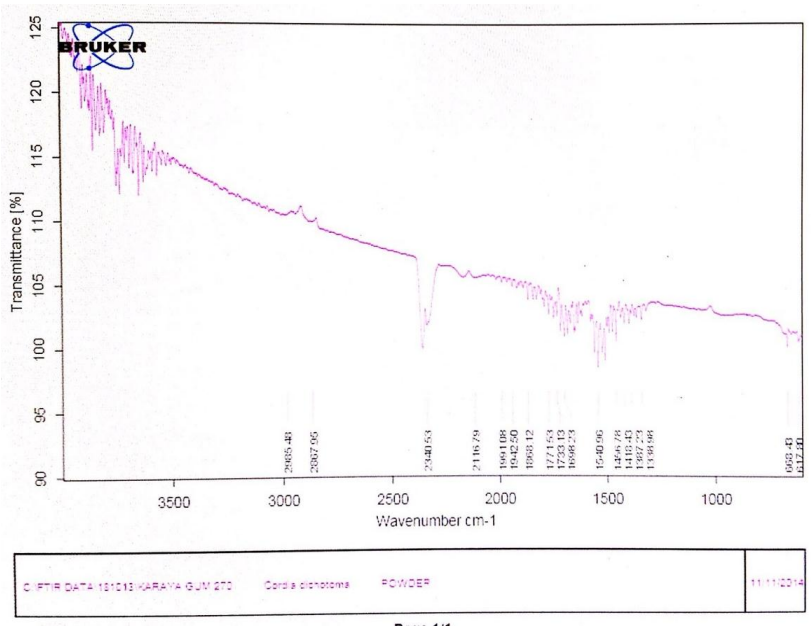
S.No.	Organoleptic properties	Result
1.	Color	Brown
2.	Odor	Characteristics
3.	Taste	Tasteless
4.	Texture	Irregular
5.	Fracture	Rough

Table 3: Micromeritic study data of isolated mucilage

S. No.	Parameters	Result (±S.D)
1.	Swelling Index	74.51%±0.503
2.	pH	8.10±0.140
3.	Surface tension (dyne/cm)	66.37±0.968
4.	Bulk Density (gm/ml)	0.722±0.015
5.	Bulkiness (ml/g)	1.38±0.028
6.	Tapped Density (gm/ml)	0.749±0.016
7.	Angle of repose (°)	1.56±0.160
8.	Carr's Index (%)	3.59±0.150
9.	Hausner's Ratio (%)	1.03±0
10.	Mean Particle Size (µ)	82.63±42.16
11.	Viscosity (poise)	8.47±0.315
12.	Ash Value (%)	6.23±0.251

Table No. 4: Functional groups and peaks in IR spectra of *Cordia dichotoma* mucilage

S. No.	Functional Group	Peak (Frequency) (cm^{-1})
1.	1387.23	C-H rock
2.	1418.43	C-H bend
3.	1456.78	C-H bend
4.	1540.96	Amide
5.	1698.23	C-C
6.	1733.13	Carboxylic acid
7.	1942.50	Allenes, Ketenes, isocyanates
8.	2340.53	Nitriles
9.	2867.95	C-H strech
10.	2985.48	C-H stretch



"Fig. 1"IR spectrum of *Cordia dichotoma* mucilage

CONCLUSION

From the whole study, it can be concluded that mucilage isolated from the seeds of *Cordia dichotoma* can be used as pharmaceutical adjuvant for drug delivery. The isolated polymer has pH value 8.1, so non-irritant in nature and has good biocompatibility. Various physicochemical studies showed that it was acceptable, suitable and has potential to be used as formulation additive in novel drug delivery systems for controlled drug delivery.

CONFLICT OF INTEREST

The authors declare no conflict of interest on the manuscript.

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REFERENCES

1. Thube Rahul, Purohit Suresh, Gothoskar Abhijit. Study of effect of custard apple pulp powder as an excipient on the properties of acetaminophen tablet. World Applied Sciences Journal, 2011; 12(3):364-371.
2. Nep Elijah I., Odumosu Patricia O., Ngwuluka Ndidi C., Olorunfemi Patrick O., Ochekpe Nelson A. Pharmaceutical properties and applications of a natural polymer from *Grewia mollis*. Journal of Polymers, 2013; Article ID 938726:1-8.
3. Malviya R., Srivastava Pranati, Kulkarni G.T. Application of mucilages in drug delivery-A review. Advances in Biological Research, 2011; 5(1):01-07.
4. Tekade Bharat W., Chaudhari Yogita A. Gums and mucilages: Excipients for modified drug delivery system. Journal of Advanced Pharmacy Education and Research, 2013; 3(4):359-367.
5. Bhaskar Darekar Avinash, Uttam Kahane Jyoti, Mahendrasingh Ashawat, Jayram Chavan Machhindra, Bhanudas Saudagar Ravindranath. Plant exudates and mucilage as pharmaceutical excipients. Journal of Advanced Pharmacy Education and Research, 2013; 3(4):387-402.
6. USP-NF. The official compendia of standers. Asian edition: 2008, pp. 1063,1067, 1261.
7. Kokate C.K., Purohit A.P., Gokhale S.B. Pharmacognosy. 14th ed., India; Nirali Prakashan: 2008, pp. 137,141, 146, 152.
8. Khar A. Pharmacognosy and Pharmacobiotechnology. 2nd ed., India; New Age International Limited: 2007, pp. 101, 103, 114, 115.
9. Hanan M.A., Al-Sayed, Rasmy Nagwa M.H., R.S. Rizk Ibrahim, E.I. Yousef Emam. Functional properties of some fat-Repalcers and their uses in preparation of reduced-fat mayonnaise. World Journal of Dairy and Food Sciences, 2012; 7(10):109-119.
10. Deore Sumit R., Mandeo Ajay G. Pharmacognostic evaluation and preliminary phytochemical screening of *Cordia dichotoma* Forst fruits. International Journal of Pharma and Biosciences, 2013, 4(2):961-965.

11. Sharma U.S., Sharma U.K., Sutar N., Singh A., Shukla D.K. Anti-inflammatory activity of *Cordia dichotoma* forst f. seeds extracts. International Journal of Pharmaceutical Analysis, 2010; 2(1):01-04.
12. Malviya R., Srivastava P., Bansal M., Sharma P.K. Mango peel as superdisintegrating agent. Journal of Scientific and Industrial Research, 2010; 69:688-690.
13. Kumar P., Kulkarni G.T. Characterization of mucilage from artocarpus heterophyllus as pharmaceutical excipient. Journal of Chronotherapy and Drug Delivery, 2013; 4(1): 31-43.
14. Lala, P.K. Practical Pharmacognosy. Calcutta; Lina Guha: 1981, pp. 135.
15. Gaud R.S., Gupta G.D. Practical Physical Pharmacy. Ist ed., CBS Publishers and distributors pvt. Ltd.: 2001, pp. 58.
16. Kulkarni G.T., Gowthamarajan K., Rao B., Suresh B. Evaluation of binding properties of selected natural gums. Journal of Scientific and Industrial Research, 2002; 61:529-532.
17. Malviya R., Srivastava P., Bansal M., Sharma P.K. Preparation and evaluation of disintegrating properties of *Cucurbita maxima* pulp powder. International Journal of Pharmaceutical Sciences, 2010; 2(1):395-397.
18. Malviya R. Extraction and characterization of selected mucilage as a pharmaceutical excipients. Polim.Med., 2011; 41(3):39-44.
19. Gween M.J., Joseph R.R., Rhodes C.T. Modern Pharmaceutics. New York; Marcel Dekker: 1996, pp. 58.