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Isolation and Characterization of Mucilage from *Cinnamon verum*

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ABSTRACT

From the last few decades the importance of search for natural polymer as pharmaceutical excipients has been increasing due to their various advantages. Natural polymer has been used in different pharmaceutical formulations. They are easily available, non-toxic, biodegradable and less cost. The synthetic polymers used as excipients suffer from many disadvantages such as high cost, toxicity, non-biodegradable and environmental pollution caused during their synthesis. In the present study, mucilage was isolated from the bark of *Cinnamon verum*. The mucilage was extracted using distilled water and isolated by the two methods such as precipitation with ethanol and acetone. The mucilage was characterized by various physicochemical properties such as solubility, pH, swelling index, loss on drying and preliminary phytochemical studies. The micrometric properties of mucilage such as bulk and tapped densities, Carr's index, Hausner's ratio and angle of repose were also evaluated. The result showed that extracted Cinnamon mucilage exhibited good flow properties (Angle of repose 20°.45″), loss on drying was 1.6%, Swelling index was 31.8% and pH was found to be 7.0. Extracted mucilage swells in water and slightly soluble in organic solvents. The preliminary phytoconstituents studies showed the presence of carbohydrates, mucilage and phenolic compounds. FT-IR studies show that presence of O-H and aliphatic C-H stretching. Results of evaluated parameters showed that cinnamon derived mucilage can be used as pharmaceutical excipients to formulate different dosage form. It has acceptable pH and organoleptic properties, so can be easily used in various dosage form.

Keywords: Excipients, *Cinnamon verum,* isolation, mucilage, extraction.

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INTRODUCTION

Excipients are the largest components of any pharmaceutical formulation. They can be of natural or synthetic origin and synthetic excipients have become commonplace in today's pharmaceutical dosage forms. [1] It is common knowledge that both synthetic and

semi-synthetic products have enjoyed a long history of use, frequently offering unique properties and advantages over naturally derived compounds, including a low sensitivity to various ingredients or moisture, resulting in more efficient and effective pharmaceutical products. [2]

These pharmaceutical excipients obtained from the natural sources play a more important role as compared to the synthetic pharmaceuticals. [3] 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. Natural polymers are obtained from either plant origin or Animal origin. These natural polymers are used as gelling agent, binding agent, bulking agent, lubricating agent, sweetening agent, flavoring agent and suspending agent. The characterization of pharmaceutical excipients using a material science approach has helped in the design of drug formulations to obtain a desired set of performance properties. Characterization of excipients becoming increasingly apparent that there is an important relationship between the properties of the excipients and the dosage forms containing them. Preformulation studies demonstrate their influence on stability, bioavailability and the process by which the dosage. Forms are prepared. This calls for the need for acquiring more information and use standards for excipients.

Mucilage is water soluble, sticky and gummy substance obtained from some plants. In plants, it acts as a membrane thickener and food reserve. [4] Mucilage occurs in almost all classes of plants in various parts of the plant, including marshmallows, flaxes, and certain seaweeds in relatively small percentages and other substances such as alkaloids and tannins are also rarely found.

Cinnamon is an important spice obtained from the inner bark of several tree species from the genus *Cinnamomum*. [5] The bark of cinnamon is usually mid-brown colour. Cinnamon is the general name for several species of trees and the commercial spice products that some of them produce. It belongs to the family *Lauraceae*. Only a few *Cinnamon* species are grown commercially for spice. Indonesia and China contribute 76% of the world's production of cinnamon. The aroma and flavor of cinnamon derive from its essential oil and principal component, cinnamaldehyde, as well as numerous other constituents, including eugenol. However there are no reports on isolation and characterization of mucilage of *Cinnamon verum*. Hence the present study was designed for isolation and characterization of mucilage from *Cinnamon verum* stick.

MATERIALS AND METHODS

Cinnamon barks were procured from the local market of Goa. All the other solvents, reagents and chemicals used were of analytical grade.

Isolation of mucilage

Precipitation with Alcohol

50 g of cinnamon bark powder was taken. This was then soaked in distilled water for 12 hours. The soaked powder was then boiled for 15 minutes. It was then filtered using a muslin cloth with 8 folds. The filtrated so obtained was precipitated using ethanol. The mucilage was separated using many methods like filtration using a funnel and then evaporation. The mucilage obtained was dried and stored.

Precipitation with Acetone

50 g of cinnamon bark powder was taken. This was then soaked in distilled water for 12 hours. The soaked powder was boiled for 20 minutes. It was then filtered using muslin cloth. The filtrate was then precipitated using acetone. The precipitated mucilage was separated and dried.

Characterization of isolated mucilage

Physical characterization

The dried mucilage was studied for the percentage yield, appearance, solubility, pH, swelling index. [6]

Solubility test: The mucilage was tested for solubility using various solvents.

pH of Mucilage: 1% w/v solution of mucilage was prepared in water and the pH was determined using pH meter.

Swelling index: 500 mg of isolated mucilage was taken in a Petri dish and then 10 ml of distilled water was added and the mixture was shaken and allowed to stand for 1 hour. After 1 hour the remaining water in the petri dish was discarded and the weight increase of the isolated mucilage was determined.

$$\text{Swelling Index (SI)} = (W_2\text{-}W_1) / W_1 \text{ X } 100$$

Where W_1= weight at time "0" W_2= weight at time "t".

Loss on drying: 500 mg of mucilage (W) was taken in the watch glass and weighed (W1). Then the watch glass was kept in the oven at 105°C, for 3 hours. After 3 hours the watch glass was cooled and weighed again (W2) till the weight was constant.

$$\text{\% of loss on drying} = (W_2\text{-}W_1) / W \text{ X } 100$$

Where W_2 is the weight of the crucible after ignition, W_1 is the weight of the empty crucible, W is the weight of the substance.

Chemical characterization

Preliminary phytochemical studies

The mucilage was tested for preliminary phytochemicals such as carbohydrates, alkaloids, oils and fats, phenolic compound, mucilage, proteins, polysaccharides etc.

FT-IR Spectral analysis

The isolated mucilage was screened for FTIR analysis to find the stretching frequency using IR Affinity-1, Shimadzu, Japan in the range of 400-4000 cm^{-1}.

Micrometric evaluation

Bulk density (D_b): It was determined by taking the quantity of the dried mucilage in a measuring cylinder with the help of large funnel and recording the volume and weight of the dried mucilage. It is expressed in g/mL.

Bulk density (D_b) =M/V_b

Where, M=mass of the particle, V_b=total volume of packing

Tapped density (D_t): It was determined by taking accurately weighed quantity of the dried mucilage in a measuring cylinder and recording the volume of granules after 300 tapping and weight of the total granules. Ti was expressed in g/mL.

Tapped density (D_t) = M/V

Where, M= weight of the granules (g), V= tapped volume of granules (mL)

Carr's index: It is an important measure that can be obtained from the bulk and tapped densities.

Carr's index (%) = (Db – Dt) / Dt × 100

Hausner's ratio: It indicates the flow properties of the powder and is measured by the ratio of tapped density to the bulk density.

Hausner's ratio =D_t /D_b

Angle of response: The funnel was fixed with its tip at a given height (h), above a flat horizontal surface on which a paper was placed. The powder was taken in the funnel and the test sample was allowed to flow smoothly, till the apex of the conical pile just touches the tip of the funnel. The height and the diameter of the powder cone was measured and angle of response (θ) was calculated by using the equation,

Tan (θ) =h/r

Where, θ =angle of response, h =height of the heap of powder, r =radius of the base of the powder.

RESULTS AND DISCUSSIONS

Isolation of mucilage

From the two methods employed such as acetone precipitation and ethanol precipitation method, acetone precipitation method was preferred since it gave high yield.

Characterization of the isolated mucilage

Physical characterization

The percentage yield of the mucilage was found to be 1.6% (Table 1). The mucilage was appeared to be brown in colour (Fig. 1).

Solubility

The solubility test was performed using various solvents. The mucilage was slightly soluble in chloroform, pet ether, diethyl ether and ethyl acetate. It was insoluble in ethanol and acetone. The results are tabulated in Table 2.

pH of Mucilage

The pH of 1% w/v solution of the mucilage was found to be in the range of 6.2-7.0. This indicates neutral pH. Therefore the mucilage can be used in the various formulations, and hence will not alter the pH of the dosage form.

Loss on drying

Loss on drying of the mucilage was found to be 1.6%. This showed the moisture content of the mucilage and its hygroscopic nature.

Swelling index

The swelling index of the isolated mucilage was found to be 31.8%. As the time increases, the swelling also increased. This indicated that the mucilage has good water absorbing capacity and it can retain water for a longer time. As the concentration of the mucilage increased the swelling index also increased.

Table 1: Physical characters of the mucilage

S. No.	Physical characters	Observations
1	Percentage yield	1.6%
2	pH	6.2-7.0
3	Appearance	Brown in colour
4	LOD	1.6%
5	Swelling index	31.8%

Table 2: Solubility of the mucilage with various solvents

Solvents	Observations
Ethanol	Insoluble
Chloroform	Slightly soluble
Water	Swells
Pet ether	Slightly soluble
Diethyl ether	Slightly soluble
Acetone	Insoluble
Ethyl acetate	Slightly soluble
Methanol	Insoluble

Table 3: Preliminary phytochemical analysis

Test	Observations
Carbohydrates	+
Polysaccharides	-
Mucilage	+
Amino acids	-
Phenolic compounds	-
Alkaloids	-
Flavanoids	-
Fats and oils	-
Reducing sugar	-

(+) Present, (-) Absent

Table 4: Interpretation of the spectra of the mucilage

Functional group	Type of Vibration	Characteristic Absorption(cm^{-1})
O-H	(stretch, H-bonded)	3287
C-H(alkane)	Stretch	2922
C=0	stretch	1703

Table 5: Micrometric Analysis of the isolated mucilage

Property	Observation
Bulk density (D_b)	0.6 gm/cc or gm/ml
Tapped density (D_t)	0.75 gm/cc or gm/ml
Carr's index	20%
Hausner's ratio	1.25
Angle of repose	20°.45″

Fig. 1: Isolated mucilage

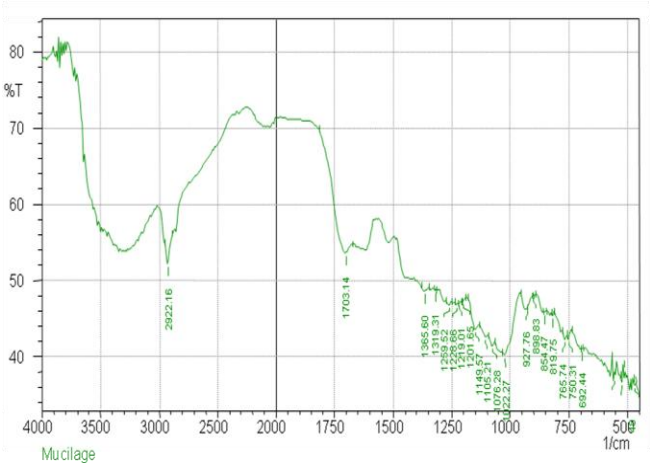

Fig. 2. FT-IR spectra of the mucilage

Chemical characterization:

Preliminary phytochemical analysis

The mucilage was tested for chemical characteristics. Test for carbohydrates, alkaloids, glycosides, phenolic compounds, mucilage, amino acids, polysaccharides, oils and fats etc were conducted. The preliminary phytoconstituents studies showed the presence of carbohydrates, mucilage and phenolic compounds in the isolated mucilage which further confirmed the presence of the mucilage. The results are presented in Table 3.

FT-IR spectral analysis

The spectra of the mucilage were taken using FTIR (IR Affinity-1 Shimadzu) in the range of 400-4000 cm^{-1}. The spectra of the mucilage (Table 4 & Fig. 2) showed peaks at 3287, 2922, 1703 cm^{-1}, these could be due to O-H stretching, aliphatic C-H stretching, respectively

Micrometric evaluation

The micrometric parameters such as bulk density (Db), Tapped density (Dt), Carr's Index, Hausner's ratio, Angle of repose of the isolated mucilage are presented in Table 5.

The isolated mucilage powder had good flow, as indicated in Table 5. Bulk density of a powder is mainly dependent on particle size, particle size distribution and particle shape. It is an indirect measure of granule flow and determines the die fill volume. Granules having higher bulk density require relatively lower die fill volume than those having small bulk density. The granules occupied larger volume making the bulk density value lower than smaller granules occupying smaller bulk volume. Table 5 also show that the granules of mucilage have Carr's compressibility index value 20% which implying the granules have excellent flow property. The Hausner's ratio was also observed to be less than 1.25, which also confirmed that the granules have good flow property.

Natural polymers play a vital role in the drug delivery. So, the selection of Natural polymer plays an important role in drug manufacturing. But, while selecting Natural polymers care has to be taken regarding its toxicity, drug compatibility and degradation pattern. Natural gums are promising biodegradable polymeric materials. Many studies have been carried out in fields including food technology and pharmaceuticals using gums and mucilages. Several polymers from plant origin have been successfully used as excipient sustained release drug delivery. These semisynthetic polymers are extensively used in the formulation of conventional dosage forms.

The project deals with the isolation of mucilage from natural source i.e. *Cinnamommun verum* and its physico-chemical and Micrometric characterisation. The chemical characterization of mucilage revealed the presence of carbohydrates. The physical characterization of mucilage was all in range which indicates it is safe to be used as excipients. The micrometric characterization indicated the good flow property of mucilage.

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