RESEARCH ARTICLE

Isolation, Characterization and Evaluation of *Mimosa pudica* and *Psidium guajava* Seed Mucilage

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ABSTRACT

Natural polymers such as gum mucilage extracted from medicinal plants have gained significant interest in pharmaceutical and food industries due to their biocompatibility, biodegradability, and diverse functional properties. This study focuses on the characterization of mucilage obtained from *Mimosa pudica* and *Psidium guajava*. The mucilage was extracted, purified, and subjected to physicochemical, rheological, and structural analysis. Key parameters such as solubility, swelling index, pH, viscosity were evaluated. The results indicate that both mucilages exhibit excellent water-holding capacity, gel-forming ability, and stability, making them suitable candidates for pharmaceutical and industrial applications.

Keywords: *Mimosa pudica*, *Psidium guajava*, Gum Mucilage, Natural Polymer, Rheology, FTIR, Biocompatibility.

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INTRODUCTION

Natural gums and mucilages obtained from plants have been extensively studied due to their potential applications in drug delivery, food technology, and biomedical fields. *Mimosa pudica* (sensitive plant) and *Psidium guajava* (guava) are known for their medicinal properties and the presence of polysaccharide-rich mucilage in their leaves and stems. These mucilages possess unique physicochemical and bioadhesive properties, making them potential excipients in pharmaceutical formulations. [1,2]

Mucilage is a complex polysaccharide with hydrophilic characteristics, allowing it to swell in aqueous solutions and form stable gels. The objective of this study is to extract and characterize the mucilage from *Mimosa pudica* and *Psidium guajava* by evaluating their physicochemical properties, rheology, and structural composition. [3]

METHODOLOGY

Collection and Authentication of Plant

The fruits of *Psidium guajava* L. and seed of *Mimosa pudica* L were collected from the nearby area in Jaipur. The fruits of *Psidium guajava* L. and the entire plant with seed of *Mimosa pudica* L were identified and authenticated by Sriman lal Meena, Scientist, Jodhpur. The specimen BSI/AZRC/A-12012/ Tech 2024-25(Pl.Id.)/ 568 dated 27/11/2024 for the plant has been deposited in the institution. [4]

Extraction of gum mucilage from natural polymers

In this section, we will discuss the methods for extracting gum mucilage from natural polymers, along with the types of gums commonly extracted and the steps involved in the extraction process.

Extraction of *Mimosa pudica* L. Mucilage

About 2 kg of fresh *Mimosa pudica* L seed was washed with water. The seed was crushed and soaked in water for 5-6 hours, boiled for 30min and left to stand for 1 hour to allow complete release of the mucilage into the water. The mucilage was extracted using a multi-layer muslin cloth bag to remove the marc from the solution. Acetone (in the quantities of three times the volume of filtrate) was added to precipitate the mucilage. Later the mucilage was separated, dried in an oven at 50^0C, collected, grinded passed through a #80 sieve and stored in desiccator at 30^0 C and 45% relative humidity till use.

Extraction of *Psidium guajava* L. Mucilage

Halves ripen and fresh fruits of *Psidium guajava* L. had been washed by water nicely to take away the dust and debris. Then they were treated with chloroform and petroleum ether to remove piles and pigments and fat and then skin and seeds were removed.

Removal of seeds was achieved using sieve no 10, having pore size greater than the size of the seed. The seed portion of the pulp was removed mixed with water passed through the sieve 10; the collected water was again used for further steps.

The pulp part of the fruit was sliced, mixed to get semisolid mass, desired quantity was transferred to a beaker and soaked in distilled water for a period of 2 hrs to exert complete mucilage into water. After 2 hrs the solution pH was adjusted to 4.5 using 10% tartaric acid solutions, boiled by conventional heating under reflux for a period of 1 hr, cooled to room temperature and then subjected to

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Table 1. Solubility of *Mimosa pudica* Mucilage Powder (MPM)

S.No.	Solubility Observations	
	Solvents	*Mimosa pudica* Mucilage Powder (MPM)
1	Cold water	Swell in cold water
2	Hot water	Soluble
3	pH 1.2	Soluble
4	pH 6.8	Soluble
5	Ethanol	Insoluble
6	Acetone	Insoluble

Table 2. Solubility of *Psidium guajava* Mucilage Powder (PGM)

S.No.	Solubility Observations	
	Solvents	*Psidium guajava* Mucilage Powder (PGM)
1	Cold water	Swell in cold water
2	Hot water	Soluble
3	pH 1.2	Soluble
4	pH 6.8	Soluble
5	Ethanol	Insoluble
6	Acetone	Insoluble

centrifugation. The supernatant solution was mixed with 3 volumes of water to precipitate the mucilage. The precipitated mucilage was filtered through the muslin cloth, dried in air then at below 50°C temperature. The extraction yield was calculated by the following formula. [4]

$$Extraction\ Yield = \frac{\text{Weight of the mucilage powder}}{\text{Weight of the } Psidium\ guajava \text{ fruit materials}} * 100$$

Physicochemical Characterization of extracted polymer

Solubility of extracted polymer

Table 3. Swelling index of *Mimosa pudica* Mucilage Powder (MPM)

S.No.	*Mimosa pudica* Mucilage Powder (MPM)	
	Solvents	*% Swelling Index*
1	Water	17.50±0.20
2	pH 1.2	20.50±0.40
3	pH 6.8	13.50±0.10

Table 4. Swelling index of *Psidium guajava* Mucilage(PGM) powder

S.No.	*Psidium guajava* Mucilage Powder (PGM)	
	Solvents	*% Swelling Index*
1	Water	19.00±0.20
2	pH 1.2	21.50±0.10
3	pH 6.8	16.50±0.30

Table 5. Melting point of *Mimosa pudica* Mucilage Powder (MPM)

S.No.	Melting Point(^{0}C)	Average Melting Point(^{0}C)
1	130.6	
2	128.5	129.2±0.3
3	128.5	

The solubility of the dried extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) and *Psidium guajava* Mucilage(PGM) Powder was tested solubility in various solvents like water, chloroform, ethanol and acetone

Swelling Index of extracted polymer

The swelling index of the *Mimosa pudica* Mucilage Powder (MPM) was calculated by weighing a butter paper of size 2 cm × 2 cm, after this the butter paper was dipped in a Petri dish containing water and reweighed the wet butter paper again. After this, 20 mg of the powdered mucilage was kept in a butter paper placing this on a Petri dish containing 15 ml of water and the swelling index was calculated and the final result was calculated using the formula. The experiment was repeated using 0.1 N HCl

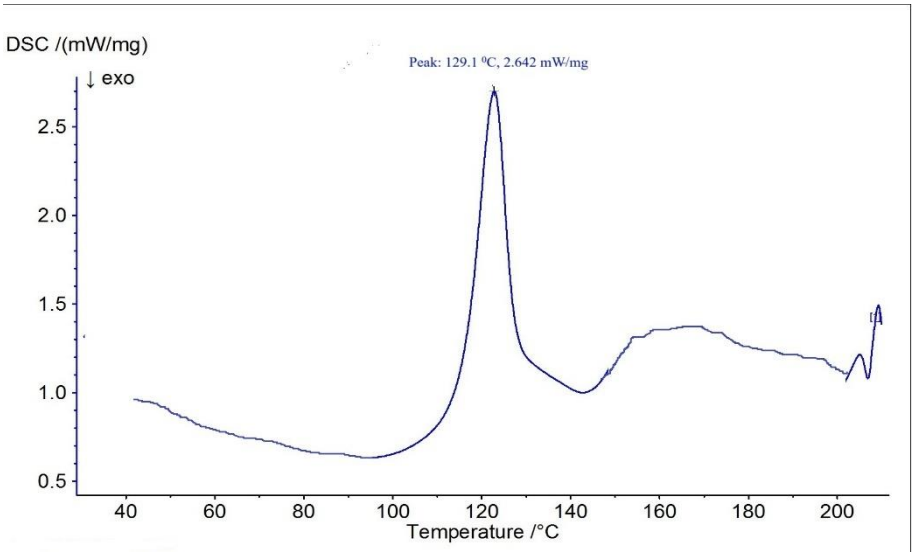

Figure 1. DSC of *Mimosa pudica* mucilage powder(MPM) extracted powder

Table 6. Melting point of *Psidium guajava* Mucilage(PGM) powder

S.No.	Melting Point(^{0}C)	Average Melting Point (^{0}C)
1	135.2	
2	136.5	136.4.±0.4
3	137.5	

Table 7. Loss of drying of extracted polymer

S.No.	Extracted Polymer	% Loss on drying
1	*Mimosa pudica* Mucilage Powder (MPM)	1.47±0.03
2	*Psidium guajava* Mucilage(PGM) Powder	2.70±0.05

Table 8. Total Ash (%) of extracted polymers

S.No.	Extracted Polymers	% Total Ash
1	*Mimosa pudica* Mucilage Powder (MPM)	73.47±0.07
2	*Psidium guajava* Mucilage (PGM) Powder	64.83±0.06

Table 9. Acid Insoluble Ash

S.No.	Extracted Polymers	Acid Insoluble Ash (%)
1	*Mimosa pudica* Mucilage Powder (MPM)	10.91±0.04
2	*Psidium guajava* Mucilage (PGM) Powder	13.25±0.06

Table 10. pH values of extracted polymer

S.No.	Extracted Polymers	pH value
1	*Mimosa pudica* Mucilage Powder (MPM)	5.8±0.4
2	*Psidium guajava* Mucilage (PGM) Powder	6.1±0.3

Table 11. Viscosity of extracted polymers

S.No.	Extracted Polymers	Viscosity (MPas)
1	*Mimosa pudica* Mucilage Powder (MPM)	9300 ±40
2	*Psidium guajava* Mucilage (PGM) Powder	8500 ±50

and phosphate buffer solution (pH 6.8).
The swelling
index was measured using following equation. [5]

$$Swelling\ Index = \frac{Initial\ weight\ of\ the\ mucilage - Final\ weight\ of\ the\ mucilagx}{Initial\ weight\ of\ the\ mucilage} * 100$$

The test was again carried out using 0.1N Hydrochloric acid and phosphate buffer solution (pH 6.8).
The test was again carried out with another *Psidium guajava* Mucilage(PGM) powder with above procedure.

Melting point of extracted polymers

The melting point determination of the extracted polymer mucilage powder was done by using the melting point apparatus. A small amount of extracted polymer mucilage powder was taken in a capillary tube and it was kept in the melting point apparatus. The reading of melting point was taken in triplicate and noted. [6]

Loss of drying of extracted polymer

Loss on drying of the extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) and *Psidium guajava* Mucilage(PGM) Powder was carried out by the IP method. Accurately weighed extracted polymers (1g) in a petri dish were dried in a hot air oven at 105ºC until a constant

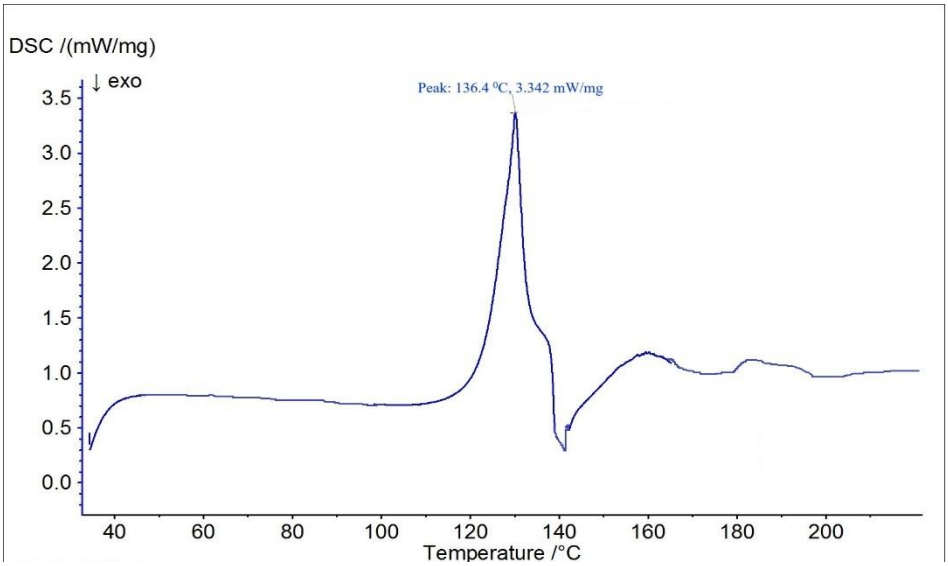

Fig 2:- DSC of *Psidium guajava* Mucilage (PGM) extracted powder

Table 12. Detection of Carbohydrates

S.No.	Test for carbohydrates	
	Extracted Polymers	Observation
1	*Mimosa pudica* Mucilage Powder (MPM)	Present
2	*Psidium guajava* Mucilage (PGM) Powder	Present

weight was attained. The moisture content was calculated the ratio of moisture loss in percentage. Loss on drying is the loss of weight expressed as a percentage w/w resulting from water and volatile matter of any kind that can be driven off under specified conditions. The test can be carried out on a well-mixed sample of the substance.

$$\text{Loss on drying} = \frac{\text{Initial weight of substance} - \text{Final weight of substance}}{\text{Initial weight of substance}} * 100$$

Total Ash of extracted polymers

Accurately weighed extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) and *Psidium guajava* Mucilage(PGM) Powder (1g) separately were transferred into a crucible, kept in an incinerator and ignited at a temperature not exceeding 450°C and weighed. Total ash was determined by the following formula. [7,8]

$$Total\ ash = W2 - W1\ /Wp \times 100$$

Where,

W_1= weight of empty crucible and

W_2 =weight of crucible after ignition,

W_p = weight of extracted polymers.

Acid Insoluble Ash

Acid-insoluble ash value was determined by boiling the 2 g of ash for 5 min with 25 ml of 2 M HCl. The insoluble matter was filtered and collected on an ashless filter paper washed with hot water and ignited in a tarred crucible at a temperature not exceeding 450° for 4 h. The insoluble matter was cooled in desiccators and weighed. The percent of acid-insoluble ash was calculated with reference to the air-dried drug using the following formula.

$$Acid\ insoluble\ ash\ \% = \frac{Weight\ of\ acid\ insoluble\ ash}{Weight\ of\ crude\ drug\ taken} \times 100$$

pH of extracted polymers

The extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) and *Psidium guajava* Mucilage (PGM) Powder were weighed and dissolved in water (1 g in 100 ml) to get a 1% w/v solution. The pH of the solution is determined using digital pH meter. Again, the process was repeated for 5% and 10 %. [9]

Viscosity of extracted polymers

10%w/v solution of extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) and *Psidium guajava* Mucilage (PGM) Powder was prepared by dissolving in boiled water (100°C) respectively. After cooling the apparent viscosity was determined using a Brookfield viscometer; spindle-64 at 50 rpm

Detection of Carbohydrates

Molisch's test: 1 ml of the extract, 2 drops of Molisch's reagent, and 2 ml of pure (H_2SO_4) sulfuric acid were carefully added along with the side of the test tube. At the intersection, a violet ring that formed suggested the presence of carbohydrates.

Table 13. Detection of Proteins

S.No.	Test for Proteins	
	Extracted Polymers	Observation
1	*Mimosa pudica* Mucilage Powder (MPM)	Absent
2	*Psidium guajava* Mucilage (PGM) Powder	Absent

Table 14. Detection of Alkaloids

S.No.	Test for Alkaloids	
	Extracted Polymers	Observation
1	*Mimosa pudica* Mucilage Powder (MPM)	Absent
2	*Psidium guajava* Mucilage (PGM) Powder	Absent

Detection of Proteins

Millon's test: To mix 1-2 ml of sample, add 1 ml of Million's reagent, if required, heat the solution till it boils and observe the pink to brick red precipitate. [10]

Detection of Alkaloids

Wagner's test: Take 1-3 ml of filtrate sample with a few drops of Wagner's reagent to give a reddish brown ppt that is formed.

Dragendroff's test: Take 2-3 ml of the filtrate sample and add a few drops of Dragendroff's reagent. An orange-brown precipitate is formed.

Detection of Tannins

Ferric chloride test: The sample should first be dissolved in water and ethanol, and then drops of a diluted ferric chloride solution ($FeCl_3$) should be added. Phenols are present when the sample develops a red, green, purple, or blue colorations

Detection of Gum

Ruthenium test: Observe a little volume of dried gum powder under a microscope after mounting it on the slide with ruthenium red solution. If a pink colouration appears, mucilage is present. [11]

Detection of Chloride

Add a few drops of the 10% $AGNO_3$ solution to the 3 ml of HNO_3-prepared test solution. $AgCl_2$ is noticed as white dilutable ppts in nitrate solution

Detection of Sulphate

Fill the 5 ml filter with a few drops of the 5% $BACl_2$ solution. $BASO_4$ appears as a white crystalline ppt. that is insoluble in HCL. Lead acetate with the reagent results in a white ppt that is soluble in NaOH. [12,13]

RESULTS AND DISCUSSION

Physicochemical Characterization of extracted polymer

Solubility of extracted polymers

The results was obtained and reported in to the given table 1,2.

The dried extracted of *Mimosa pudica* Mucilage Powder (MPM) was soluble in the hot water, acid buffer pH 1.2, Phosphate Buffer pH 6.8 but insoluble into the organic solvents like ethanol and acetone.

The dried extracted of *Psidium guajava* Mucilage Powder

Table 15. Detection of Tannins

S.No.	Test for Tannins	
	Extracted Polymers	Observation
1	*Mimosa pudica* Mucilage Powder (MPM)	Absent
2	*Psidium guajava* Mucilage (PGM) Powder	Absent

Table 16. Detection of Gum

S.No.	Test for Gum	
	Extracted Polymers	Observation
1	*Mimosa pudica* Mucilage Powder (MPM)	Present
2	*Psidium guajava* Mucilage (PGM) Powder	Present

Table 17. Detection of Chloride

S.No.	Test for Chloride	
	Extracted Polymers	Observation
1	*Mimosa pudica* Mucilage Powder (MPM)	Absent
2	*Psidium guajava* Mucilage (PGM) Powder	Absent

Table 18:- Detection of Sulphate

S.No.	Test for Sulphate	
	Extracted Polymers	Observation
1	*Mimosa pudica* Mucilage Powder (MPM)	Absent
2	*Psidium guajava* Mucilage (PGM) Powder	Absent

(MPM) was soluble in the hot water, acid buffer pH 1.2, Phosphate Buffer pH 6.8 and insoluble into the organic solvents like ethanol and acetone.

Swelling Index of extracted polymer

The results was obtained and reported in to the given table 3.

Swelling index is very important and was the most widely accepted general mechanism of action for drug release. Thus, from Table 3, it could be concluded that the *M. pudica* mucilage has the swelling index of isolated mucilage was found to be 17.50±0.20 % in water, 20.50±0.40 % in pH 1.2, and 13.50±0.10% in phosphate buffer 6.8 . It has less swelling property, and this property can be used as rate controlling agent in various pharmaceutical formulations. The test was again carried out with another extracted *Psidium guajava* Mucilage(PGM) powder in to water. The results was reported in the given below table 4.

Swelling index is very important and widely accepted general mechanism of action for drug release. Thus, from Table 4 , it could be concluded that the *Psidium guajava* mucilage has the swelling index of isolated mucilage was found to be 19.00±0.20% in water,21.50±0.10% in pH 1.2, and 16.50±0.30% in phosphate buffer 6.8 . It has less swelling property, and this property can be used as rate controlling agent in various pharmaceutical formulations.

Melting point of extracted polymers

The melting point *Mimosa pudica* Mucilage Powder (MPM) was done by using the melting point apparatus and melting point was obtained 129.2±0.3^{0}C. The reading of melting point was taken in triplicate which was represented into the table 5. DSC of *Mimosa pudica* mucilage powder(MPM) extracted powder in shown in fig 1.

Melting point of *Mimosa pudica* mucilage powder(MPM) was confirmed by the DSC. DSC thermograph peak was observed at 129.1 ^{0}C. (shown in figure 1)

The melting point of *Psidium guajava* Mucilage (PGM) extracted powder was found to be 136.4.±0.4 was done by using the melting point apparatus. The reading of melting point was taken in triplicate which was represented into the table 6. DSC of *Psidium guajava* Mucilage (PGM) extracted powder is shown in fig 2.

Melting point of *Psidium guajava* Mucilage (PGM) extracted powder was confirmed by the DSC. DSC thermograph peak was observed at 136.4 ^{0}C.

Loss of drying of extracted polymer

The weight loss on drying indicated that some amount of moisture was present in the material which is available to interact with other material at the time of formulation of different solid dosage forms. Loss on drying of the extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) was found 1.47±0.03 and in the *Psidium guajava* Mucilage(PGM) Powder was found 2.70±0.05 as shown in table 7.

Total Ash of extracted polymers

Total ash value observed for extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) and *Psidium guajava* Mucilage(PGM) Powder 73.47±0.07% and 64.83±0.06 respectively. Total ash value was determined and noted into the below table 8.

Acid Insoluble Ash

Acid insoluble ash value observed for extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) and *Psidium guajava* Mucilage(PGM) Powder 10.91±0.04% and 13.25±0.06 respectively. The percent of acid-insoluble ash was calculated with reference to the air-dried drug and results was given below the table 9.

pH of extracted polymers

The pH of 1% w/v solution of extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) and *Psidium guajava* Mucilage(PGM) Powder was obtained 5.8±0.4 and 6.1±0.3 respectively. Results are displayed in table 10.

Viscosity of extracted polymers

Viscosity was determined and noted into the below table 11.

Detection of Carbohydrates

Molisch's test

Both extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) and *Psidium guajava* Mucilage (PGM) Powder was given the positive result for carbohydrate . They have the carbohydrate in the extracted powder. Results of test are given in table 12.

Detection of Proteins

Both extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) and *Psidium guajava* Mucilage (PGM) Powder was given the negative response for proteins test . They don't have the proteins in the extracted powder. Results of protein test in given in table 13.

Detection of Alkaloids

Both extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) and *Psidium guajava* Mucilage (PGM) Powder was given the negative response for Alkaloids test They don't have the alkaloids in the extracted powder. Results of alkaloids test in given in table 13.

Detection of Tannins

Both extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) and *Psidium guajava* Mucilage (PGM) Powder was given the negative response for tannins test . They don't have the tannins in the extracted powder. Results of test for tannins in given in table 15.

Detection of Gum

Both extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) and *Psidium guajava* Mucilage (PGM) Powder was given the positive response for gum determination . They have the gum in the extracted powder. Results of test for gum in given in table 16.

Detection of Chloride

Both extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) and *Psidium guajava* Mucilage (PGM) Powder was given the negative response for chloride test . They don't have the chloride in the extracted powder. Results of test for chloride in given in table 17.

Detection of Sulphate

Both extracted polymers of *Mimosa pudica* Mucilage Powder (MPM) and *Psidium guajava* Mucilage (PGM) Powder was given the negative response for sulphate test . They don't have the sulphate in the extracted powder. Results of test for tannins in given in table 18.

CONCLUSION

The study successfully characterized the mucilage extracted from Mimosa pudica and Psidium guajava, demonstrating their potential as natural polymers for industrial applications. Their physicochemical characterization of extracted polymers make them suitable for pharmaceutical formulations, cosmetics, and food stabilizers. Further research on their bioactive components and functional applications is recommended.

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