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ISOLATION AND PHYSICOCHEMICAL DEPICTION OF *PLANTAGO OVATA* SEED MUCILAGE: CREDIBLE USE AS PHARMACEUTICAL EXCIPIENT

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ABSTRACT

The search for a new excipient needs a lot of time and finance. The aim of the present investigation is to extract and characterization of *Plantago ovata* and proposing it as a pharmaceutical aid. The mucilage from *P. ovata* seeds was extracted with water and the mucilage was precipitated using Acetone (Approach-I) and 95% ethanol (Approach-II). The mucilage was characterized for physical, chemical, and micromeritic characterization. A FTIR spectra was also engendered for the mucilages and compared. The mucilages showed and possess all the official parameters required as a pharmaceutical excipient. Among the extractives, mucilage precipitated with acetone was partially better than ethanol precipitated one. The work summarizes that *P. ovata* mucilage can be used as a tablet binder and viscosity modulating agent in pharmaceutical preparations.

Keywords: *Plantago ovata*, seeds, Isolation, Characterization

INTRODUCTION

*Plantago ovata*is universally known as Isapghol, which is a Persian word (Isap= the horse; Ghol= the ear **[1]**. *P. ovata* was introduced as amedicinal plant and grown in the western part of India, and now it is widespread all the regions of India **[2]**.

Traditionally the seeds and husk has been used as low-calorie food, and medicine (since the 18thcentury). *P. ovata* seeds are very small in size with lightweight **[3]**. The taxonomy of the plant described in **Figure 1**.

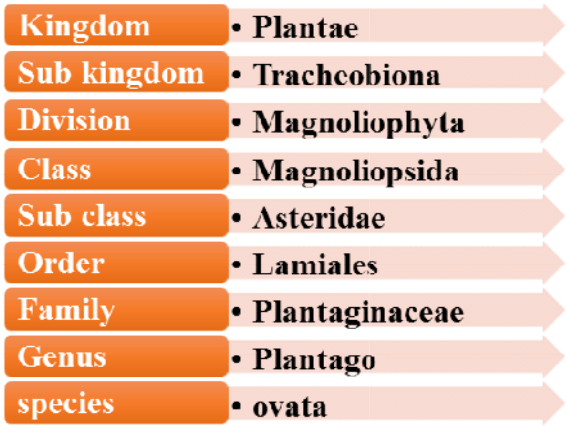

Figure 1: Taxonomical classification of *P. ovate*

MATERIALS AND METHODS

Materials

The fresh *P. ovata* seeds were acquired from the local market of Anantapur, India and authenticated SK University (Botany department), Anantapur, India. Ethanol (95%), Acetone, diethyl ether, methanol were brought from Fisher chemicals. Double distilled water wasused where ever requisite.

Organoleptic Characters

The organoleptic strictures were depicted in **Figure 2**.

Figure 2: Organoleptic strictures of *P. ovata* seeds

Chemical constituents

P. ovata contains mainlyPentosan and aldobionic acid, xylose, arabinose, galacturonic acid and

Rhamnose, fixed oil, proteins **[4]**.

Customary uses of *P. ovata*

P. ovata has proved for its laxative **[5]**, gastro protective **[6]**, weight loss (inhibit glucose absorption) **[7]**, nutrient **[8]**, anti-obesity **[9]**, anti-asthmatic **[10]**, resolving breathing issues **[11]**, anti-hemorrhoids **[12]**, reliving headache **[13]**, curing fissure **[14]**, and anti-diabeticactions **[15]**.

Extraction of Mucilage

POSM was extracted by 2 approaches.

Approach 1:

POSM was extracted with water and the mucilage was precipitated using Acetone **[16, 17] (Figure 3)**.

Approach 2:

POSM was extracted with water and the mucilage was precipitated using 95% v/v of Ethanol **[18] (Figure 4)**.

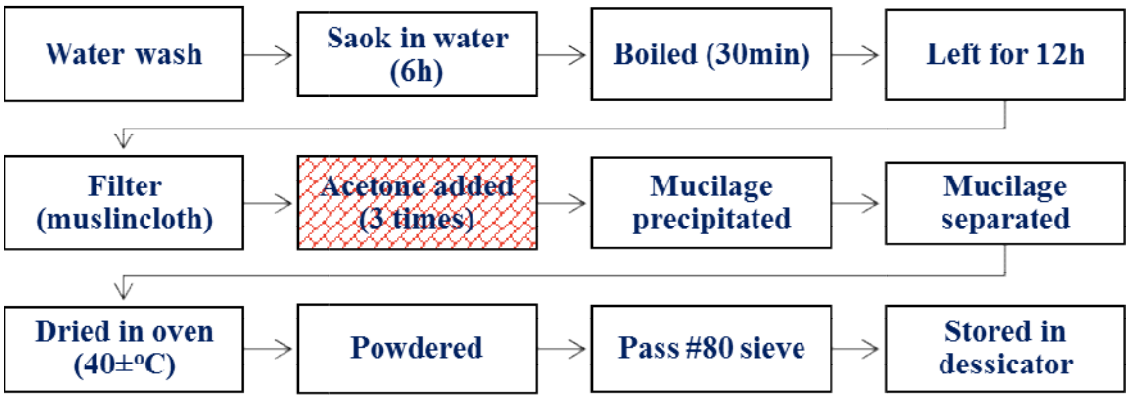

Figure 3: Isolation of mucilage using Acetone precipitation

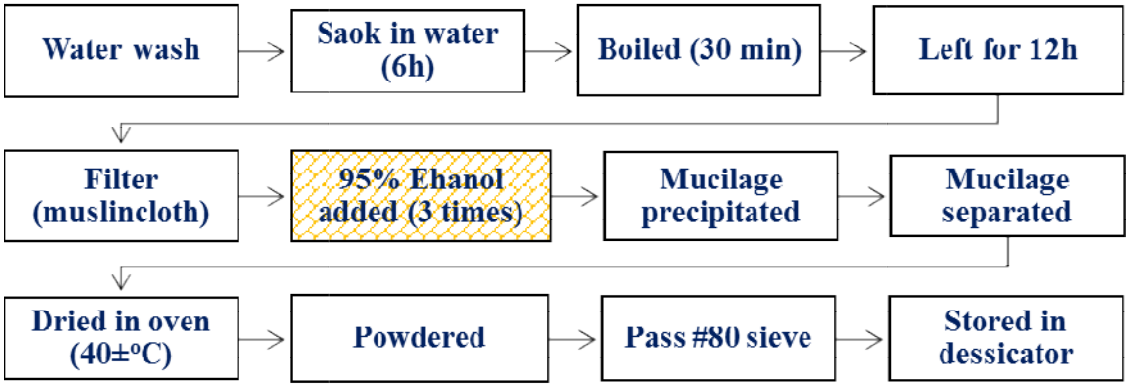

Figure 4: Isolation of mucilage using Ethanol precipitation

Characterization of Mucilage

The POSM was assessed for following constraints **[19-23]**.

Organoleptic constraints

P. ovata mucilage was assessed for its colour, odour, taste, and texture

Physical constraints

The mucilage was prosecuted for the following constraints

Solubility

Solubility of*P. ovata* was elucidated with water and various organic solvents

Yield

The mucilage amounts extracted was determined using the formula

$$\frac{\textbf{weight of mucilage after drying}}{\textbf{weight of P. ovata mucilage taken}}\textbf{X100}$$

Particle size

The POSM was subjected to size assessment by a compound microscope and the mean was obtained.

Loss on drying (LOD)

The LOD gives the amount of moisture present. 1g of POSM was heated at 105°C (Oven) until anunceasing weight attained, and the loss of moisture upon drying was documented.

$$\frac{\textbf{mass of water in mucilage}}{\textbf{total mass of mucilage}}\textbf{X100}$$

Swelling index (SI)

The swelling index of POSM was docked as per the modified tacticreported by Ahad *et al.,* 2010.

1g of POSM placed in a 100 ml stopper measuring cylinder, and made up 100 ml volume with distilled water, shaken, left for 24 h, and swelling was measured.

$$\frac{\boldsymbol{final\ volume - initial\ volume}}{\boldsymbol{initial\ volume}}\boldsymbol{X100}$$

Melting point

POSM was introduced in an open capillary and place in the melting point apparatus and heated till it melts.

pH

1g of POSM was assorted with 10 ml of distilled water and the pH was assessed by a universal pH paper.

Chemical characterization

The POSM was tested for chemical constraints for identifying steroids, saponins, flavonoids, and tannins. The POSM was also tested forannoying chemicalsviz., foreign matter, heavy metal,and arsenic.

Flow properties

The dried POSM was tested for theflow propertiesviz., angle of repose, bulk densities, compressibility index, and hausner's ratio.

Rheological studies

A 1% w/v of POSM was tested for viscosityusing an Oswald viscometer.

Fourier transform infrared (FTIR) studies

FTIRspectra of POSM were recorded on samples prepared in KBrdiskusing the FTIR spectrophotometer (Bruker) at 500 to 4000cm^{-1}.

RESULTS AND DISCUSSIONS

The POSM was confirmed as mucilage when tested with ruthenium red as it gave a pink coloration.

The POSM was observed as light brown, devoid of odor, and taste.

The POSM was insoluble in acetone, ethanol, methanol, dichloromethane, diethyl ether and it forms a jelly solution with water.

The yield per 100g of the sample was more with acetone precipitated mucilage 42.25±0.09 g. The same mucilage showed a fine particle size 151.76±3.2 µm, with LOD 2.15±0.03, and good swelling of 74.84±2.81%, Bothe the isolated POSM were observed to have similar melting with nearer neutral pH. The amount of foreign matter was observed negligible and the heavy metal and Arsenic content was within the limits.

The POSM was given negative reactions for steroids, saponins, flavonoids, and phenolic contents.

The angle of repose of the dried POSM was < 25^{o}, indicates excellent flow propertiesas

per Indian Pharmacopoeia. Thebulk and tapped density values were used to calculate the compressibility index and Hausner's ratio, they were found to be <10%, and <1.25 respectively, which confirms the excellent flow properties of POSM **(Table 1)**.

A 1% w/v of POSM with acetone precipitated was more viscus (12.33±0.17Mpas) than ethanol precipitated one. All these values were made in triplicates and depicted in the **Table 1**.

The FTIR spectrum of POSM showedsharp and characteristic peaks indicates the purity of the mucilage. TheFTIR spectral values and probable bonds present were represented in **Table 2** and shown in **Figure 5, 6**.

Table 1: Physical, chemical, and flow properties of P. ovata seed mucilage

Parameter	*P. ovata* mucilage	
	Acetone precipitated	95% Ethanol precipitated
IDENTIFICATION OF MUCILAGE		
Ruthenium red solution added	Pink coloration	Pink coloration
ORGANOLEPTIC CHARACTERIZATION		
Colour	Light brown	Light brown
Odour	Odorless	Odorless
Taste	Tasteless	Tasteless
Texture	Rough	Rough
PHYSICAL CHARACTERISTICS		
SOLUBILITY		
Acetone, ethanol, methanol, dichloromethane, diethyl ether	Insoluble	Insoluble
Water	Yellowish-brown gel	Yellowish- brown gel
Yield /100g (g)	39.25±0.05	42.25±0.09
Mean particle size (µm)	165.54±4.8	151.76±3.2
Loss on drying (%)	1.97±0.07	2.15±0.03
Swelling index (%)	68.71±1.28	74.84±2.81%,
Melting point (^{o} C)	128±2.15 and charred	125±3.64 And charred
pH	6.8±0.11	6.9±0.25
CHEMICAL CHARACTERISTICS		
Steroids (Libermann – burchard test)	Absent	Absent
Saponins (foam test)	Absent	Absent
Flavonoids (Shinoda test, Zinc/HCl reduction test)	Absent	Absent
Tannins/ Phenols (Ferric chloride test, Gelatin test)	Absent	Absent
Foreign matter (%)	NMT 0.1	MT 0.1
Heavy metals-Lead (PPM)	<20PPM	<20PPM
Arsenic (PPM)	<1	<1
FLOW PROPERTIES		
Angle of repose (^{o})	23.25±0.04	24.68±0.06
Bulk density	0.549±0.02	0.619±0.03
Tapped density	0.563±0.03	0.652±0.01
Carr's index	2.487±0.01	5.061±0.05
Hausnerratio	1.025±0.03	1.053±0.04
RHEOLOGICAL DATA		
Viscosity (mPas)	11.25±0.28	12.33±0.17
Values in mean ±S.D; n=3; NMT-Not More Than		

Table 2: FTIR spectral bonds and stretches for POSM

Absorption range	Peak for precipitated *P. ovata* seed mucilage		Bond
	Acetone	95% Ethanol	
~3400	3386.93	3410.96	Alcohol stretch
2400-3200	2921.92	2920.64	N-H bond (ammonium ion)
1730-1715	1730.52	1728.88	C=O stretching
1615-1700	1628.88	1632.09	C-N bond (any)
1465	1461.54	1463.10	C-H bending
1370-1335	1354.03	1355.60	Isopropyl group/S=O stretching
1310-1250	1300.51	1299.25	C-O stretching
1220-1260	1245.83	1249.35	C-O bond (ethers, aromatic)
~1100	1104.09	1102.89	C-O bond (alcohols, secondary)
1035-1149	1032.59	1034.47	Polysaccharide
800-860	847.74	844.99	C-H bond (aromatic, para di substituted benzene)

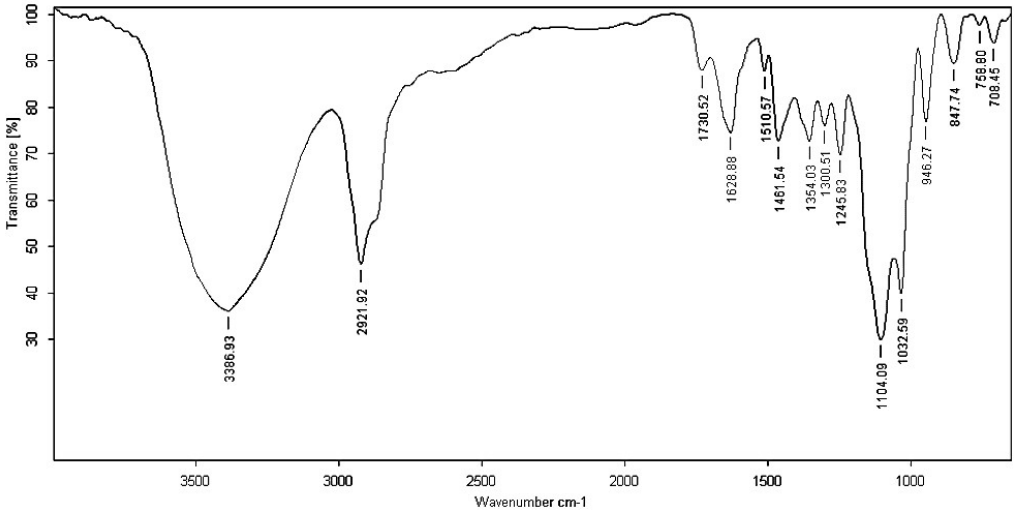

Figure 5: FTIR spectrum of POSM (Acetone precipitated)

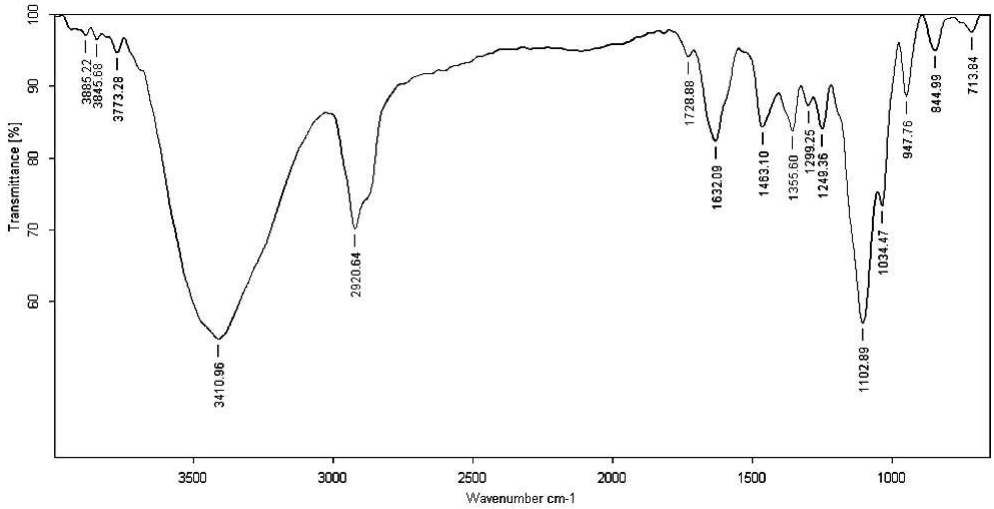

Figure 6: FTIR spectrum of POSM (Ethanol precipitated)

CONCLUSIONS

This study revealed that *P. ovata* seed mucilage has goodphysicochemical characteristics with excellent flow properties.The mucilage can be used as viscosity modifying agent inliquid orals and as an excipient in tablet formulations andas matrix-forming material in pharmaceutical dosage forms. Acetone precipitated mucilage has better excipient properties compared to ethanol precipitated one.

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