International Journal of Pharmaceutical Science Invention
ISSN (Online): 2319-6718, ISSN (Print): 2319- 670X
www.ijpsi.org Volume 13 Issue 6 ǁ Nov. –Dec, 2024 ǁ PP. 15-22

A Study on Tamarind (Tamarindus Indica) Seed Mucilage

Ms.M. Pavani[1], Koyya Gowtham Kumar [2]

[1](Bachelor of Pharmacy)– Narayana Pharmacy College, Nellore, Andhrapradesh, India
[2](PhD Scholar) – Dr. Samuel George Institute of Pharmaceutical Sciences,Markapur, Andhrapradesh, India

Date of Submission: 29-12-2024 Date of acceptance: 09-01-2025

ABSTRACT:

1.Aim: The aim of the present study is extraction of the Tamarind seed mucilage and characterize the extracted Tamarind seed mucilage.

2.Objective: Extraction of the natural polymer i.e., Tamarind Seed Mucilage. To carry out the pre formulation studies for polymer by FTIR studies and to perform the characterization studies for the selected natural polymer and to evaluate the extracted natural polymer for various parameters like percent yield, average particle size, degree of swelling, drug content.

3.Method: Extraction of the polymer, Characterization of the natural polymer for properties like solubility, swelling index, pH, moisture content, melting point, percentage yield, particle size, viscosity. Characterization study by FTIR, and Surface Morphology Study.

4.Introduction:

Natural polymers such as gum and mucilage are commonly employed as both traditional and new dosage forms. In general, natural polymers are safe to use in pharmaceutical applications. Natural polymers and their semi-synthetic derivatives have gained popularity in the development of novel drug delivery systems in recent years. They are water soluble and have a high molecular weight. They consist of monosaccharide unit linked by a polysaccharide unit and a glycosidic bond. Gums are water soluble whereas mucilage is water insoluble. Gums and mucilage's are amorphous and transparent solids.

Benefits of Natural polymers: Biodegradable, Bio-compatible

Easily Modified, have a non-irritant nature, Lack of toxicity makes them a versatile carrier that is preferred over synthetic and semi-synthetic polymer, Lowcost, readily available.

Pharmaceutical Applications of Natural Polymers

Suspending agents for insoluble solid components in a mixture. Emulsifying agents for the oil phase.

Troche adhesives, Pills and masses.

Natural polymers have found their use in the home, agriculture, and the food industry.

It aids in the reduction of environmental impact in packaging pollution and landfill disposal GUMS AND MUCILAGES Gums are formed when a plant is injured by the breakdown of the cell walls, by the process known as gummosis. They can also be formed extracellularly in adverse conditions such as drought. They easily dissolve in water or absorb water, causing them to swell, but they are insoluble in oils and organic solvents. Mucilage is a metabolic substance obtained from the plant. Mucilage forms a slimy mass when comes in contact with water.

5.Materials and Methods: Seeds were obtained from plant species Tamarindus indica (family: Fabaceae) and all other chemicals and solvents used were of analytical grade obtained from SD fine chemicals and Ranbaxy

Fine chemical Ltd. Isolation of mucilage from Tamarindus Indica: For the isolation of mucilage, modified method of KhanitthaChawananorasest [et al] was used.

Tamarindus indica powder has been used to produce the slurry with cold distilled water (500 ml).

The slurry was then put into boiling distilled water (200 ml), and 2g of sodium chloride was added. It was boiled on a hot plate for around 10 minutes, so that a clear, overnight stored solution could be found.

The thin clear solution was obtained after filtration to remove all foreign matter. The supernatant was isolated and continuously agitated over acetone at 1:3 portions. The precipitate produced was collected using an untreated sieve and dried for 4 hours in an oven at a temperature of 50 °C. The dried polymer can be stored using a desiccator.

4.1.Characterization of extracted tamarind seed mucilage

The characterization of the natural polymers involves the physicochemical characterization, Thermal stability, Fourier Transform Infra-Red(FTIR)study,Microstructure studies, phytochemical screening, and Micrometric studies.

4.2. Percentage yield:

The percentage yield of the extracted tamarind seed mucilage was calculated based on the amount of endosperm of Tamarindus indica seeds used for the extraction process and the amount of dry water-soluble mucilage obtained individually depending upon the solvents used.

The percentage yield was calculated using the formula mentioned below,

Percentage yield = (Wt. Of dried mucilage obtained / Wt. Of seed powder taken) × 100

4.3. Organoleptic Evaluation

The isolated mucilage was subjected for various organoleptic evaluations which includes evaluation of color, odour, shape, taste and special features like touch and texture.

The majority of information on the identity, purity and quality of the material can be drawn from these observations.

4.4. PhysicochemicalCharacterization of Tamarind Seed Mucilage:

The physicochemical characterization of tamarind seed mucilage involves Solubility test, Loss on drying, Swelling index, pH determination, Determination of Surface tension, Melting point determination, Viscosity determination.

4.5. SolubilityTest:

The extracted Tamarindus Indica Mucilage was subjected for solubility test in different solvents such as water, ethanol, methanol, acetone, chloroform, cyclohexane, benzene as per British Pharmacopoeia specifications.

4.6. Loss on Drying:

An accurately weighed quantity of about 1-2 g of extracted Tamarindus Indica Mucilage was taken in a tarred petridish.

The powder was then evenly distributed and it was kept in a hot air oven at 105°C till a constant weight was recorded.

The percentage loss of moisture on drying was calculated using the formula and expressed as a percentage.

Percentage Loss on drying (%) = (Loss in weight of the sample/Weight of the sample) ×100

4.7.Microstructure studies:

The morphological features of the Tamarindus Indica Mucilage were studied with a scanning electron microscope (SEM, JEOL, Japan).

4.8.Phytochemical Screening of Tamarindus Indica Mucilage:

The extracted Tamarindus Indica Mucilage was tested for chemical characteristics for identification, Ruthenium red test, Molisch's test, test for reducing sugars, test for tannins, test for chlorides, test for sulphates, test for uranic acid, test for flavonoids, test for steroids, test for saponins, test for tannins, test for phenols and test for alkaloids.

The Tamarindus Indica Mucilage was also tested for unwanted chemicals such as foreign matter, heavy metals and arsenic.

4.9. Swelling index:

Swelling index of Tamarindus Indica Mucilage was determined by using a reported method.

1 g of Tamarindus Indica Mucilage powder was accurately weighed and carefully transferred into a 50 ml measuring cylinder. The volume was made up to 50 ml with distilled water.

The cylinder was firmly closed and shaken vigorously every 10 minutes for 1 hour and then allowed to stand undisturbed for 24 hours.

The volume occupied by the material under test after the entire 24 hours was measured.

Swelling index (SI) is expressed as a percentage and calculated according to the following equation.

Percentage Swelling Index (%) = (Initial volume of powder in measuring cylinder/ final volume of powder in measuring cylinder) × 100

The same procedure was repeated using different media such as 0.1 N hydrochloric acid and pH 7.4 phosphate buffer.

pH determination:pH of the 1% (w/v) solution of the Tamarindus Indica Mucilage was determined using a digital pH meter.

Determination of surface tension: The surface tension of the Tamarindus Indica Mucilage was determined by drop count method using a stalagmometer

The stalagmometer was filled with purified water above the upper mark. Using the screw pinch cork, the flow rate was adjusted to 10-15 drops/min. Then, the number of drops of water was counted between the marks of the stalagmometer (n1).

The water was removed and the stalagmometer was filled with the Tamarindus indica mucilage solution (0.1%w/v) and the number of drops was counted (n2).

The surface tension of the Tamarindus indica mucilage was determined using the formula given below.

Surface tension ($\gamma 2$) = $n2\rho1\gamma1/n1\rho2$

Where, n1=number of drops of water

n2=number of drops of sample

$\rho1$=density of water (0.9956 g/mL)

$\rho2$=density of sample

$\gamma1$=surface tension of water (71.18 dynes/cm)

4.10. MeltingPoint Determination:

The powdered sample of Tamarindus Indica Mucilage was transferred into a capillary tube.

By using a melting point apparatus, the melting point was determined.

4.11. Viscosity Determination:

Rheological studies of Tamarindus Indica Mucilage were carried out using varying concentrations (0.1% –0.5% (w/v)) of the mucilage, prepared in distilled water.

The viscosities were measured using a Brookfield viscometer.

4.12.Thermal stability:

A sufficient quantity of the powdered mucilage was taken in a petridish and exposed to successive higher temperatures (30°C, 40°C, 50°C, etc.).

The temperature at which the product showed a change in color was noted.

For thermal stability under liquid conditions, 1% solution of mucilage was exposed to successive higher temperatures (30°C, 40°C, 50°C, etc.) and the temperature at which the product showed a change in the viscosity was noted.

4.13.Fourier Transform-Infrared Spectral Study:

The Fourier transform-infrared (FT-IR) spectrum of the Tamarindus Indica Mucilage was recorded by using FTIR 8300, Shimadzu, Japan using potassium bromide (KBr) discs.

test for phenols and test for alkaloids.

The Tamarindus Indica Mucilage was also tested for unwanted chemicals such as foreign matter, heavy metals and arsenic.

4.13.Micrometric characterization of tamarindus indica mucilage

Particle size: The particle size of the Tamarindus indica mucilage was determined by the microscopic method.

Angle of repose: Angle of repose was determined by the fixed funnel method.

The height and mean diameters of the powder cones were determined and the tangent of the angle of repose calculated using the equation:

$$\text{Tan}\theta = h/r$$

4.14.Bulk and tapped density:

4.14.1.Bulk density:

The bulk density of Tamarindus Indica Mucilage was determined by the three-tap method.

A weighted quantity of Tamarindus Indica Mucilage powder was carefully introduced into a 100 ml graduated cylinder.

The cylinder was dropped onto a hard wood surface 3 times from a height of 2.5 cm at an interval of 2 seconds.

The bulk density was calculated by using the equation.

$$\text{Bulk density} = \text{Mass of the dry powder/Bulk volume}$$

4.14.2. Tapped density:

The weighed quantity of dry powder was taken in a graduated cylinder.

The cylinder was placed on the tap density tester and subjected to 250 drops per minute and drop height is 3mm±10%.

The volume of the powdered bed is measured after each increment of 250 drops until the difference of the last two volume measurements is zero and the tapped volume is recorded.

The tapped density was calculated by using the equation.

Tapped density = Mass of the dry powder/Tapped volume

4.15. Carr's consolidation index/ compressibility index:

It is a simple test to evaluate the LBD(Loose Bulk Density) and TBD(Tapped Bulk Density) of a powder and the rate at which it is packed down.

Carr's Index can be calculated by following equation.

Carr's Index (%) = [(TBD-LBD) x100]/TBD

4.16. Hausner's ratio:

It was determined by using the following formula.

Hausner's Ratio= Tapped bulk density/ Loose bulk density

4.17. True density:

True density was determined by liquid displacement method at 25°C. Benzene was used as the displacement liquid.

The weight (W1) of the clean, dry 50mL density bottle was determined.

The bottle was filled with water and the top of the bottle was dried with filter paper and weighed as (W2).

The procedure was repeated using benzene to obtain the weight of the bottle plus benzene (w3).

About 3g of the Tamarindus indica mucilage powder was transferred to dried density bottle and weighed as (W4).

The bottle was filled with benzene and the weight (W5) was measured.

14.18.Accelerated stability study:

Tamarindus Indica Mucilage was subjected to accelerated stability studies according to ICH guidelines, to predict the stability of mucilage.

Approximately 1–2 grams of the mucilage were placed in a petri dish and dried in an oven at 105°C until constant weight was achieved. The percentage loss on drying was calculated.

The samples were analyzed at regular intervals as perthe stability protocol.

20 grams of the tamarind seed mucilage is taken in each petridish and it is placed in a humidity chamber, subjecting to the following conditions: Temperature of 40^0 C and Relative Humidity of 75% for the initial period of 3 months.

15.RESULTS AND DISCUSSION:

Results: The results of the physiochemical characterization of isolated tamarind seed mucilage have shown all the desired characteristics of potential pharmaceutical excipients that could be used in the formulation of various pharmaceutical formulations.

Percentage Yield: The yield of the extracted mucilage was consistent with previous studies.

Solubility Test: The mucilage was water-soluble but insoluble in organic solvents.

Loss on Drying: The mucilage showed a moisture loss of 2.5%.

Swelling Index: The swelling index was 13 ml.

Viscosity: The viscosity increased with higher concentrations of mucilage.

Thermal Stability: The mucilage remained stable up to 200°C.

Percentage yield:

The percentage yield of the extracted tamarind seed mucilage in different solvents is as follows

Solvent	**% Yield**
Demineralised/Distilled Water	45
Hot Water	60

Organoleptic Evaluation:

The isolated mucilage was evaluated for color, Odor, shape, taste, and texture. These sensory observations provided information on its identity, purity, and quality.

ORGANOLEPTIC EVALUATION	
PARAMETERS	**RESULT**
Colour	Half white
Odour	Characteristic
Taste	Mucilaginous
Shape	Regular
Touch and texture	Smooth texture
Nature	Amorphous

Solubility Test:

The extracted Tamarindus Indica mucilage was tested for solubility in various solvents including water, ethanol, methanol, acetone, chloroform, cyclohexane, and benzene, as per British Pharmacopoeia guidelines.

SOLUBILITY TEST			
SOLVENT	**SOLUBILITY BEHAVIOUR**	**SOLVENT**	**SOLUBILITY BEHAVIOUR**
Cold water	Sparingly soluble	Acetone	Insoluble
Warm water	Quickly soluble forming a neutral, viscous colloidal solution	Chloroform	Insoluble
Ethanol	Insoluble	Cyclohexane	Insoluble
Methanol	Insoluble	Benzene	Insoluble

LOSS ON DRYING	RESULT
pH(1% (w/v))	6.5
Moisture content	2.5
Ash value	
Ash value (%)	**2.75 ± 0.20**
Water soluble ash	1.21± 0.02
Acid insoluble ash	0.2 ± 0.01
SWELLING INDEX	
Distilled water	**25**
0.1 N HCl	7
Phosphate buffer pH 7.4	18

MICROBIAL LOAD	
PARAMETER	**RESULT**
Bacterial (CFU/g)	10
Fungi (CFU/g)	1
E.coli	Absent
Salmonella typhi	Absent
S. aureus	Absent
Pseudomonas aeruginosa	Absent

PARAMETER	RESULT
Water absorption capacity	13ml
Surface tension (0.1%(w/v))	85.52 ± 0.21
Average particle size(µm)	165.18±8.54
Melting point (°C)	290±6.851

PARAMETER	RESULT
Foreign Matter(%)	NMT 0.1
Test for Arsenic	<1 ppm
Test for heavy metal (lead)	15 ppm

VISCOSITY DETERMINATION	
CONCENTRATION(%)	**VISCOSITY(cps)**
0.1	75
0.2	165
0.3	220
0.4	296
0.5	325

THERMAL STABILITY TEST	
MUCILAGE	**TEMPERATURE**
Tamarind Seed Mucilage Solid Powder	200°C

18.Conclusion: Tamarind seed mucilage shows potential as a natural excipient for pharmaceutical applications. It can be used effectively in various pharmaceutical formulations due to its favourable physicochemical properties, biocompatibility, and biodegradability. Future research should focus on structural elucidation, drug-mucilage interactions, and the use of tamarind seed mucilage in advanced drug delivery systems such as nanoparticles and microcapsules.

References:

[1]. Malviya R., Srivastava P., Kulkarni G.T.: Application of gum in drug delivery. Adv. Biol. Res. 2011, 5(1), 1–7.
[2]. Jani G.K., Shah D.P., Prajapati V.D., Jain V.C.: Gums and Mucilages: versatile excipients for pharmaceutical formulations. Asian J. Pharm. Sci. 2009, 4, 308–322.
[3]. Maru S.G., Prakash S.B., Dharmesh S.B., Agham S.A., Aghera N.J.: Natural Polymer: Gums and Mucilage as Good Pharmaceutical Excipients. PhTechMed 2012, 2, 64–74.
[4]. Deogade U.M., Deshmukh V.N., Sakarkar D.M.: Natural Gums and Mucilages in NDDS: Applications and Recent Approaches. IJPRIF 2012, 4, 799–814.
[5]. Krishna L.N.V., Kulkarni P.K., Dixit M., Lavanya D., Raavi P.K.: Natural Gums, Mucilages and their Applications in Novel Drug Delivery Systems. IJDFR 2011, 2, 54–71.
[6]. Khanittha Chawananorasest, Patsuda Saengtongdee, Praphakorn Kaemchantuek, "Extraction and Characterization of Tamarind (Tamarindus indica L.) Seed Polysaccharides (TSP) from Three Different Sources", Molecules 2016, 21, 775, pp. 1-9.