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ISOLATION AND CHARACTERIZATION OF *SAMANEA SAMAN*FRUIT GUM: NATURAL STRONG BINDING AGENT FOR CONTROLLED DRUG DELIVERY SYSTEM

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Abstract

Controlled drug delivery system (CDDS) is majorly used oral conventional dosage forms. They regulate the drug level in your body for specific time period. This leads to precise medication levels even after taking it once, preventing from taking multiple doses throughout the day. CDDS increases patient compliance and decreases toxicity due to dose dumping in body. In recent era,the number of synthetic and semi synthetic polymers availability in market has increased in order to prepare strong binders for CDDS but they are having many disadvantages such as costly, toxic, there side effects and poor patient compliance along with environmental hazard during synthesis. Because of these side effects we are choosing natural gums such as gum obtained from fruits of *Samanea saman* which are eco- friendly as well as low cost and strong binder. In the following studies effort were made and depicted of Samanea saman gum extraction from the Samanea saman fruits and the gum is evaluated for their various physical characteristics. *Samanea saman* possesses various additional properties like non carcinogenicity, broad pH tolerance, high viscosity and biocompatibility. This extract is also used by food and pharmaceutical industries as thickening agent, gelling agent, stabilizer, this fruit constitutes about 65% of polysaccharide in the fruit components.

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Introduction

Fruit gums are important agrochemical used in various industries worldwide. The growing industrial utility of these gums in the pharmaceutical industries, petroleum recovery, textile, andfield of paper has resulted in adrastic movement in India for intense research on new resources of natural gums and their modified products.

Gum is a byproduct obtained as a result of metabolic mechanism of plants. Natural gums are either water soluble or absorb water to form a thick solution [1]. Natural gums are economic, easily available. Gums have been wildly used as tablet binders, thickeners and emulgents in suspensions as film-forming agents, cosmetics andtransitional colloids [2].

Polysaccharides are mostly chosen materials among the hydrophilic polymers used, because they are most acceptable and highly nontoxic nature is regulated and monitored by regulating authorities [3]. The various polysaccharides used in drug delivery application are cellulose ethers [4], xanthum gum [5], locust bean gum [6] and guar gum [7]. Another natural gum *Samanea saman* gum obtained from the fruit of *Samanea saman* possesses properties like high viscosity, broad pH tolerance, non-carcinogenicity and biocompatibility [8]. It is used as thickening agent, stabilizing agent, binding agent, and gelling agent in food and pharmaceutical industries. The *Samanea saman* fruit polysaccharide constitutes about 65% of the *Samaneasaman* fruit components [9]. In the present study an effort was made to extract the *Samanea saman* gum from the *Samaneasaman* fruits and to evaluate their physical characteristics.

Isolation of gum from *Samanea saman* fruits

The pulp extracted from the crushed fruits of *Samanea saman* were soaked in water for 24 h, boiled for 1h and kept for 2h for the release of gum into water. These soaked seeds were taken and squeezed in a muslin bag to remove any further residual marcin the filtrate. Then, to the filtrate, double quantity of acetone was added to precipitate the gum. The gum was separated by filtration. The marc was reprocessed for multiple extractions with decreasing quantity of same extracting

solvent, i e., water with the increase of number of extraction per each process. The isolation was continued until the gu 1 was free form material. The separated gum was dried in hot air oven at temperature 400 C. The dried gum was powdered and stored in air tight containers at room temperature.

Phytochemical Examination [10-11]

For the detection of the presence of carbohydrates, reducing sugars, tannins, and peroxide enzymes the standard tests Molisch's test for carbohydrate, reduction of Fehling's solution for reducing sugars, ferric chloride test for tannins, and ruthenium red test for Samanea saman gum were done.

Test for carbohydrates (With aqueous test solution)

1. Molisch's Test [11]

Procedure: To the aqueous solution of Samanea saman gum, few drops of alcoholic α-naphthol were added and to it few drops of concentrated sulphuric acid was added through sides of the test tube.

Result: Violet coloured ring appeared at the junction and this confirmed the presence of carbohydrates in the Samanea saman Gum.

2. Test for proteins

Ninhydrine Test [12]

Procedure

To the aqueous solution of Samanea saman gum, ninhydrine solution was added and then this solution was boiled.

Result: No violet color was formed indicating the absence of proteins in Samanea saman gum.

3. Test for alkaloids

Wagner's Test [13]

Procedure: To the aqueous solution of Samanea saman gum, Wagner's reagent was added.

Result: Reddish brown precipitate was formed with Wagner's reagent indicating the presence of alkaloids in Samanea saman gum.

4. Test for tannins

Ferric Chloride Test [14]

Procedure

The extract was treated with ferric chloride solution.

Result

No blue or green colored appeared indicating the absence of tannins in Samanea saman gum.

5. Confirmatory Test for Chlorides: (By Silver Nitrate Test) [15]

Procedure

Small amount of sodium extract was taken in a semi micro test tube and it was neutralized with dilute nitric acid and then silver nitrate was added.

Result

No white precipitate was formed indicating the absence of chlorides in Samanea saman gum.

6. Test for Sulphates [16]

Procedure

Small amount of sodium carbonate extract was taken in a semi micro test tube and it was neutralized with dilute nitric acid. To this solution 5 drops of barium chloride solution was added finally.

Result

Formation of white precipitate insoluble in concentrated nitric acid is obtained indicating the presence of sulphates in Samanea saman gum.

7. Fehling's Test [17]

Procedure

To the aqueous solution of Samanea saman gum, few drops of Fehling's reagent were added.

Result

Brick red precipitate of cuprous oxide was not formed indicating the absence of reducing substances in Samanea saman gum

Physicochemical Characterization of Gum

The separated Samanea saman gum was evaluated foe solubility, swelling index, density, compressibility index and angle of repose.

Bulk Density [24]

Samanea saman gum Bulk density (g/mL) was determined by three tap method in a graduated cylinder.

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

Tapped Density [25]

Samanea saman gum Tapped density is measured by mechanically tapping a graduated cylinder containing a powder sample.

$$\text{Tapped density} = \frac{\text{Mass of the powder}}{\text{Tapped volume of the powder}}$$

Angle of Repose [26]

Samanea saman gum Angle of repose was determined by fixed funnel method.

$\tan \theta = h/r$

Compressibility Index [27]

*Samaneasaman*gum compressibility index was determined by measuring the initial volume (vo) and final volume (v) after hundred tappings of a sample in a measuring cylinder. Compressibility index calculated using the equation.

$$\text{Compressibility index (CI)} = \frac{V0 - V \times 100}{V0}$$

Determination of Sulphated Ash [18]

A platinum dish was pre heated until it was reddened for 10 minutes and it was cooled in a dessicator and its weight was noted. 1 g of substance was placed and examined in a dish; it was moistened with sulphuric acid, ignited gently, again moistened with sulphuric acid and ignited at about 8000C. Then it was cooled, weighed again, ignited for 15 minutes and this procedure was repeated until 2 successive weighing do not differ by more than 0.5mg.

Test for Arsenic [19]

Procedure

5 ml of the test solution was heated on a water-bath with as equal volume of hypo phosphorous agent.

Result

No brown precipitate was obtained indicating the absence of arsenic.

Test for Mucilage

Ruthenium Red Test [20]

Procedure

To the aqueous test solution, little amount of ruthenium red solution was added.

Result

Pink colored appeared indicating the presence of mucilage in Samanea saman gum.

Determination of Loss on Drying [21]

Loss on drying is loss of weight expressed as %w/w. The weighed quantity of substance to be examined was placed in a weighing bottle previously dried under conditions prescribed for substances to be examined. The substance was dried to constant mass or for the prescribed time by one of the following procedures.

a) **"Indesiccators"**
   The drying was carried out over diphosphorous pentoxide R at ATM pressure & room temperature.

b) **"In Vacuum"**
   The drying is carried out over diphosphorous pentoxide R at ATM pressure 15 kilopascals – 2.5 Kpa at room temperature.

c) **"In an Oven'**
   Within a specified temperature range should be followed as prescribed in a monograph.

d) **"Under high Vacuum"**
   Drying is carried out over Diphosphorous pentoxide R at a pressure not exceeding 0.1 KPa at temperature prescribed in monograph.

Test for Foreign Matter [21]

100 – 500 g of substance to be examined was weighed and was spreaded out in a thin layer. Foreign matter was examined by inspection with unaided eye or by use of a microscope using lens range of 6x. Separate foreign matter was separated & weigh & the percentage present in it was calculated.

Determination of Ash Value [22]

2-3 g of the ground drug was incinerated in a tarred platinum /silica dish at a temperature not exceeding 4500C until free from Carbon, cooled& weighed. If a carbon free ash cannot be obtained in this way, the charred mass was exhausted with filter water, the residue was collected on an ash less filter paper and was incinerated ignited at a temperature not exceeding 4500C. The percentage of ash value was determined with reference to air dried substance. (For other substances) Carry out the above procedure using 1 g of drug.

Determination of Acid insoluble ash [22]

The ash was boiled for 5 min with 25 ml of 2 M HCl then the insoluble matter was collected in a sintered glass beaker or on an ash less filter paper, washed with hot water & then ignited. The percentage of acid insoluble ash was determined with reference to air dried gum.

Phytochemical Characterization of Mucilage: 13-15

The separated Samanea saman gum was evaluated for solubility, swelling index, loss on drying, ash value, microbial load, density, compressibility index and angle of repose.

Determination of Viscosity

1 g of dried and finely powdered gum was suspended in 75 ml of distilled water for 5 h. Distilled water was added up to 100 ml to produce the concentration of 1 % w/v. The mixture was homogenized by mechanical stirrer for 2 h and its viscosity was determined using a Brooke field viscometer, spindle-LV2 (Brooke field LV-II, USA) at 20 rpm and 250 C.

Table 3.1: Physiochemical Characterization of Samaneasaman gum

Parameters	Observation
Solubility	Slightly soluble in water, Partially insoluble in alcohol, chloroform and acetone. Forms thick gel in water.
pH (1% w/v solution)	5.5
Loss on drying	1.2%
Ash value	2.0 %
Water soluble ash	1.9%
Acid insoluble ash	0.8%
Sulphated ash	2.3 %
Test for foreign matter	Less than 0.1%
Test for Arsenic	Less than 1 ppm
Swelling ratio	
In water **In 0.1 N HCL** **In phosphate Buffer 7.4**	9.09 11 5.9
True density	1.4 g/dl
Bulk density	0.65 g/cc
Tapped density	0.70 g/cc
Compressibility index	13.90%
Hausner ratio	0.32
Description Powder	Brownish red coloured granular powder.
Angle of repose	22.70

Results and Discussion

Physiochemical Characterization of *Samanea saman* gum

Polysaccharide gum derived from the seeds of *Samanea saman*, Samanea saman fruits are brownish red to black color powder, and the viscosity of its 1% aqueous dispersion was 450 cP indicates that the gum is colloidal in nature. Which is following non-Newtonian bodies i.e., they do not settle down quickly. The gum obtained was subjected to physiochemical characteristics the results of which are summarized in Table 3.1.

The presence of tannin was determinedby treating the gum with ferric chloride solution. There was no black precipitation was observed for tannin with ferric chloride solution. The presence of mucilage was tested by treating the gum mucilage with ruthenium red solution and benzidine solution, formation of pink color with ruthenium red and blue color with benzidine solution indicate the presence of mucilage. To know whether the gum contains the peroxidise enzymes, which is commonly present in some gums like gum acacia. *Samanea saman* gum was treated with few drops of hydrogen peroxide, no blue color formation; indicate the absence of enzymes in it. This indicates there is a less chance of oxidative degradation by gum as excepient which is minute as compared to gum acacia. Mucilage gum on treating with Ninhydrin reagent did not give purple coloration indicating the absence of amino acids. The results of

phytochemical screening of Samanea saman gum are summarized in Table 3.2.

Table 3.2: Phytochemical Screening of Samanea Saman Gum

S.No	Tests	Observation
1.	Test for Carbohydrates (Molischs's test)	+
2.	Test for Tannins (Ferric chloride test)	+
3.	Test for proteins (Ninhydrin test)	-
4.	Test for alkaloids (Wagner's test)	+
5.	Test for reducing sugar (Fehling's test)	-
6.	Mounted in 95 % alcohol	Transparent angular masses under microscope.
7.	Mounting in the iodine	No blue coloured particles (starch absent)
8.	Test with cupric-tartaric solution	Red precipitate is not produced.
9.	Warming with 5 M sodium hydroxide	A brown colour is produced.
10.	Test for chlorides (silver nitrate test)	-ve
11.	Test for sulphates (barium chloride test)	+ve

Conclusion

The result of the present study demonstrated that the Samanea saman gum obtained from seed of plant *Samanea saman* is brownish red colored powder which is amorphous in nature. It is slightly soluble in water, practically insoluble in alcohol, acetone and chloroform; it also forms thick gel which can control the drug release.

Moreover as this plant is widely distributed in nature, Samanea saman available chiefly in India and many other countries and easily available option without destroying the natural sources as compared to that of the other available natural option will be one of the suitable options to utilize as pharmaceutical controlled release matrix polymer. Since the primary ingredients are inexpensive, devoid of toxicity, biocompatible, biodegradable and easy to manufacture, they can be used in place of currently marketed sustained release polymers.

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Conflict of interest

Authors are declared that no conflict of interest

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Ethical Consideration and Inform Consent

Not Applicable

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