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RECENT TRENDS IN THE EXTRACTION AND UTILIZATION OF GUMS AND MUCILAGES

A. Veenadevi*, S. K. Shabana Begam, T. Kumari, Rounak Upodhaya, P. Srinivasa Babu

Department of Pharmaceutics, Vignan Pharmacy College, Vadlamudi, Guntur, AP, India.

***Corresponding Author: A. Veenadevi**

Department of Pharmaceutics, Vignan Pharmacy College, Vadlamudi, Guntur, AP, India.

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ABSTRACT

Extensive research efforts have been focused on emerging safe and efficient natural-based polysaccharide particulate drug delivery systems. Gums and mucilage's are common natural ingredients for both traditional and innovative dosage forms. Compared to synthetic gums, natural gum excipients are better in delivering the bioactive substance. Since these natural materials are readily accessible, nontoxic, chemically inert, and biodegradable, they are superior to synthetic ones. They can also be altered in many ways to create materials specifically designed for drug delivery systems, which allows them to compete with currently available synthetic excipients. These days, a lot of pharmaceutical excipients come from natural sources. Nature has given us a vast array of resources that can either directly or indirectly support or enhance the health of all living systems. These gums and mucilages also improve food goods' sensory qualities, increase moisture retention, and stop staling, which prolongs their shelf life. Due to the progress in drug delivery technology, natural polysaccharides are included in novel drug delivery to fulfill multitasking functions and, in specific cases, directly or indirectly control the extent and/or rate of drug release. This article concentrates on the origins, isolation, purification, characterization, extraction techniques, and various uses of gums and mucilages obtained from plants in the food industry.

KEYWORDS: Gums & Mucilages, Extraction, Isolation, Applications.

INTRODUCTION

Natural and sustainable ingredients have gained popularity in the food business in recent years. There is a growing emphasis on investigating plant-derived substitutes as consumers grow more aware of the possible negative effects synthetic chemicals may have on their health and the environment.[1] Excipients were traditionally used in drug formulations as an inert vehicle to provide the precise weight, consistency, and volume required for the proper administration of the active ingredient. However, in contemporary pharmaceutical dosage forms, they frequently serve multiple purposes, including modifying release, enhancing patient acceptability, improving the stability and bioavailability of the active ingredient, and ensuring ease of manufacture.[2]

Because they may satisfy the requirements of sophisticated drug delivery systems, natural gums are frequently utilized as pharmaceutical excipients. They are also effective in fulfilling multifunctional duties, such as enhancing the dosage form's stability and solubility, which increases the active ingredient's bioavailability and can alter drug release. Because the gums are effective at imparting the dosage form's release retardant qualities, they are frequently utilized in controlled-release dosage forms. Utilizing natural gums as pharmaceutical excipients in dosage forms guarantees ease of manufacturing and improves patient acceptability.

In addition to being poisonous by nature, the creation of synthetic polymers is expensive, pollutes the environment, and has negative side effects that result in low patient compliance. Because they are nontoxic, affordable, readily available, biodegradable, and biocompatible, natural gums are superior to synthetic polymers. It is simple to chemically and biochemically alter natural gums to achieve the desired qualities needed to create a drug delivery system that can rival synthetic polymers.[3]

Both gums and mucilage. The disintegration of cell walls caused by harm to the plant or by unfavourable circumstances, like drought, results in gums, which are regarded as pathological products [extracellular formation: gummosis]. These days, synthetic poly-biopolymers (gums, mucilage, cellulose, and glucans) are used as an efficient element in the creation of sustainable, economical, and environmentally friendly products because of their potentially harmful effects.[4]

ADVANTAGES OF NATURAL GUMS AND MUCILAGES[5]

1. Biodegradable: Natural gums and mucilage break down easily in the environment because they are derived from living organisms. They are therefore safe for both people and the environment.

2. Non-toxicity: Since sugars (monosaccharides) make up the majority of natural gums and mucilage, they are both biocompatible and non-toxic. Their structure is based on carbohydrates, which makes them naturally non-toxic and biocompatible.

3. Economical: Compared to synthetic alternatives, mucilage and natural gums are significantly less costly. Their low production costs make them an affordable choice, especially for widespread use.

4. Eco-friendly Processing: It is simple to collect and process natural gums in an environmentally friendly way. They may be gathered in large quantities without the need for laborious or environmentally harmful processes.

5. Locally accessible: Two examples of plants that are frequently grown locally, particularly in developing nations, are tragacanth and guar gum. Governments usually promote their manufacturing because it boosts local economies and supports several industries.

6. Safety: Safe and Few Adverse Reactions: Because these gums are made from natural ingredients rather than synthetic ones, they are often safe to use and rarely cause adverse reactions.

7. Better Tolerability and Public Acceptance: The public accepts natural gums more easily, and patients frequently tolerate them better. Compared to synthetic medications like povidone or PMMA, they are less likely to cause allergic reactions or adverse side effects.

8. Consumable Resources: The majority of natural gums and mucilages come from edible plants, which makes them appropriate for use in medicinal applications involving ingestion.

DISADVANTAGES OF NATURAL GUMS AND MUCILAGES[6]

1. Risk of Microbial Contamination: Natural gums and mucilages usually contain 10% or more moisture due to their carbohydrate composition. Microorganisms are drawn to this, especially during manufacturing, when they are exposed to the environment. However, this risk can be reduced with the use of preservatives and proper handling.

2. Differences Among Batches: Unlike synthetic gum, which is produced under strict, controlled conditions, natural gum is influenced by a variety of elements, such as soil, climate, and harvesting methods. Batches may vary in quality and content as a result.

3. Unpredictable Hydration Rates: Natural gums may absorb water at varying rates depending on the region, plant species, or even the season in which they were harvested. This disparity makes it more challenging to predict how they would behave in a formulation. Monographs, or standardized documentation, could help overcome this issue.

4. Slow Production Process: Because natural gums are derived from plants, their availability and production rate are influenced by environmental factors. Unlike synthetic replacements, their production cannot be accelerated only in a laboratory.

5. Viscosity Changes Over Time: Natural gums thicken mixtures when they combine with water.

6. Potential for Heavy Metal Contamination: Due to their plant origin and regular soil cultivation, natural gums are vulnerable to heavy metal contamination. Since this is a known problem with several herbal excipients, it requires careful monitoring.

Table: 1: Classification of Gums and Mucilage.[7, 8]

CLASSIFICATION BASIS	CATEGORY	EXAMPLES
Based on the Source	Marine Origin	Agar, Carrageenan's, Alginic Acid, Laminarin
	Plant Origin	Gum Arabic, Gum Ghatti, Gum Karaya, Gum Tragacanth, Khaya Gum, Albizia Gum
	Animal Origin	Chitin, Chitosan, Chondroitin Sulphate, Hyaluronic Acid
	Microbial Origin	Xanthan, Dextran, Curdlan, Pullulan, Zanflo, Emulsan, Schizophyllan, Lentinan, Krestin, Scleroglucan, Baker's Yeast β-glucan
Based on Nature (Semi-Synthetic)	Starch Derivatives	Hetastarch, Starch Acetate, Starch Phosphates
	Cellulose Derivatives	Carboxymethyl Cellulose (CMC), Hydroxypropyl Methylcellulose (HPMC), Methylcellulose (MC), Microcrystalline Cellulose (MCC)
Based on Charge	Non-Ionic	Guar Gum, Locust Bean Gum, Tamarind Gum
	Anionic	Gum Arabic, Gum Karaya, Gum Tragacanth

	Cationic	Chitosan
Based on Molecular Shape	Linear Polymers	Alginates, Amylose, Cellulose
	Branched Polymers	- Short Branches: Xanthan, Xylan, Amylopectin - Branch-on-Branch: Gum Arabic, Tragacanth
Based on Monomeric Units	Homoglycans	Amylose, Cellulose, Arabinans
	Di-Heteroglycans	Alginates, Carrageenan's, Galactomannans
	Tri-Heteroglycans	Arabinoxylans, Gellan, Xanthan
	Tetra-Heteroglycans	Gum Arabic, Psyllium Seed Gum
	Penta-Heteroglycans	Ghatti Gum, Gum Tragacanth

APPLICATIONS

1. Pharmaceutical Application[9]

Because of their non-toxicity, biodegradability, bio-compatibility, and functional flexibility, natural gums and mucilages are frequently utilized in pharmaceutical formulations.

- **Formulation of Tablets:** Consumed as disintegrants, binders, and agents with prolonged release.
  Common binders include gums such as tamarind seed gum, tragacanth, leucaena, and acacia. Okra, flaxseed, and Grewia asiatica mucilage's have a high swelling capacity, making them effective binding and dissolving agents.
- **Suspension and Emulsifying Agents:** Gums and mucilage's stabilize emulsions by enclosing droplets in a protective layer. Examples include cashew gum, guar gum, gum tragacanth, and carrageenan. Viscosity and electrostatic stability are provided by mucilages.
- **Coating agents:** Polysaccharide-based gums and mucilage's provide film coatings that shield medications and prolong their release. Gum copal, gum dammar, and aloe vera mucilage (used in edible coatings) are such examples.
- **Gelling Agents:** 3D polymeric networks are created by gums through intramolecular and intermolecular interactions.
  Examples include the mucilage of fenugreek, sesbania gum, cactus mucilage, and konjac gum.
- **Mucoadhesive Drug Delivery:** Longer stomach residence time and improved bioavailability.
  Tamarind gum, xanthan gum, moringa, hakea gum, and karaya gum are a few examples.
- **Microencapsulation and Novel Drug Delivery:** For regulated or sustained release, gums and Mucilage's wrap the drug cores.

Few examples of Novel Drug Delivery are given below

- Acacia: Naproxen is delivered osmotically.
- Guar gum: Delivery to the colon.
- Gellan gum: In-situ gelling systems for eyes.
- Karya gum: A Mucoadhesive delivery system for nicotine.
- Xanthan gum with tamarind: Regulated release of theophylline, verapamil, and diclofenac.

2. Applications in the Food Industry[10]

- **Packaging and Edible Coating:** By preventing moisture loss and serving as gas barriers, Mucilage's create naturally occurring edible coatings that extend the shelf life of food. Examples include the mucilage of aloe vera on tomatoes, flaxseed on cheese, and basil on apricots. Mucilage from okra and cacti for texture preservation and microbiological safety.
- **Additives and Food Stabilizers:** Gums are used as stabilizing, emulsifying, thickening, and gelling agents. Utilized in frozen goods, dairy, confections, sauces, and drinks. Examples include guar gum, which thickens and stabilizes ice cream. Carrageenan: Stabilizer for meat products. Alginate, xanthan, and pectin: stabilizers for beverages, jams, and jellies.
- **Nutraceuticals and Food Encapsulation:** Mucilage improves stability by encasing flavors, oils, vitamins, and polyphenols. Flavor masking and controlled release. For example, mucilage's from hibiscus, okra, and cress seeds can be used to encapsulate bioactive compounds.

3. Industrial Uses

- **Personal care products and makeup:** In creams, lotions, and shampoos, gums such as acacia, tragacanth, and karaya are utilized as stabilizers, emulsifiers, or film formers. Mucilages bring therapeutic, antioxidant, and moisturizing properties.
- **The Cotton and Paper Sector:** Thickening, coating, and sizing agents are among their uses. For instance, pectin, cellulose derivatives, and tamarind gum give paper its strength and smoothness.
- **Cosmetics and Adhesives:** Arabic gum and tragacanth gum are examples of natural adhesives. Gums, pectin, and hemicellulose are added to paints and resins to provide viscosity and binding.

4. Environmental Applications

Mucilages and gums are efficient bio-flocculants that can be used to remove turbidity, dyes, and heavy metals (Fe, Zn, Cd, and Cr) from wastewater.

Examples include

- Removal of arsenic from cactus mucilage.
- Wastewater flocculant: okra mucilage.
- Heavy metal binding is a feature of Dicerocaryum eriocarpum.

5. Therapeutics and Medicine Applications: Applied for antibacterial, antioxidant, anti-inflammatory, wound-healing, and diabetic control. Mucilage-based hydrogels,

such as the mucilage from basil seeds, exhibit strong antibacterial and therapeutic qualities.

ISOLATION AND PURIFICATION OF GUMS/MUCILAGES[11,12]

To preserve its qualities, plant material is either dried in the sun (ideally) or in an oven set at 105˚C. Before isolating the mucilage, the plant's colors or chlorophyll should usually be eliminated. To remove colors and chlorophyll, plant material must be treated with petroleum ether and chloroform. Distilled water must then be added. The resulting separated or extracted mucilage should be dried carefully. It needs to be vacuum-dried or dried at a very low temperature (no more than 50˚C). To stop additional moisture absorption or deterioration, the dry material is carefully preserved in desiccators.

After gathering the fresh plant materials, they were cleaned with water to get rid of any dirt or debris and then allowed to dry. In order to release all of the mucilage into the water, the powdered material was then soaked in water for five to six hours, boiled for thirty minutes, and let to stand for one hour. The marc was then extracted from the solution by squeezing the material out of an eight-muslin bag. The mucilage was then precipitated by adding three volumes of acetone to the filtrate. A No. 80 sieve was used to filter out the dry powder, which was then kept after the mucilage was removed and baked in an oven at a temperature lower than 50˚C.

CHARACTERIZATION OF GUMS AND MUCILLAGES[13]

The characterization of gums and mucilage is initially achieved by only a multiple technique approach.

- **Physico-chemical properties** of Gums and mucilages are characterized for the following parameters: Colour, odour, shape, taste, touch, texture, solubility, pH, swelling index, loss on drying, hygroscopic nature, angle of repose, bulk and true densities, porosity, and surface tension.
- **Rheological properties** of Gums and mucilages are important criteria for deciding their commercial use because of their viscous nature. Hence, the flow behaviour of the sample is determined.
- **Structural elucidation** of Gums and mucilage is carried out by various techniques because they contain polysaccharides and sugars. so, confirmation of the different sugars is carried out by chromatography, and structure elucidation can be carried out by NMR and mass spectroscopy.
- **To determine the purity** of the selected gum and mucilage, tests for alkaloids, glycosides, carbohydrates, flavonoids, steroids, amino acids, terpenes, saponins, oils and fats, tannins, and phenols are carried out.
- **Impurity profile testing** for impurities must be carried out using suitable analytical techniques.
- Different ash values are also estimated.
- The microbial load and presence of specific pathogens are also determined.
- In vitro cytotoxicity is also determined.

FUNCTIONAL PROPERTY[14]

Functional properties of various Gums are given below

- **Thickness**: Gums can make solutions more viscous, which makes them helpful in dressings, sauces, and other goods that require a certain consistency.
- **Emulsifying**: By lowering surface tension and avoiding separation, gums help stabilize emulsions, which are mixes of water and oil.
- **Stabilizing**: Gums can stop ingredients in food goods from separating, which keeps ice crystals from forming in frozen desserts, for example.
- **Gelling**: Certain gums can gel, giving goods a firm or semi-solid texture. Holding Water
- **Capacity**: Gums' ability to absorb and hold onto water is crucial for preserving food's moisture content and avoiding dryness.
- **Film-forming**: Some gums can create edible coatings and films that can be applied to food surfaces to enhance their texture or to package food.

Functional properties of various mucilages are given below

- **Mucilage's Ability to Hold Water:** The ability to retain water in the face of external compression or centrifugal gravitational forces is known as water holding capacity.
- **Mucilage's Ability to Hold Oil:** The most crucial functional characteristic of hydrocolloids that reveals their ability to absorb oil is their ability to hold oil. As the temperature rises, mucilage generated from plants exhibits an enhanced propensity to bind oil.
- **Mucilage's Emulsifying Property:** Emulsion products frequently contain plant-derived polysaccharides such as gum, mucilage, and starch in addition to carboxymethyl cellulose (CMC). In the pharmaceutical industry, polysaccharide gum and mucilage are gaining popularity for their commercial applications in particle suspension, emulsion stability, crystallization control, film creation and thickening, and encapsulation.
- **Foaming Property of Mucilage:** Good foaming property is associated with the elastic structure of the mucilage; the foaming property of mucilage depends upon many factors, such as the presence of further compounds in the hydrocolloid, molecular weight, protein, structure, and carbohydrates. The good foaming capacity of mucilage is highly associated with the flexible structure of mucilage that can reduce the surface tension.
- **Antioxidant Property of Mucilage:** Plant-derived polymers contain different phenolic compounds, including flavonoids and polyphenols, as bioactive compounds. These bioactive compounds prevent the chain propagation reactions initiated by free radical

reactions and prevent disease-related oxidative damage.

GENERAL EXTRACTION METHODS OF GUM AND MUCILAGE

The variety of techniques used to separate mucilage and gum. The plant portion that contains gum or mucilage can be gathered and verified prior to extraction. The material can then be crushed and sieved after drying in the sun or an oven set to 105 degrees Celsius. Several techniques, including heating, solvent precipitation, and microwave-assisted extraction, can be used to remove the gum or mucilage from plant parts. The following methods can be used for the isolation of gum/ mucilage:

1. Heating method

2. Solvent precipitation

- Precipitation of mucilage in alcohol
- Precipitation of mucilage in acetone

3. Microwave oven extraction

1. Heating method

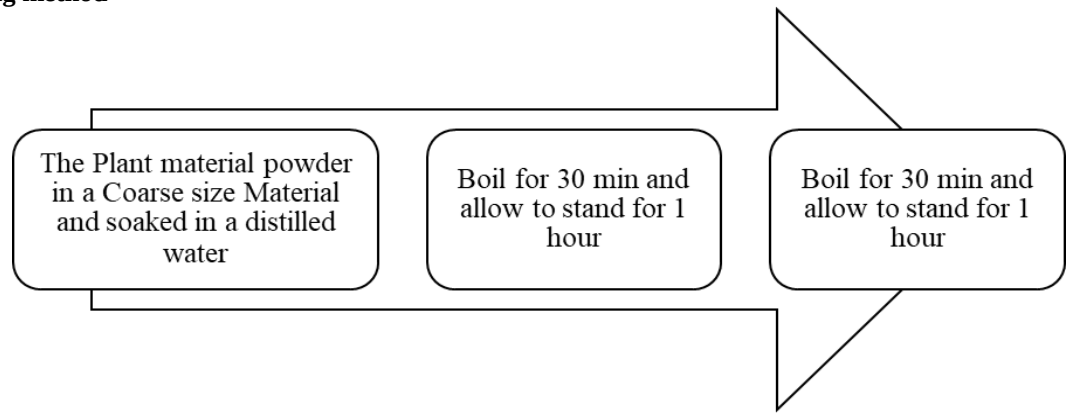

Fig. 1: Heating Method for extraction of gum and Mucilage.

2. Solvent precipitation: Gums and mucilage can precipitate using the solvent precipitation method. For precipitation, acetone and alcohol are utilized. This is the simplest, most popular, and most straightforward approach. This approach is the most widely utilized one.[15,16,17]

A. Precipitation of mucilage in alcohol

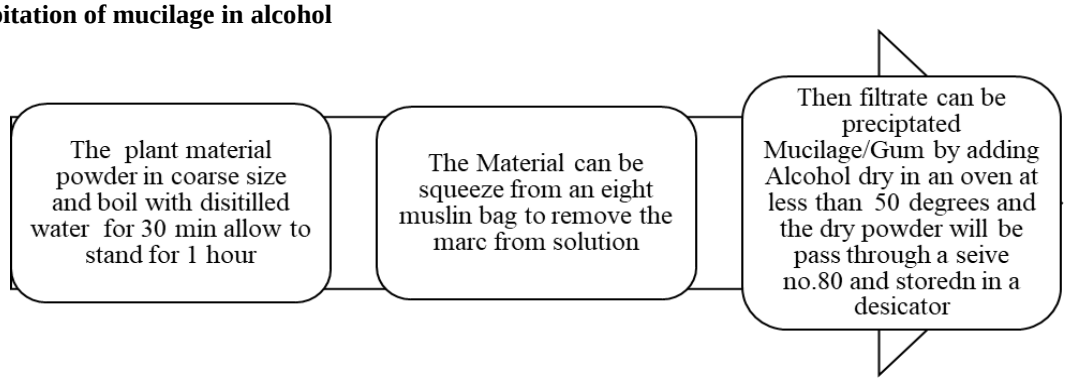

Fig. 2: Extraction of mucilage by the alcohol precipitation method.

B. Precipitation of mucilage in acetone

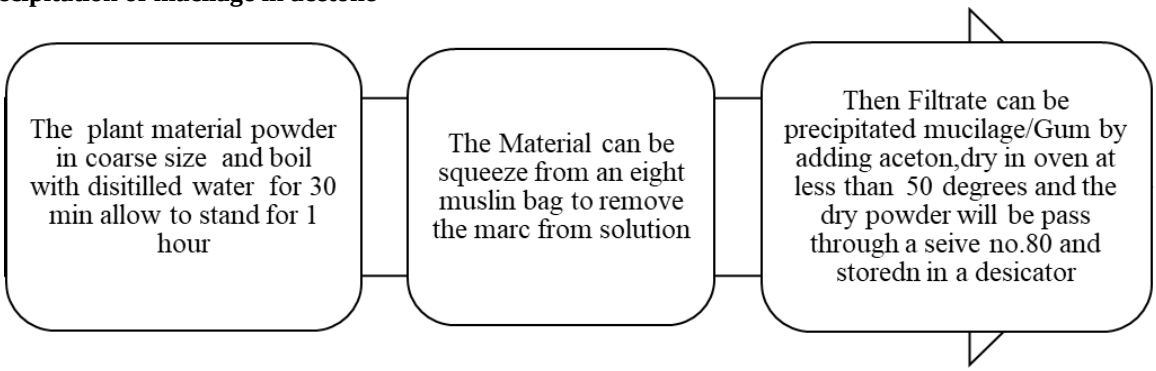

Fig. 3: Extraction of mucilage by the acetone precipitation method.

3. Extraction from a microwave oven

The phytoconstituents that were isolated from the plant with microwave energy can be used. It is a quick, simple, environmentally friendly, and efficient method. It saves energy, gasoline, and electricity. Although the process of microwave extraction is comparable to that of maceration or percolation, plant cells and tissues disintegrate much more quickly. Microwave-assisted extraction methods produce better outcomes and a higher extraction rate at a lower cost, in addition to requiring less solvent and time.[18]

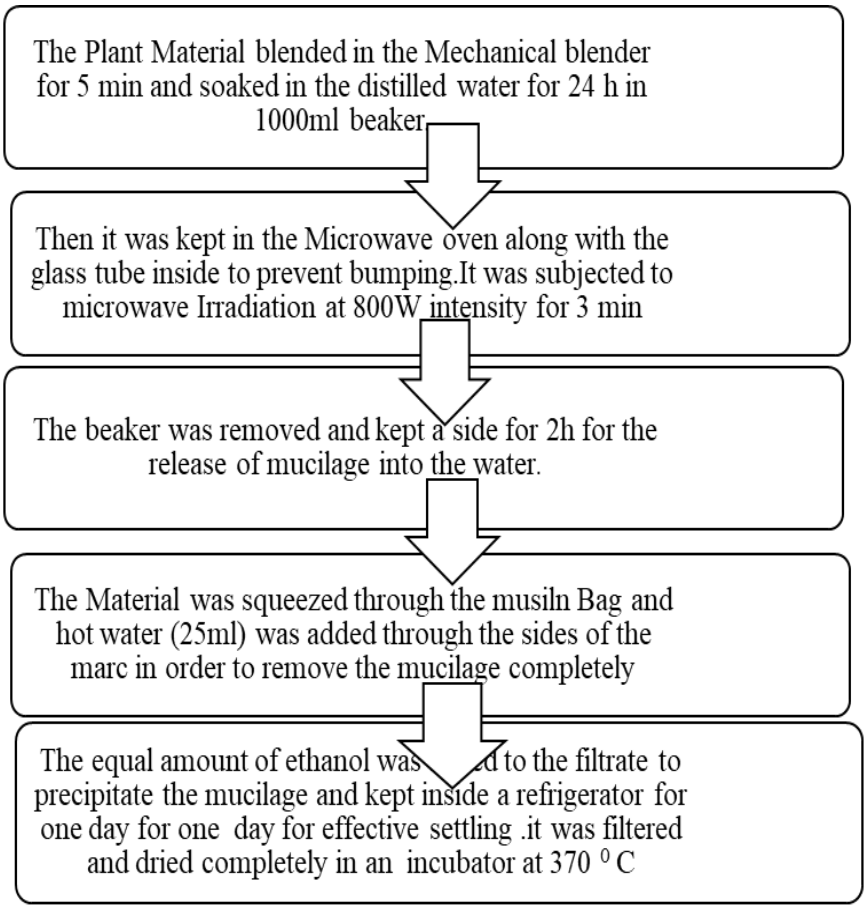

Fig. 4: Extraction of mucilage by the microwave oven.

Table 2: PRELIMINARY CONFORMATION TEST.[19,20]

Test Name	Procedure	Observation	Inference
Molisch's Test	Mix 100 mg dried mucilage powder with Molisch's reagent. Carefully add conc. H_2SO_4 along the side of the test tube.	Violet-green ring at the layer junction	Confirms the presence of carbohydrates
Ruthenium Red Test	Place a small amount of mucilage powder on a slide, add ruthenium red, and observe under the microscope.	Pink colour appears	Confirms the presence of mucilage
Iodine Test	Add 1 ml of 0.2 N iodine solution to 100 mg dried mucilage powder.	No colour change observed	Indicates polysaccharides present, but no starch
Enzyme Test	Dissolve 100 mg of mucilage in 20 mL of distilled water. Add 0.5 ml benzidine to alcohol, shake, and let stand.	No blue color forms	No enzymes detected (helps distinguish from acacia)

Table 3: A Few Examples of various gum extractions are given in the table below.

S. No	Name	Biological Source & Family	Extraction	Reference
1.	Abelmoschus esculentus okra fruit gum (OFG)	Okra fruit gum (OFG) is procured from the fruits of **Abelmoschus esculentus** (family - Malvaceous)	Initially, the overripe fruits are cleaned and sliced. These slices are then mashed in 2% v/v glacial acetic acid to obtain a slurry. This slurry undergoes ultrasonic-assisted extraction using 65°C distilled water. The extract is then filtered through muslin cloth to remove debris. Enzyme sections are added to the filtrate to precipitate the gum. The resulting precipitates are separated and dried in a vacuum oven at 50°C.	[21]
2.	Figs fruits	Figs are the plant species **Ficus carica L.**, (Family: Moraceae)	Filtering-clarifying concentrating method (FCCM)— Prepare the mucilage solution by boiling the fruits, which were filtered through filter paper (×3) and concentrated to a sixth of its volume. Ten grams of activated carbon powder were added to the concentrated mucilage solution and filtered using a vacuum and a diatomite filter aid (×3), and then stored in an airtight jar for later use.	[22]
3.	Cordia myxa fruit or Assyrian plum fruit	Plum fruit is a plant species of **Cordia myxa** (Family*:* Boraginaceae)	Cordia myxa fruit powder was suspended in distilled water, and the sonicated mixture was cooled to room temperature, and then the insoluble pellet was filtered. The supernatant was mixed with four volumes of 80% ethanol. Then, the precipitates were collected by centrifugation at 3000g for 15 min. After being washed sequentially with 80% ethanol, 95% ethanol, 100% ethanol, and acetone, was dried at 50 °C under vacuum to obtain an unpurified polysaccharide.	[23]
4.	Tamarind Seed	The tamarind is a plant species of **Tamarindus indica** (Family: Leguminosae or Fabaceae).	The crushed seeds of tamarind were soaked in water for 24 h, and the soaked seeds were put into a muslin cloth to release the gum from it. The separated gum was dried in a hot air oven at a temperature of 40ºC. Then the dried gum was powdered and stored in airtight containers at room temperature.	[24]
5.	Fenugreek seed	Fenugreek is the dried seeds of the plant **Trigonella foenum-graecum**, which belongs to the Leguminosae (or Fabaceae) family.	Approximately 500g of fenugreek seed powder was used in this method. PET ether (bp 30- 60 °C) of 800ml was used as solvent in the Soxhlet extractor in which solvent flows back and forth into the extraction thimble for 14hrs at 30 °C. After that, the mixture of solvent-oil was filtered via NO.1 Whatman filter paper. Further, the extract was transferred into the rotary evaporator, and the solvent in the round flask was evaporated at 30 °C. The extract was stored in the refrigerator at 5 °C for further studies.	[25]
6.	Flax seed	The flax seeds are obtained from **Linum usitatissimum**. (Family: Linaceae)	Firstly, dried seeds were collected and cleaned. Then, accurately weighed (300 g) of seed was boiled with 2 liters of 0.1 M $NaHCO_3$ for 1 h. at 85°C. The boiled extract was cooled and filtered through a muslin cloth. Glacial acetic acid was added to neutralize the extract. Further, the neutralized extract was added to ethyl alcohol. The amount of ethyl alcohol was 10 times greater than that of the filtrate. The extracted mucilage was precipitated immediately. The precipitated mucilage was separated and dried in the hot air oven at 55°C for 5 h. The yield of the dried mucilage was	[26]

			calculated and stored in a desiccator until further use.	
7.	Hibiscus Leaf	The biological source of hibiscus is **Hibiscus rosa-sinensis** (Family Malvaceae)	**Extraction of Mucilage:** The fresh young leaves were collected, washed with water to remove dirt and debris, and shade-dried for 25 days. The dried leaves were ground to a fine powder, and the leaf powder was soaked in water for different time periods in order to identify the time taken for the release of mucilage.	[27]
8	Aloevera Leaf	Aloe vera is the dried latex from the leaves of the **Aloe barbadensis miller.** (Family: Liliaceae (now classified as Asphodelaceae).	**Wash the Aloe vera Leaf**: The yellow fluid secretion should be completely removed. Leaves are initially washed in a sterilizing solution, a 200-ppm solution of sodium hypochlorite. The Aloe Vera leaves are preconditioned by sun drying, shade drying, and steaming. **Whole leaf aloe Vera processing:** The material is then treated with special chemical products which break down the hexagonal structure of the fillet, releasing the constituents, by means of a series of coarse and screening filters, or passage through a juice press, and aloe vera mucilage is produced and stored	[28]
9.	Cactus leaf	Cacti belong to the plant family Cactaceae	A solution was prepared by mixing the milled sample (100 mg) with water (5 mL) and allowing it to stand for 24 h. Then, the solution was filtered, and the mucilage was precipitated by adding 15 mL of ethanol and dried in an oven at 60°C.	[29]
10.	Bomboax ceibaf flower	The biological source of **Bombax ceiba** is the Red Silk Cotton Tree. Its family is Bombacaceae.	**Soxhlet extraction method:** After gathering and drying the Bombax ceiba flower petals completely, 150g of them were ground into a powder for five minutes in a mechanical blender. They were then placed in a Soxhlet apparatus to be deflated with petroleum ether, benzoene, and chloroform until the extraction process was complete. The extracted material was then concentrated under low pressure using a rotary evaporator to obtain extracts. Then deflatted flowers were placed in heated water for 1 hr under reflux with periodic stirring and put aside for 2 hrs for the release of mucilage into water. After passing the material through a muslin bag, 100 milliliters of hot distilled water were added through the marc's sides, and the mixture was thoroughly squeezed to eliminate all of the mucilage. To precipitate the mucilage, an equal volume of ethanol was added to the filtrate, which was then refrigerated for a day to ensure proper settling. After being filtered and thoroughly dried at 37 °C in an incubator, it was ground into a powder and weighed.	[30]
11.	Locust bean gum	Derived from the seeds of the carob tree known as **Ceratonia siliqua L.** (Family: Leguminosae)	Clarification of native locust bean gum may be achieved by dispersing it in water and dissolved by heating. This solution is subjected to filtration to remove insoluble substances and to obtain clear solution. Locust bean gum is recovered by precipitation with isopropanol or ethanol, followed by filtering, drying and grinding or milling, to obtain fine particle size powder of clarified or purified carob bean gum	[31]
12.	Tara Spinosa fruits gum	The biological source of **Caesalpinia spinosa** is	The extract was prepared *via* infusion, with distilled water as the solvent. A total of 200 g of *C.*	[32]

		the tara bush or Peruvian carob tree. (Family: Fabaceae)	*spinosa* fruits (pods without removal of seeds) was introduced into 1 L of distilled water and placed in an oven at 55°C ± 1°C for 7 h. After which time, it was filtered with Whatman paper No 1 and followed by a second filtration with a 1.0-µm pore size filter, using a vacuum pump. The extract was concentrated in a rotary evaporator at 60°C and dried in an oven at 50°C.	
13.	Mimosa pudica gum (Whole plant gum)	Mimosa pudica, commonly known as the Touch-Me-Not plant & its biological source was **Mimosa pudica L.,** (Family: Fabaceae)	A weighed quantity (100 g) of *Mimosa*. *Pudica* seed were taken and processed for separating the brown peels. All the seed were then crushed and soaked in double volume of water for 10 h., a thin layer of the hydrated mucilage along with seed was then spread on the stainless-steel tray and dried in an oven at 50°C for 4–5 h. The dried mucilage was collected from the tray by blade or knife and separated from the seed by passing it through a sieve no 80. The powdered mucilage was further purified by winnowing to separate seed husk. The dried mucilage powders were preserved in desiccators for further use.	[33]
14.	Albizia gum	Gum exudate collected from bark of **Albizia lebbeck L.** **(**Family: Fabaceae or Leguminosae)	A mixture of 100 g of stem bark powder was macerated in 100 mL of acetone in water (80:20, respectively) with continued shaking for three days in the dark at room temperature of 23–25 °C, followed by filtering and collecting the macerate, then repeating the same procedure twice more. A mixture of the three mixed filtrates from each step was combined and concentrated at 50 °C using a rotary evaporator which was then freeze-dried for 48 hours.	[34]
15	Basil seeds Mucilage	Basil seeds obtained from **Ocimum basilicum** L.is an annual herb that belongs to the family Lamiaceae or mint family.	Mucilage was extracted using distilled water. Seeds were added to a specific proportion of water at a desired temperature. Slurry was maintained at a constant temperature and continuously stirred using a magnetic stirrer under reflux conditions for the entire extraction period. Later, mucilage was separated from seeds using a rubber spatula on a mesh screen. Slurry obtained was passed through a screen of mesh size 10. Separated mucilage and a seed suspension were obtained, which was dried at 50 °C for 10 h in a conventional hot air oven.	[35]
16.	Cassia Tora Seed gum	Cassia tora obtained from **Cassia obtusifolia L.** It is a member of the Leguminosae, Fabaceae or Caesalpiniaceae family	The seeds were further air dried and the dried seeds were coarsely ground by grinder. The coarsely powdered seeds were defatted using toluene and boiled with water for 30 min. The aqueous extract was filtered through a muslin cloth and gum was precipitated using excess of acetone. The precipitated gum was washed with isopropyl alcohol for purification.	[36]
17.	Cocculus hirsutus Mucilage	Mucilage was isolated from the leaves of **Cocculus hirsutus** (Family: Menispermaceae also known as moon seed family)	The dried leaves powder was soaked in water for 1 hour, boiled for 30 minutes and kept aside for complete release of the mucilage into the water and filtered through eight-fold muslin cloth. An equal volume of ethanol was added to the filtrate for subsequent precipitation. The precipitated mucilage was dried in an oven and then grounded into fine powder using a mortar and pestle. Finally, it was weighed and stored in desiccators.	[37]

18.	Grewia Gum	Grewia gum, is derived from the inner stem bark of the plant **Grewia Mollis.** (Family: Malvaceae)	Aqueous Grewia mollis stem bark gum was extracted from the bark powder using distilled water (water to powder ratio (10 : 1 to 80 : 1) at pH 4 to 10 . The pH was adjusted with 0.1 M HCl or NaOH. Water was preheated to a designated temperature before the powder was added. The powder water slurry was mixed throughout the extraction period (1 h to 3 h). Separation of the gum from the swollen powder was achieved by passing the powder through an extractor with a rotating plate that scraped the gum layer on the powder surface. The collected gum was filtered and dried in an oven (45°C overnight). The dry gum was packed and stored at cool and dry conditions.	[38]
19.	Jack fruit Mucilage	Biological source of jack fruit was **Artocarpus heterophyllus**. (Family: Moraceae)	To get rid of dirt and debris, the fruits were carefully cleaned with water. They were sliced, left overnight, and then sliced into pieces. They removed the seeds that were within the fruit. To fully release the mucilage into the water, the fruit pulps were crushed, soaked in water for five to six hours, heated for thirty minutes, and then allowed to stand for one hour. To remove the marc from the solution, the mucilage was removed using a multi-layered muslin cloth bag. To precipitate the mucilage, three times the filtrate volume of ethanol was applied. After being separated and dried at 35°C in an oven, the mucilage was gathered, crushed, and sieved using a #80 screen before being kept in a desiccator until it was needed.	[39]
20.	*Cassia fistula* mucilage	*Cassia fistula* mucilage derived from the seeds of **Cassia fistula Linn**. is a common herbaceous annual. (Family: Fabaceae or Leguminosae)	Seeds of C. fistula. A slurry was created by soaking 20g of kernel powder in 200ml of cold distilled water. After that, 800 milliliters of boiling distilled water were added to the slurry. In a water bath, the solution was cooked for 20 minutes while being stirred. The thin, clean solution that was produced was left overnight to allow the fibers and protein to settle. The solution is centrifuged for 20 minutes at 5000 rpm. After being separated, the supernant was added to twice as much absolute ethanol while being continuously stirred to cause the polysaccharides to precipitate. After being cleaned with petroleum ether, diethyl ether, and 100% ethanol, the precipitate was dried at 40 to 45 degrees Celsius, passed through sieve #120, and kept in desiccators until it was needed for additional research.	[40]

REFERENCES

1. Harshvardhan Patel. Plant derived gums: source, extraction, and food application. The Pharma Innovation Journal, 2023; 12(7): 3439-3447.
2. Sanjib B, Uttam Kumar S*, Dipesh S, Ghanshyam S, Amit Roy. Review on natural gums and mucilage and their application as excipient. Journal of Applied Pharmaceutical Research, 2017; 5(4): 13 -21.
3. Prameela Rani A, Varanasi. S. N. Murthy*. Natural gums: it's role as excipients and diverse applications in pharmacy – a comprehensive review. IAJPS, 2014; 1(6): 502-511.
4. Pritam dinesh choudhary, Harshal Ashok Pawar. Recently investigated natural gums and mucilages as Pharmaceutical excipients: An overview. Journal of Pharmaceutics, 2014; 2(1): 1-9.
5. Jani GK, Shah DP, Prajapati VD, Jain VC. Gums and mucilages: versatile excipients for pharmaceutical formulations. Asian J Pharm Sci., 2009; 4(5): 309-23.
6. Chowdhury S, Chakraborty S, Nandi G, Pal S. Pharmaceutical excipients from natural sources. NSHM Journal of Pharmacy and Healthcare Management, 2014; 1(2): 50-63.

7. Sunil Goswami, Sonali Naik. Natural gums and its Pharmaceutical application. Journal of scientific and innovative research, 2014; 3(1): 112-121.
8. Rajeshwari s. Patil, Anilkumar U. Tatiya, Dipashri Malkhede, Vaibhav G. Kute & Vishal S. Bagul. Review on natural gums & mucilage used as suspending agents in various suspension. Ejpmr, 2021; 8(3): 1-12.
9. Shivam Navale, Jagdish Nagare, Nikhil Mehetre, Vaishnavi Mhaske, Varsha Chaudhari. Plant Based Mucilage And Its Application In Different Pharmaceutical Formulation. IJCRT, 2022; 10(1): 87-94.
10. Thomas SP, Joseph MV. Exploring Plant-Derived Alternatives in the Food Industry: A Review. Food Chemistry, 2019; 127(2): 487-493.
11. Baveja S. K, Rao K. V. R, Arora J. Examination of natural gums and mucilages as sustaining materials in tablet dosage forms. Indian Journal of Pharmaceutical Sciences, 1988; 50(1): 89–92.
12. Wahi S. P, Sharma V. D, Jain V. K, et al. Studies on suspending property of mucilage of Hygrophila Spinosa T. Anders and Hibiscus Esculents Linn. Indian Drug, 1985; 22(1): 500–502.
13. Snehal Munot*, Bhagyashree Padwal*, Pratima Shinde*. A Review on: Natural Gums and Mucilages: Used as Excipients and Pharmaceutical Sciences. International Journal of Advances in Engineering and Management (IJAEM), 2021; 3(4): 460-472.
14. Mansuri M. Tosif, Agnieszka Najda, Aarti Bains. A Comprehensive Review on Plant-Derived Mucilage: Characterization, Functional Properties, Applications, and Its Utilization for Nanocarrier Fabrication. Polymers, 2021; *13*(7): 1066.
15. Sharma VK, Tiwari M, Chauhan NS, Nema RK. Phytochemical investigation on the ethanolic extract on the leaves of Zizyphus xylopyrus (Retz.) Willd. International journal of Agronomy and Plant Production, 2012; 3(1): 26-37.
16. Kolhe S, Kasar T, Dhole SN, Upadhye M. Extraction of mucilage and its comparative evaluation as a binder. American Journal of Advanced Drug Delivery, 2014; 2(3): 330-43.
17. Sunil M, Biswal PK, Mishra B, Sahoo S. Isolation, characterization and pharmaceutical evaluation of the mucilage from Polyalthia suberosa leaves. International Journal of PharmTech Research, 2010; 2(2): 1455-9.
18. Shah BN, Seth AK. Microwave assisted isolation of mucilage from the fruits of abelmoschus esculentus. Hygeia journal for drugs and medicines, 2011; 3(1): 54-67.
19. C. K. Kokate, A. P. Purohit, S. B. Gokhale. Pharmacognosy. Pune, India: Nirali Prakashan, 2006.
20. V. D. Rangari. Pharmacognosy & Phytochemistry. Nashik, India: Career Publication, 2006.
21. Meenu nagpal*, geeta aggarwal, upendrea k jain, jitender madan. Extraction of gum from Abelmoschus esculentus: physicochemical peculiarity and antioxidant prepatent. Asian J Pharm Clin Res., 2017; 10(9): 174-179.
22. Reyes-Ocampo, Córdova-AguilarM. S, Guzmán G, Blancas-Cabrera A. Solvent-free mechanical extraction of Opuntia ficus-indica mucilage. Journal of food process engineering, 2018; 42(1): 1-10.
23. Shaghayegh Keshani-Dokht, Zahra Emam-Djomeh , MohammadSaeid Yarmand, Morteza Fathi. Extraction, chemical composition, rheological behavior, antioxidant activity and functional properties of Cordia myxa mucilage. International Journal of Biological Macromolecules, 2018; 118(1): 485–493.
24. Singh R, Malviya R, Sharma PK. Extraction and characterization of tamarind seed polysaccharide as a pharmaceutical excipient. Pharmacognosy Journal, 2011; 3(20): 1-92.
25. S. Divakar S. *, Shanthin K., Kanaga P. A Review Article On Extraction Of Fenugreek Seed. Int. J. of Pharm. Sci., 2024; 2(6): 461-466.
26. Seema Mahor, Neelkant Prasad, Phool Chandra, Hina Chadha, Manisha Kumari, Meenakshi. Extraction, Evaluation and A Comparative Study of *Mimosa Pudica* Seed Mucilage with *Trigonella Foe Num Graecum* and Flax Seed Mucilage. JCHR, 2023; 13(5): 138-149.
27. Vignesh R. M.*, and Bindu R. Nair. Extraction and characterisation of mucilage from the leaves of *hibiscus rosa-sinensis* linn. (malvaceae), IJPSR, 2018; 9(7): 2883-2890.
28. Komal Mohite*, Tejashri Kamble, Kavita Nangare, Vaishali Payghan, Santosh Payghan. A Review Article on: Aloe Vera: Extraction of Gel and Extraction of Aloin From Aloe Vera Gel by Ultrasonic Assisted Method. IJCRT, 2021; 9(6): 276-291.
29. Mariel Monrroy, Erick García, Katherine Ríos, José Renán García. Extraction and Physicochemical Characterization of Mucilage from *Opuntia cochenillifera* (L.) Miller. Journal of Chemistry, 2017; 2017(1): 1-9.
30. Dr. Santosh Bhadkariya and Dr. Chakresh Patley. Isolation and characterization of mucilage from flower petals of Bombax ceiba. Journal of Pharmacognosy and Phytochemistry, 2024; 13(2): 215-219.
31. Sheweta Barak, Deepak Mudgil. Locust bean gum: Processing, properties and food applications—A review. International journal of Biological Macromolecules, 2014; 66(1): 74-80.
32. David Salirrosas, Nataly Reategui-Pinedo, Jan Pier Crespo, Linda Sánchez-Tuesta, Mónica Arqueros, Angelita Cabrera, Renata Miliani Martinez, Carmen Ayala, André Rolim Baby. Safety Profile of *Caesalpinia spinosa* Aqueous Extract Tested in *Oreochromis niloticus* Toward Its Application in Dermocosmetics, Frontiers in Sustainability**,** 2021; 2(1): 1-10.

33. Seema Mahor, Neelkant Prasad, Phool Chandra, Hina Chadha, Manisha Kumari, Meenaksh. Extraction, Evaluation and A Comparative Study of *Mimosa Pudica* Seed Mucilage with *Trigonella Foenum Graecum* and Flax Seed Mucilage. JCHR, 2023; 13(5): 138-149.
34. Omer H. M. Ibrahim and Essam Y. Abdul-Hafeez. The Acetone Extract of *Albizia lebbeck* Stem Bark and Its In Vitro Cytotoxic and Antimicrobial Activities. Horticulturae, 2023; *9*(3): 385-389.
35. Sadaf Nazir, Idrees Ahmed Wani, Farooq Ahmad Masoodi. Extraction optimization of mucilage from Basil (*Ocimum basilicum* L.) seeds using response surface methodology. Journal of Advanced Research, 2017; 8(3): 235-245.
36. Joshi U. M.* and Biyani K. R. Extraction of a Novel Seed Gum from Cassia Tora Seeds and its Characterization. Ijppr. Human, 2015; 4(1): 243-251.
37. Devasahayam Leema Rose Mary, Antonysamy Lawrance, Arokiadoss Edwina Sherley Felicita, Pushpam Marie Arockianathan. Characterization and antioxidant effect of mucilage in leaves from *Cocculus hirsutus*. Bioinformation, 2024; 20(5): 439–448.
38. Emmanuel Panyoo Akdowa, Thaddee Boudjeko, Alice Louise Woguia, Nicolas Njintang-Yanou, Claire Gaiani, Joel Scher, Carl Moses F. Mbofung. Optimization of Variables for Aqueous Extraction of Gum from *Grewia mollis* Powder. Journal of Polymers, 2014; 2014(1): 1-9.
39. Vidya Sabale, Vandana Patel1, Archana Paranjape. Isolation and characterization of jackfruit mucilage and its comparative evaluation as a mucoadhesive and controlled release component in buccal tablets. International Journal of Pharmaceutical Investigation, 2012; 2(2): 61-69.
40. S.K. Singh*and S.Singh. Evaluation of *Cassia fistula* Linn. Seed Mucilage in Tablet Formulations. Int.J. PharmTech Res., 2010; 2(3): 1839-1846.