

## Natural Binders: A Review

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### ABSTRACT

Natural binders are easily available and it is useful in tablet formulation. It is having low cost and low side effect that's why today's world is running after natural product and natural excipient. Binders in pharmaceutical preparation hold the powder material together to form granules and it also ensure that it remain intact after compression. Binders can also determine the drug release properties of any formulation and its bioavailability. There are different types of binding agent like starch, gum, mucilage's, and it is safer and more economical than synthetic one. The use of synthetic binders, such as petroleum-based adhesives and resins, has raised concerns regarding their carbon footprint, non-biodegradability, and dependence on finite fossil fuel resources. In contrast, natural binders, derived from renewable sources such as plants, animals, and microorganisms, offer an eco-friendly and sustainable solution to address these challenges. This abstract provides an overview of different types of natural binders commonly employed in various industries, including lignin, proteins, cellulose derivatives, and polysaccharides. It highlights their unique characteristics, such as biocompatibility, biodegradability, and abundance in nature, which make them attractive alternatives for material adhesion.

**KEYWORDS:** Natural gums, Sustainable materials, Compatibility, Cost-effective, Green binders

### I. INTRODUCTION

Pharmaceutical products like tablets, capsules, syrups etc administered to human body to treat several disease conditions. But single drug component cannot work properly to treat those disease and showing their therapeutic effect. That is why in pharmaceutical preparations excipients should use. Binders added in tablet formulation to hold the powder together to form granules. Using of binding agent may help tablet to remain intact after compression. Natural polymer and binders are used in tablet formulation because of its advantages

having low cost, less toxicity, biocompatible and environmentally friendly processing. Synthetic excipients show adverse effects that's why world is increasing paying attention to natural products. In recent years the plants derived polymer have evoked tremendous interest due to their diverse pharmaceutical application such as diluent, binders, disintegration in tablet, thickness in oral liquid, suspending agent. The present investigation was aimed at natural binders in tablet formulation. Natural binders (polymers) (mainly gum and mucilage's) are natural plant hydrocolloids which are formed by giving injury to the plant or due to unfavourable conditions such as drought by breakdown of cell wall. <sup>(1)</sup> They are translucent, amorphous substance produced in higher plants as a protective after injury. <sup>(2)</sup> they are heterogenous in composition. Gums are found in trees and shrubs of number of families especially rutaceae<sup>(3)</sup> leguminosae etc.

Mucilages are normal products of metabolism, which are formed within the cells of the plant and many represent <sup>(4)</sup>.

### ADVANTAGES

1. It can modify the drug release and can influence the bioavailability and absorption of drugs. <sup>(5)</sup>
2. They should optimize the performance of dosage form during manufacturing as well as when patient consume them.
3. Naturally occurring polymers produced by all living organism. they show no adverse effect on the environment or human being. <sup>(6)</sup>
4. All those plant materials are carbohydrates in nature and composed of repeating monosaccharide unites. Hence, they are non-toxic.
5. They are cheaper and their production cost is less than synthetic materials. <sup>(7)</sup>

### DISADVANTAGES

1. When polymer binders are selected addition of strong disintegrates typically required but these are considerable expensive and have a negative effect on product stability

2. It sometimes may lead to processing difficulties such as rapid over granulation, tablet hardness increases etc.<sup>(8)</sup>
3. Synthetic manufacturing is controlled procedure with fixed quantities but in case of natural polymers is dependent on environment and various physical factors.
4. As the production rate is depends on environment and other factors so natural polymers have a slow rate of production.<sup>(9)</sup>

#### CHARACTERISTICS OF AN IDEAL NATURAL EXCIPIENT

1. Nontoxic and non-irritant
2. Easy handling
3. Noninteraction with drugs or with other substances present in the formulation and packaging
4. Pharmaceutically active<sup>(10)</sup>

#### SOURCES OF NATURAL BINDERS

Natural binders obtain from origin like plants, animals, and minerals and sometimes from microbes<sup>(11)</sup>

1. Plant sources: starch, sugar, cellulose, and alginate
2. Animal sources: lactose, gelatine, and stearic acid
3. Minerals sources: calcium, phosphate, silica.

The natural binders often lack of trade name after examining those binders obtains from the plant, animal, and minerals origin its therapeutic value can be identified. Natural binders used in pharmaceutical formulation over synthetic one because of its non-toxicity property with any other ingredients used in the preparation. It does not show any adverse effect in the target site that's why today world is running after natural excipient in the pharmaceutical preparation.<sup>(12)</sup>

#### REASON FOR APPRECIATING NATURAL POLYMER INSTEAD OF SYNTHETIC ONE

Synthetic polymers used in pharmaceutical industries possess drawbacks of toxic effects and health problems.<sup>(13)</sup> Natural gums (polymer) are currently being imported by India from other countries like Sudan (56 %), Chad (29 %) and Nigeria (10 %). To avoid drawbacks of synthetic gums (polymer) and reduce import expenses, alternative natural gums are to be explored. Polymer attain from plants were utilized in India as excipients in food, pharmaceutical and cosmetic industries<sup>(14)</sup>. India is the hub of

medicinal plants and these are not commercially exploited much. Indian industries depend upon the imported gums. Since commoner are going to be involved in collecting the gums the society are going to be benefited.<sup>(15)</sup>

#### NATURAL GUM AND MUCILAGE AS A BINDER

Natural polymers are made of high molecular weight carbohydrates which are biodegradable non-hazardous and biocompatible polymers<sup>(16)</sup>. They have environment sustainable features Natural Gums are natural plant hydrocolloids which are formed by giving injury to the plant or due to unfavourable conditions such as drought by breakdown of cell walls<sup>(17)</sup>. They are translucent, amorphous substances produced in higher plants as a protective after injury<sup>(18)</sup>. They are heterogeneous in composition. They are soluble in water and gives a viscous, sticky solution. Gums can be hydrolysed by prolonged boiling with dilute acids to yield a mixture of sugars and uronic acids. They are found in trees and shrubs of several Families especially Rutaceae etc. Mucilages are normal products of metabolism, which are formed within the cells of the plant and may represent<sup>(19)</sup>

#### II. METHOD AND MATERIALS DATA COLLECTION

In this study we mainly focus on natural binders used in pharmaceutical application. We have collected lots of journals and review article on natural binders from google search engine and google scholar research engine and science direct engines by using keyword "a review on natural binders" "review on natural polymers" "slide share on natural polymers" "plant ecudates and mucilage as pharmaceutical excipient" "industrial use of natural binders in modern drug delivery" etc

#### DATA PROCESSING

Many journals and review article we have found and we have selected the journals and articles which contain data about natural binders.

#### DATA ANALYSING AND REPORT

We have collected the data and segregate for different natural binders, biological source chemical constituents, botanical name, part used of natural gum and mucilage, method of purification etc and reported into the result and discussion.

### III. RESULT AND DISCUSSION

#### EXTRACTION OF DIFFERENT BINDING AGENT

##### 1. EXTRACTION OF PECTIN FROM CITRUS FRUIT PEEL

Dried citrus fruit peel powder (in required quantity) was dissolved in distilled water. (20) The water used in extraction should be acidic in nature so using any acidic medium like citrus acid made it acidified and the pH of that acidified water should be 1.2. then prepared acidified mixture was pour in the peel mixture and heat the mixture by maintaining temperature up to 60 and time period up to 120 min. after heating period is over the resulting mixture is treated in two ways either with ethyl alcohol or ethanol with continuous stirring up to 15 min. the mixture is kept aside for 2 hours and filter out the precipitation. After dried out the precipitate it is kept in the desiccator until further use. (21)

##### 2. STARCH 1500 AS A BINDING AGENT

Starch 1500 act as an excellent binding agent with different pharmaceutical formulation. It is used as super disintegrant for mouth dissolving tablets ordispersible tablets which release their active ingredient rapidly. In compare with the povidone which is also a super disintegrant, the starch 1500 improves tablets hardness and friability. (22) The formulation of Lamivudine tablets with starch 1500 exceeded the disintegration and dissolution performance of povidone formulation that utilizes a super disintegrant. (23)

##### 3. EXTRACTION OF TAPIOCA STARCH AS A BINDING AGENT

It is a natural binders used mainly in the Diclofenac tablet formulation. The fresh tapioca

roots contain starch contain 25% to 32% which is widely used in extraction. In the extraction process first uprooted the raw cassava tubers and that is clean with tapioca starch processing machine. Then the fresh cassava was taken to the rasper (rasper mainly mill the cassava into pulp). To separate the starch and fibers the pulp is than taken to screening machine. An equipment is attached with the screening machine to collect the extracted starch from pulp. The slurry is taken into the dewatering machine for drying. After decreasing the moisture content is starch that meet the commercial demand (24-25).

##### 4. EXTRACTION OF GUM OKRA FRUIT AS A NATURAL BINDER

It acts as a natural binder which contains gum that makes a thick, sl9imy mucilage. It is mainly obtaining from the pods of okra plant. The potential of okra gum obtained by traditional extraction as a film coating tablet. The powder of okra pods dispersed in demineralized water heating upto 80 for 30 minutes in the presence of sodium chloride. Then the mixture was filtered in centrifuge in 4000 rpm for 30,60,120 min and freeze dried. The gum was then filter under vacuum and dried in desiccator. (26)

##### 5. A POTENTIAL NATURAL TABLET BINDERS FROM GREWIA OPTIVA

The mucilage was isolated from the bark of Grewia Optiva. The gum mucilage obtained from the GrewiaOptiva have superior rheological properties. (27) The dissolution, disintegration and hardness of the tablet increases with increase in the concentration of gum mucilage. The Grewia Optiva is cheap, economic, and easily available and also suitable for use of pharmaceutical tablet binders. (28)

#### APPLICATION OF GUM AND MUCILAGES AS BINDERS:

Common name	Botanical name	family	Pharmaceutical application	Reference
Neem gum	Azadirachtaindi ca	Meliaceae	it is used as binders, suspending agent and transdermal film forming agent	29
Guar gum	Cyamompsistetr agannolbus	leguminoseae	It is used as emulsifier, binder and disintegrant	30-35
Gum ghatti	Anogeissuslatif olia	combretaceae	It is used as binders, emulsifiers and	35

			suspending agent	
Albizia gum	Albiziazgyia	albiziazgyia	It is used as tablet binders	<b>36-38</b>
Mango gum	Mengiferaindica	anacardiaceae	It is used as tablet binders	<b>39</b>
Fenugreek mucilage	Trigonellafoenu mgraceum	leguminoseae	t is used as a gelling agent. It can be also used as a disintegrant, table binder, sustaining agent, emollient and demulcent.	<b>40-46</b>
Cassia tora mucilage	Cassia obstusifolialinn.	caesalpiniaceae	It is used as a granulating agent, binding agentand suspending agent	<b>47-50</b>
Phoenix mucilage	Phoenix dactylifera	arecaceae	It is used as binder	<b>51</b>
Dendrophthoe Mucilage	Dendrophthoe falcata	Loranthaceae	It is used as a binder	<b>52</b>
Cordia mucilage	Cordia obliqua	Boraginaceae	It is used as a tablet binder and emulsifier	<b>53-55</b>

#### IV. CONCLUSION

There are variety of natural excipient used in tablet formulation which is cheaper than the synthetic one. Natural binders show good binding property, good dissolution rate and having excellent disintegration time with pharmaceutical preparation. Recently the utilization of the variety of natural as a binding agent gained promising attention due to its healthy effect. The pharmaceutical scientist has achieved an excellent success in developing the foremost therapeutic system Using natural polymers. Natural excipient drug dosage form could be developed to address challenges of drug formulation in pharmaceutical industry.

This review article has provided a comprehensive overview of natural binders and their applications in various industries. Natural binders, derived from renewable resources, have gained significant attention due to their eco-friendly nature and sustainable characteristics. The article explored different types of natural binders,

including proteins, polysaccharides, lignin, and tannins, highlighting their unique properties and functionalities.

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