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A current review on natural binders used in pharmaceuticals

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Abstract
Binders are applied to tablet formulations to give them plasticity and thus increase the strength of inter-particle bonding inside the tablet. The research and production of new excipients for use as a binding agent in tablet formulations is still a hot subject. This is due to the fact that different binding agents can be used to achieve different tablet mechanical strengths and drug release properties for various pharmaceutical purposes. Binders are substances that give granules their cohesiveness. The composition of granules of derived hardness and size ensures that the tablet remains intact after compression while also enhancing the flow qualities. Natural binders including starch, gums, mucilage, and dried fruits have binding properties as well as filler and disintegrant properties. Natural polymers are safe and economical than synthetic polymers like PVP. Natural gums and mucilage are naturally occurring plant components that are relatively inexpensive and abundant. They are commonly used as natural excipients in both traditional and novel dosage types, and they have the potential to be biodegradable polymeric Materials. With the growing interest in natural-source polymers, the pharmaceutical industry has decided to use the majority of them in formulations. Natural products have grown in popularity in recent years, and they are now widely used for a number of purposes. Excipients were used as inert vehicles in drug formulations to provide the required weight, consistency, and volume for the proper administration of the active ingredient, but in modern pharmaceutical dosage forms they often fulfill multi-functional roles such as modifying release, enhancement of the active ingredient's stability and bioavailability must be improved, as well as patient acceptability and manufacturing simplicity.

Keywords: binders, natural polymers, starch, pre-gelatinized starch

Introduction [1, 2]

Plant-derived polymers have sparked a lot of interest in recent years because of their wide variety of pharmaceutical applications, including diluents, binder, and dis integrant in pills, thickeners in oral liquids, defensive colloids in suspensions, gelling agents in gels, and bases in suppository. Cosmetics, textiles, paints, and paper making all use them. Natural gums and mucilage are naturally occurring plant components that are relatively inexpensive and abundant. They are commonly used as natural excipients in both traditional and novel dosage types, and they have the potential to be biodegradable polymeric materials. With the growing interest in natural-source polymers, the pharmaceutical industry has agreed to use the majority of them in formulations. Natural products have exploded in popularity in recent years, and they are now used for a wide range of purposes. Gums and mucilage have been used in several studies in fields such as food technology and pharmaceuticals. The traditional role of excipients in drug formulations was to serve as inert vehicles that provided the necessary weight, consistency, and volume for the correct administration of the active ingredient. However, in modern pharmaceutical dosage forms, they often perform multiple functions such as adjusting release, improving the stability and bioavailability of the active ingredient, and upgrading the active ingredient of ensure patient acceptability and manufacturing simplicity. Plant-based pharmaceutical excipients are widely available today. Several studies have looked at the use of plant-based materials as pharmaceutical excipients such as binders, disintegrating agents, and emulsifiers. Natural polymers have been the focus of research in drug delivery systems due to their ability to manufacture a broad variety of materials based on their properties and molecular weight. Natural gums and mucilage can also be adapted to meet the needs of drug delivery systems, making them a viable alternative to synthetic excipients. The aim of this article is to highlight the natural gums and mucilage as natural binding agent in various pharmaceutical dosage forms. Many modern dosage formulations are complex systems containing many other components in addition to the active pharmaceutical ingredient (API). These compounds are often added in addition to the API to protect, assist, or improve the formulation's stability. Both the drug substance (also known as the active pharmaceutical ingredient or API) and the excipients are present in drug products. The excipients selected, their concentrations, and interactions have a significant impact on the drug product's biological, chemical, and physical properties. A pharmaceutical formulation production project's goal is to deliver the necessary amount of medication to the patient at the required pace, reliably within a batch, from batch to batch, and during the product's shelf life. A binder or binding agent is any material or substance that mechanically, chemically, or by adhesion or cohesion binds or draws other materials together to form a cohesive whole. Binders, in a broader sense, are liquid or dough-like substances that harden through a chemical or physical process and bind fibre, filler powder, and other particles attached to natural gum-based binders. Various edible thickening agents are used as binders in cooking. Some of them are often used in pharmacology to make pills, such as tapioca flour, lactose, sucrose, microcrystalline cellulose, polyvinyl pyrrolidone, and different starches. Binders are applied to tablet formulations to improve the interparticulate bonding strength within the tablet by imparting plasticity. The research and production of new excipients for use as a binding agent in tablet formulations is still a hot topic. This is due to the fact that different binding agents can be used to achieve various tablet mechanical strengths and drug release properties for various pharmaceutical applications. Binders are substances that give granules their cohesiveness. The composition of granules of derived hardness and size ensures that the tablet remains intact after compression while also enhancing the flow qualities. In both solid and liquid dosage formulation, a variety of plant mucilage, gums/hydrocolloids have been used as binding, suspending, or emulsifying agents. They've been found to be useful in the manufacture of tablets with varying mechanical strengths and drug release properties for a variety of pharmaceutical applications. Mucilage is non-toxic, and its widespread availability has piqued interest. Binders work by causing powders to clump together and form granules during the granulation process.

Advantages of natural binder [3, 4, 5]

- They can be used to change the way drugs are released, affecting the absorption and bioavailability of the combined drugs.
- Natural binders are commonly used as excipients and additives in the pharmaceutical and food industries due to their low toxicity, biodegradability, accessibility, and low cost.
- They act as vehicles which convey the integrated drug to the absorption site and precision and accuracy of the dosage, and also improve the organoleptic properties of the drugs where required in order to enhance patient faithfulness.
- They should conduct the performances of dosage forms during manufacturing as well as when patients consume them.

Classification of Binders on The Basis of Their Source [6, 7]

1. **Natural polymers:** Starch, Pre-gelatinized starch, Gelatin, Acacia, Tragacanth and Gums.
2. **Synthetic polymer:** PVC, HPMC, Methylcellulose, Ethyl cellulose, PEG.
3. **Sugar:** Glucose, Sucrose, Sorbitol.

Starch

Starch is the most abundant carbohydrate reserve material in green plants, often contained in seeds and underground organs. Granules of starch can be found (starch grains). A number of starches are recognized for pharmaceutical use and these include maize (Zea mays), rice (Oryza sativa), wheat (Triticumaestivum), and potato (Solanum tuberosum).

Applications

- A variety of guar gum modifications are used in the drug delivery system.
- The formulation of a transdermal therapeutic device uses carboxy methyl guar film.
- Guar gum is particularly useful for colon delivery because it can be degraded by enzymes found in this section of the digestive tract.
- The gum protects the drug in the stomach and small intestine and transports it to the colon, where it is either as similate by unique microorganisms or degraded by an enzyme excreted by these microorganisms.

Pre-Gelatinized Starch

Pre-gelatinized starch is an alternative to native corn starch or polymers for wet granulations. This is a powdered starch that has been previously gelatinized and dried. Pre-gelatinized starches are divided into two classes based on their functionality: completely pre-gelatinized and partially pre-gelatinized. In wet granulated formulations, completely pre-gelatinized starches are used as binders. However, many of the disintegration properties are lost due to gelatinization. On the other hand, partially pre-gelatinized starches combine the properties of both native and completely gelatinized starches. As a consequence, they can be used as a binder as well as a disintegrant in wet granulated formulations. The use of partially pre-gelatinized starch is also well suited to high shear wet granulation. To make viscous slurries, partially gelatinized starches can be hydrated with cold water, or they can be applied directly to the granulator bowl and granulated with water.

Applications

- Oral Dosage for Pharmaceuticals and/or Nutraceuticals
- Swallowable tablet

Tapioca starch as a binding agent [8, 9]

The use of a natural product tapioca starch as binding agent in the formulation of Diclofenac tablets was identified. To establish two other commonly used disintegrating agents potato starch and maize starch were selected and formulated for comparison. During pharmaceutical granulation, the objective is to produce granules that have a uniform (and repeatable) distribution of drug particles within the bulk carrier (excipient) solid. This can be difficult to achieve and both drug depletion and enrichment in granule scan occur.

Extraction of Different Starches

Extraction of tapioca starch

The starch was extracted from root tubers of cassava (Mani hot esculent) according to the method of Alebiowu using established procedures. Cassava tubers were peeled, washed and cut to small pieces. These small pieces were then soaked in distilled water for a fixed amount of time, say 1 hour. The softened tubers were milled to a pulp at the end of the steeping cycle, and more distilled water was applied to make a dilute slurry that was sieved using mesh size 100.

Extraction of corn starch

Stage 1: Crushing the dry kernels with a hammer, scraping the seed coat, separating the germs, and collecting the starch without drying it under a fan were all part of the process.

Stage 2: In screw-top 25-ml test tubes, three corn kernels were mounted. To soften the kernel, enhance seed coat peeling, and preserve the kernel during steeping, 0.45 percent sodium meta-bisulfite (2 ml) was applied to each tube before incubation in a 50°C water bath for 48 hours (2 hours).

Extraction of potato starch [10, 11]

The enzyme solution was created by thoroughly mixing 1g of enzyme in 10ml of distilled water in a 20ml test tube with a glass rod. The potatoes were washed under running water to remove any soil that had adhered to them. To allow grinding, the potatoes were washed and cut into small pieces without peeling with a stainless steel knife. After standardizing the time, grinding was done in a Commercial grinder with a motor rpm of 15000 for 1 minute and 15 seconds. After that, the ground potato meal was moved to a 500 mL conical flask and a suitable amount of water was added to it. A pipette was used to apply the prepared enzyme solution to the potato meal. 1ml of the enzyme solution was applied to 100g of potato meal to achieve a concentration of 0.1g per 100g of potato meal. The flask was cotton-wrapped and held in an incubator cum shaker set to 45°C and 125 rpm. All of the samples had a pH between 6 and 7, and cellulose enzyme works best at pH 3 to 7. As a result, the broth's normal pH was not altered. After incubation, the resulting slurry was screened into a 400 ml beaker using a nylon tea strainer with a mesh size of 100. The pomace was washed twice in 150 mL of tap water during the screening process. The starch was separated from the other components of the starch-containing filtrate by sedimentation for 1 hour. A revamped protein digestion protocol was used to separate starch from flour.

Extraction of wheat starch: from wheat flour

Flour (0.3 g) was placed in 50-mL plastic centrifuge tubes with 5.0 ml of water and 2 ml of 0.8% pepsin A (P7012, Sigma, St. Louis, MO) in 0.04N Hcl and incubated for 60 min at 37°C. After protease treatment, 1.0 ml of 0.08% Hemi cellulose 90 (90,000 U/g activities, a gift from Amano Enzyme U.S.A., Lombard, IL) in 0.1M sodium acetate buffer (pH 4.5) was added to the mixture and incubated for 3 hr at 45°C. A detergent mix (1 ml) (5% SDS, 5% Triton X- 100, 5% Tween 40, and 5% Triton X-15) was added after incubation, and the suspension was vortex-mixed for 30 sec.

Acacia

Acacia senegal Wild exudates gummy exudates that have been air dried. (Family Mimosaceae) and other Acacia species native to Africa. Senegal gum is another name for it. The tree is known as ‘Hashab' in Kordofan and ‘Verek' in Senegambia. The gum developed in the kordo fan from tapped trees is thought to be of high quality. The gum from Senegal and Nigeria is also of high quality. Senegal gum can be found in desert areas of India, such as Rajasthan, Gujarat, and Haryana. It is water soluble, leaving just a trace of vegetable particles behind, but virtually insoluble in alcohol and ether.

Acacia is used as a tablet binder and as a suspending and emulsifying agent. Its demulcent qualities are used in a variety of cough, diarrhoea, and throat remedies. Gum Arabic is primarily used as an emulsifier in confectionery, as well as in the preservation of soft drink flavours and the production of chewing gums. It is used as a binding agent in the pharmaceutical industry to make cough pastilles and other medical preparations, as well as a coating for tablets. Gum can also be used to set hair and as a suspending agent.

Guar Gum

Guar gum is also called guar an, cluster bean, Calcutta lucern, Gum cyamposis, and Cyamopsis gum, Guar in a, Glucotard and Guyarem21. Guar gum is a powder made from the endosperm of Cyamopsis tetragonolobus Linn seeds (Leguminosae). Guar gum is the powder of the endosperm of the seeds of Cyamopsis tetragonolobus Linn. (Leguminosae). Guar gum is also called guar an, cluster bean, Calcutta lucern, Gum cyamposis, Cyamopsis gum, Guar in a, Glucotard and Guy a rem. It is a galactomannans which is a linear polysaccharide consisting of (1→4)-die quatorially linked β-D-mannose monomers, some of which are linked to single sugar side-chains of α-D-galactoseattached.45Guar gum has a backbone composed of β-1,4 linked-D-manno pyranosesto which, on average, every alternate manno se an α-D-galactoseis linked 1→6.46. The FDA has affirmed guar gum as generally safe. Guar gum has recently been highlighted as an inexpensive and flexible carrier for oral extended release drug delivery Guar gum is particularly.

Applications

- It is highly used in the form of guar gum powder
- Meat, pharmaceuticals, paper, textiles, explosives, oil well drilling, and cosmetics industries all use it as an additive.
- Guar gum powder is a very versatile product that has many uses in industry, including thickening, sizing, wet-end strength additives, gelling agent and water barrier, flocculation aid, waste water treatment, emulsifier, and binder. Mud formulations, enhanced oil recovery, polymer flooding, well treatment, and missing circulation plugging are only a few of the applications. Guar gum of mining grade is used as a floatation agent, flocculating or setting better quality agent in the mining industry.

Gelatin

By de naturation and/or physical–chemical degradation of collagen, a high molecular weight polypeptide is produced, called gelatin40. Gelatin is also a protein and consists of 19 amino acids 41. It is water soluble. Elast in, albumin and fibrin are other proteins from animal sources. Gelatin is a polymer manufactured from collagen extracted from animal skin, white connective tissue, and bones that has been partly hydrolyzed. In this step, insoluble collagens are converted to soluble gelatin, which is then distilled and condensed into a solid shape. Alcohol, chloroform, fixed oils, volatile oils, and ether are virtually insoluble, while it is soluble in a hot mixture of glycerol and water and in nacetic acid. Gelatin is used to make pastes, pastilles, suppositories, tablet coatings, and hard and soft capsule shells, among other things. It's also used to encapsulate medications and other industrial products in microcapsules. For intravenous injection, specially distilled and pyrogen-free gelatins are available, and a grade with a high ‘Bloom intensity' is used to make gelatin capsules and bacteriological culture media.

Applications

- These Widely Include Emulsifiers,

- Foaming Agents, Colloid Stabilizers,
- Biodegradable Film-Forming Materials,
- Microencapsulating Agents.

Tragacanth

The branches of the Astragalus gummifer are used to make this gum (Leguminosae). Tragacanth contains traga canthin, a water-soluble fraction that ranges from 20% to 30%. (Composed of tragacanthic acid and arabino galactan). It also contains between 60% and 70% of a water-insoluble fraction known as bass or in. D-galacturonic acid, D-xylose, L-fructose, D-galactose, and other sugars make up tragacanthic acid. Tragacanthin is made up of uronic acid and arabinose, and it dissolves in water to form a viscous colloidal solution (sol), but it swells to form a dense gel in bass or in swells. When used as a carrier in the formulation of 1- and 3-layer matrices, tragacanth developed adequate release prolongation either alone or in combination with other polymers, similar to other water-soluble gums. There is some preliminary evidence that concomitant ingestion of tragacanth with a high sugar load can moderate blood sugar levels in diabetic patients although this effect has not been reliably established and needs much further research. While gum tragacanth swells to increase stool weight and reduce GI transit time, after a 21-day supplementation duration, it appears to have no impact on serum cholesterol, triglyceride, or phospholipid levels, as do other soluble fibres. Tragacanth has been used as an emulsifier, thickening agent, and suspending agent since ancient times.

Natural Binding Agent [12]

Excipients role in evaluating formulation consistency and, in many cases, drug bioavailability from tablets has received a lot of attention. Binders are applied to tablet formulations to impart plasticity and, as a result, improve the strength of inter-particle bonding within the tablet. The research and production of new excipients for use as a binding agent in tablet formulations is still a hot subject. This is due to the fact that different binding agents can be used to achieve different tablet mechanical strengths and drug release properties for various pharmaceutical purposes. Binders are substances that give granules their cohesiveness. The composition of granules of derived hardness and size ensures that the tablet remains intact after compression while also enhancing the flow qualities. The selection of a suitable binder for a tablet formulation necessitates a thorough understanding of the relative significance of binder properties in improving tablet strength, as well as the interactions between the various materials that make up a tablet. Binder keeps different powders together to shape a tablet; fillers typically do not have good binding capacity; binder is either added in dry mix or mixed in granulation or mixed in granulating liquid; binder forms matrix with fillers and drug embedded in it; when solid binder dries, it forms glue that holds the particles together; the wet binder is the most important; binders are hydrophilic & most times soluble in water.

Sources of Polymers [13]

Natural polymeric excipients may be categorized into the following classes

Polysaccharides of the plant cell wall: These polymers are often derived from plant cell walls, and the main polymers in this category are cellulose, hemicelluloses, and pectin.

Gums and mucilage

Natural plant hydrocolloids such as gums and mucilage are divided into anionic and nonionic polysaccharides. They may also be polysaccharide salts.

Seaweed polysaccharides

Seaweeds are multicellular, microscopic marine algae. Carrageenans, agar, and alginates are the most common polysaccharides found in seaweed.

Microbial polysaccharides

These polymers are primarily produced from starch products that have been fermented. Unique bacteria or fungi are responsible for this fermentation. This includes xanthan gum, pullulan, and other similar substances.

Animal polysaccharides

Natural gums can be found in animal sources that fall under this category. Animal polysaccharides such as chitin and chitosan are commonly used.

Exudates gums

The viscous, sticky fluid obtained after cutting the plant is known as exudates gums. They help to minimise moisture loss due to physical damage or fungi attack by sealing off contaminated parts of the plant. This category includes acacia gum, tragacanth gum, and locust bean gum, among others.

Inulin

Plant sources of inulin include onion, garlic, artichoke, and chicory. It's basically a polysaccharide that plants store. Gluco-fructants are present chemically, and several monomers are present.

Starches

Starches are polymeric carbohydrates with large glucose units that are bound together by glycosidic bonds.

Dextran

Dextran is a branched glucan with a variety of chain lengths.

Cyclodextrins

Cyclodextrins are cyclic oligosaccharides that contain six to eight glucose units and are connected by glucosidic bonds.

Curdlan

It's a neutral, linear -glucan with intra- and inter-chain linkages.

Sclero glucan

It's a branched homo polysaccharide with (1-3) connected b-D gluco pyranosyl units in the main chain.

Binders used in Pharmaceuticals [14, 15]

Tablets are solid dosage types that are normally made with the help of pharmaceutical excipients. Depending on their intended use and oral drug administration, they can differ in scale, shape, weight, hardness thickness, disintegration and dissolution characteristics, and other aspects. Binder excipients are designed to serve as an adhesive, essentially "binding together" powders, granules, and other dry ingredients to give the product the mechanical strength it needs. They can also add volume to tablets with a low active dose. Binders are commonly used in wet granulation to make granule forming more effective and predictable. Binders are classified according to their application. Solution binders, such as gelatin, cellulose, cellulose derivatives, polyvinyl pyrrolidone, starch, sucrose, and polyethylene glycol, are dissolved in a solvent. The agents used to impart cohesiveness or adhesion to the granules are known as binders. In addition to the flow qualities offered by the formulation of granules of derived hardness and size, this ensures that the pill remains intact when compressed. The use of the Dioscorea rotundata genus as a binder and disintegrant in pill formulation has compressional propertiesa. The effects of starches from columbiform bird pea and plantain on the compressional, mechanical, and disintegration properties of paracetamol tablets are studied. Starch 1500 has been shown to be an effective binder, generating compressible granulation. There are dry powders or liquids that are applied to wet granulation to facilitate granules or cohesive compactness during direct compression. It gives the tablet mechanical power. Binders come in both powder and liquid form. Powder binders include cellulose, methyl cellulose, polyvinyl pyrrolidine, and PEG, while solution binders include gelatin, PVP, HPMC, PEG, sucrose, and starch. Binders may be applied to the formulation in the following ways: as powder before wet agglomeration to ensure even distribution of the binder. In wet granulation, it is used as an agglomerization solvent in solution form. It's known as a liquid binder. Until compaction as a dry powder that is blended with other ingredients (slugging or tabletting). It's known as a dry binder. Natural binders such as acacia and tragacanth are used in solution at a concentration of 10-25 percent, either alone (or) in combination, for wet granulation, and they can also be added as powder for direct compression. When gelatin is combined with acacia (or) used alone, it creates a stronger binding agent than the two natural polymers mentioned above. Polymers such as MC and HPMC are used as dry powders in direct compaction and serve as strong binding agents and adhesives in solution form. Ethyl cellulose and HPMC can be used as anhydrous adhesives in alcoholic solutions. The binding agent (Binder) is the material needed to preserve the tablet preparations' strength structure throughout the manufacturing process before they are packaged. The binding agent can improve the inter-particle bonding power of the tablet. The binding agent improves granule flow properties, allowing for the formulation of granules with the desired hardness and scale. Acacia, carboxy methyl cellulose, gelatin, polyvinyl pyrrolidone, povidone, and starch paste are examples of these binding agents. Paste formulations containing the original corn starch have long been used as binding and disintegrating agents in the manufacture of new drug items. Alternative excipients and other mixed excipients must be investigated due to flow and compressibility issues). Depending on the intended use, different binding agents may produce different mechanical strengths and drug release properties in tablets. Natural polysaccharides are commonly used as excipients in the pharmaceutical industry due to their low toxicity, biodegradability, safety, and affordability. Other than as binding agents, starch, mucilage, gum, and dried fruits have many other properties such as disintegrant, filler, and sustained release, and they are also used to alter drug release in order to affect the bioavailability and absorption of the added drug acting as a medium for transporting the medication integrated into the absorption site, as well as ensuring dosage accuracy and precision, stability, and enhancing the drug's organoleptic properties, thereby increasing patient compliance.

Table: Sources of natural binders used in Gum and Mucilage

Gum and Mucilage	Botanical Source	Family	Application in Pharmacy
Almond gum	*Prunus communis*	*Rosaceae*	Suspending agent, Thickening agent, Stabilizer
Gum moringa	*Moringa olifera*	*Moringaceae*	Disintegrating agent
Okra mucilage	*Abelmoschus esculentus*	*Malvaceae*	Suspending agent, Disintegrating agent
Aegle gum	*Aegle marmelos*	*Rutaceae*	Binder, Thickening agent
Gum acacia	*Acacia catechu*	*Leguminosae*	Suspending agent, Antioxidant, Astringent
Tamarind gum	*Tamarindus indica*	*Fabaceae*	Gelling agent, Binder, Stabilizer
Prunus gum	*Prunus domestica*	*Rosaceae*	Binder, Tonic
Gum ferula	*Ferula gummosa*	*Apiaceae*	Binder
Cassia roxburghii mucilage	*Cassia roxburghii*	*Fabaceae*	Binder, Thickening agent
Fenugreek mucilage	*Trigonella foenum-graenum*	*Leguminosae*	Solubulizing agent Binder
Brachystegia mucilage	*Brachystegia eurycoma*	*Leguminosae- caesalpinioideae*	Emulsifyingagent, Stabilizer, Thickening agent
Ayoyo gum	*Cochorus olitorius*	*Tiliaceae*	Emulsifying agent, Thickening agent, Binder
Gum kondagogu	*Cochlospermum gossypium*	*Bixaceae*	Thickening agent, Emulsifying agent
Cordia gum	*Cordia oblique*	*Boraginaecae*	Binder, Stabilizer
Gum odina	*Odina wodier*	*Anacardiaceae*	Binder, Stabilizer
Cassia tora mucilage	*Cassia tora*	*Caesalpiniaceae*	Binder, Disintegrating agent
Cassia fistula	*Cassia fistula*	*Caesalpiniaceae*	Granulatingagent, Binder

Table 2: Natural binders used in different pharmaceutical formulation

Binders	List of Formulations	Natural Polymers	Applications
Chitin and Chitosan	"Pharmaceutical tablets containing chitin or chitosan as a disintegrant,"	natural polysaccharide polymers	Semi-crystalline nature, DDA, and MW enhance beneficial use as such and as a co-processed excipient in pharmaceutical preparations.
Guar Gum	"A 52-week oral toxicity study of Gellan gum in the Beagle dog. Bio Research Lab. Ltd, Montreal, Canada, 1986,"	Galactomannan polysaccharide extracted from guar bean	thickening and stabilizing properties useful in food, feed, and industrial preparation

Gum Karaya	"Herbal excipients in novel drug delivery systems,"	acid polysaccharide composed of the sugars galactose, rhamnose and galacturonic acid	Great potency in pharmaceutical industry as adhesive, suspension, emulsifier and tablet agent
Agar	"Formulation and evaluation of ciprofloxacin hydrochloride dispersible tablets using natural substances as disintegrates,"	polysaccharide agarose	agar-based formulas for growing unique bacteria, fungi,yeast
Fenugreek Seed Mucilage	"Isolation and evaluation of disintegrant properties	polar glycoprotein and an	High percentage yield of mucilage using acetone as non-solvent
Soy Polysaccharide	"A new disintegrant for pharmaceutical dosage forms," Drug Development and Industrial Pharmacy,	Nano structured polysaccharides	polymer to prepare simvastatin solid dispersion
Gellan Gum	Cellulose	anionic polysaccharide	gelling agents in pharmaceutical industries
Mango Peel Pectin	galacturonic acid, a sugar acid derived from galactose	hetero polysaccharide	test for mucilage, gums, tannins, alkaloids and proteins
Lepidium sativum Mucilage	exert cohesion between the powder mixes so as to form granules	plant-specific polysaccharides	hardness and disintegration time increases with the increase in the binder concentration
Planta go ovata Seed Mucilage	microcrystalline cellulose	polysaccharides	pharmaceutical industry
Aegle marmelos Gum	lubricant and microcrystalline cellulose	polysaccharides	Disintegrant
Rice starch	4-α-Glucanotransferase amylase and amylopectin	natural polymeric carbohydrate	starch showed comparative effectiveness as binders in paracetamol tablets
Corn starch	glucose, amylase and amylopectin	polymeric carbohydrate	disintergrant in pharmaceutical tablets
Potato starch	Leucoplasts	amylopectin	excipient in tablets formulation and an alternative to traditional binder agent
tapioca starch	amylose and amylopectin	Natural polymeric carbohydrate	Less friable tablets were produced and reduced amounts of materials were used.

Conclusion

Drug delivery relies heavily on polymers. As a result, polymer selection is critical in drug manufacturing. However, when choosing polymers, consideration must be given to their toxicity, drug compatibility, and degradation pattern. By this review, we can say that natural polymers can be good substitute for the synthetic polymers and many of the side effects of the synthetic polymers can be overcome by using natural polymers. Natural gums are promising biodegradable polymeric materials. In food technology and pharmaceuticals many studies have been carried out using gums and mucilage. It is clear that gums and mucilage have many advantages over synthetic materials. Various applications of gums and mucilage have been established in the field of pharmaceuticals. However, other natural sources must be created, as well as existing natural materials updated, for the formulation of novel drug delivery systems, biotechnological applications, and other delivery systems. As a result, natural gums and their modifications will continue to be of interest in the production of improved materials for drug delivery systems in the future.

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