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Natural Polymers Use In Mouth Dissolving Formulation: A Review

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Abstract: Mouth dissolving pills are a type of solid medication dosage form that dissolves quickly on the tongue when applied, usually in a few seconds. Due to its simplicity of administration, it is becoming more and more popular among patients who have difficulty swallowing, especially those who are young, elderly, or have dysphagia. This article's goal is to investigate the application of natural polymers as mouth dissolving tablet superdisintegrants. The physicochemical properties of tablets are improved by natural polymers like locust bean gum, fenugreek gum, dehydrated banana powder, orange peel pectin, Mangiferaindica gum, Hibiscus rosasinenses mucilage, and soy polysaccharide. These polymers also add nutritional value and increase the solubility of poorly water-soluble drugs. Compared to synthetic polymers, natural polymers are more dependable, safe, non-toxic, biodegradable, and ecologically friendly. They are also less expensive.

Index Terms **- Mouth dissolving tablets, natural polymer, superdisintegrants**

1. Introduction

Due to its many benefits, including ease of handling, low cost, and simple development, tablets are the most often prescribed dosage form. However, there are certain disadvantages to it, including swallowing difficulties, especially in young children and elderly individuals as well as those who have trouble swallowing regular tablets and capsules. Because there isn't any water available, this issue could get worse when traveling. [1,2]

To get around these problems, a novel kind of dosage has been developed: mouth dissolving pills. As the name implies, these tablets dissolve in the mouth in 20 to 30 seconds, and the active ingredient starts to operate therapeutically as soon as it comes into contact with saliva.[2]

A mouth dissolving tablet that doesn't require chewing or drinking water because it dissolves quickly in saliva in a matter of seconds. These pills dissolve in the mouth in about 20 to 30 seconds, and when they come into contact with saliva, the active ingredient begins to operate therapeutically. Compared to conventional tablets, mouth dissolving tablets exhibit superior bioavailability, effectiveness, and biopharmaceutical qualities, as well as better patient compliance and acceptance. [3,4]

Compared to taken tablets and capsules, they have advantages. Swallowing difficulties are more common in older and paediatric patients. The following processes are frequently used to prepare tablets for oral dissolution: freeze drying, sublimation, spray drying, moulding, mass extrusion, and direct compression. [5,6,]

Synonyms used for mouth dissolving tablet

- Oral disintegrating tablet
- Quick dissolving tablet
- Fast melt tablet
- Oral dispersible tablet
- Rapid disintegrate tablet

This review aims to compare and assess the effects of various natural polymers with synthetic polymers in the role of superdisintegrants in mouth dissolving tablets. Tablet disintegration is accelerated by natural polymers employed as superdisitegrant, which causes the tablet to dissolve rapidly in a matter of seconds. [7,8]

Natural polymers are more dependable and effective. The reason they are preferred over synthetic polymers is their widespread availability in unspoiled environments across the globe. They are readily available in large quantities and are highly cost-effective. Since they are safe for human usage and are not poisonous in nature, they are a better option. Furthermore biodegradable, natural polymers have no negative environmental effects. Because natural polymers are safer, more effective, and have better patient compliance than synthetic ones, patients typically prefer them.[9]

Advantage of mouth dissolving tablet

- Simple administration for people who have difficulty swallowing, like the elderly, individuals with stock injuries, and bedridden patients.
- Those with swallowing difficulties, such as pediatric, geriatric, and psychiatric patients, find it easy to use.
- Patients also complain about the inconvenience of not having easy access to water when they are on the go or are busy.
- Easy administration and precise dosage in comparison to liquid formulation;
- quicker absorption and start of action
- supplying enhanced safety by averting the possibility of choking or asphyxia while being administered.
- enhancing bioavailability, lowering dosage, and enhancing clinical efficacy by diminishing adverse effects. [10,11]

Disadvantage of mouth dissolving tablet

- Due of insufficient mechanical strength, handling must be done carefully.
- Its taste is unpleasant and improperly formulated.
- Hygroscopic by nature, most should be stored in a dry environment.
- Patients experiencing dry mouth should not be treated by MDTs.
- Special packaging is needed for MDTs in order to provide optimal stabilization and safe, stable product.
- Patients who take anticholinergic medicine concurrently might not be the greatest candidates for mental health technicians. [10,11]

CRITERIA FOR MOUTH DISSOLVING TABLETS

- When taken orally, they should dissolve or disintegrate in the mouth in a few seconds without the need for water.
- Sweeteners should work well together when used to mask tastes.
- It should, in theory, taste good.
- After use, there shouldn't be much residue left in the mouth.
- It has to be appropriate for excessive medication loading.
- Possessing sufficient strength to withstand the demands of manufacturing and handling after manufacturing
- It shouldn't be impacted by outside variables like temperature and humidity.
- Packaging and manufacturing ought to be financially viable. [12,13]

List Natural polymers use in mouth dissolving tablet

1. Soy Polysaccharide
2. Gellan Gum
3. Mango Peel Pectin.
4. Lepidiumsativum Mucilage
5. Chitin and Chitosan.
6. Guar Gum.
7. GumKaraya
8. Agar and Treated Agar.
9. Fenugreek Seed Mucilage.
10. Plantagoovata Seed Mucilage.
11. Locust Bean Gum.
12. Hibiscus Rosa Sinensis Mucilage and Treated Agar.
13. Dehydrated Banana Powder (DBP).
14. Xanthan gum
15. Maltodextrin
16. Sodium alginate
17. Gum acacia
18. Gum tragacant

1. Soy Polysaccharide:

Soy beans are a source of soy polysaccharide, a high molecular weight water soluble polymer. This is a disintegrant used in the formulation of tablets prepared with lactose and dicalcium phosphate dihydrate as fillers in the direct compression method. Since soy polysaccharides don't include sugar or starch, they can be utilized in foods that are meant to be nutritious. Cellulose, arabinogalactan, arabinan, and an acidic polysaccharide complex make up the majority of soy polysaccharides.[14]

2. Gellan Gum:

Pseudomonas elodea is the bacterium that produces gellan gum. It is a biodegradable polymer with a high molecular weight that is soluble in water and linear anionic polymers. It is primarily made up of a repeating unit of tetrasaccharide, which is made up of two residues of D-glucose and one each of D-glucuronic acid and L-rhamnose. Fermentation is used in the manufacturing process. There are two varieties: Low acyl (LA) and High acyl (HA). Gellan gum is utilized as a tablet superdisintegrant because of its high hydrophilic nature, which causes it to swell quickly when it comes into contact with water. In the current investigation, 90% of the medication dissolved in 23 minutes, while the entire pill disintegrated in 4 minutes with a gellan gum concentration of 4% w/w. [15,16]

3. Mango Peel Pectin

Mango peel makes up 20–25% of the waste generated during the processing of mangos, making it a useful source for pectin extraction. This pectin is of a high caliber and ideal for making gelly and film. Pectin is a hydrophilic colloid that possesses structural heteropolysaccharides. Because of its increased swelling index and strong solubility, mango peel pectin—which is used as a superdisintegrant—can be used to produce tablets that dissolve quickly. Anhydrogalactouronic acid and methoxyl components make up this pectin. [17, 18]

4. Lepidiumsativum Mucilage:

Garden cress, oraSaliyo, is Lepidium sativum, a member of the Cruciferae family. Lepidium sativum A significant amount of mucilage, two imidazole alkaloids called semilepidinoside A and B, and dimeric imidazole alkaloids called lepidine B, C, D, E, and F are found in seeds. Lepidium sativum mucilage contains a variety of qualities, including binding, dissolving, gelling, etc. Several methods can be used to extract the mucilage from seeds. The fast-dissolving tablet formulation process uses the extracted mucilage. It is discovered that mucilage is a brownish-white powder with a strong odor that breaks down over 200°C. The estimated values of the swelling index, angle of repose, bulk density, and tapped density are 18, 32oC, 0.58g/cc, and 0.69g/cc, respectively, based on its diverse physicochemical features.[19, 20, 21]

5. Guar Gum:

Natural high molecular weight polysaccharides, guar gum has an approximate molecular weight of 50 000–8,000 000 and is widely utilized in food goods, cosmetics, and pharmaceutical applications. Consisting of galactomannan units joined by glycosidic bonds, it is extracted from the endosperm of the Cyamopsistetragonoloba (L) Taub seed of the guar plant. It is also referred to by a number of names, including meprogat, meyprodor, guar flour, jaguar gum, and galactosol. It is utilized in numerous pharmacological compositions as an emulsifier, thinner, and stabilizer. To extract guar gum, guar seeds are dehusked, ground,

and sieved. It is made into an off-white, fluid powder. Solutions containing guar gum can be left in the pH range of 1.0–10.5. It dissolves quickly in both hot and cold water. Because of its affordability and solubility in organic solvents, it is widely used in the gum and stabilizer industries. Guar gum is utilized in oral and topical pharmaceutical formulations as a suspending, thickening, stabilizing, and controlled-release carrier in addition to its function as a binder and disintegrant in solid-dosage forms. [22, 23]

6. Gum karaya:

Gum karya, a dried sticky exudate, is derived from the huge, bushy, 30-foot-tall Sterculiaurens tree, which is endemic to India. The main components of the gum, an acid polysaccharide, are acetyl groups, xylose residues, l-rhamnose, d-galactose, and d-glucouronic acid. It can also be used as a disintegrant in place of synthetic superdisintegrants, according to earlier research. It is inexpensive, widely accessible, and biocompatible. It serves a multitude of functions because of its high-water retention capacity, viscosity, swelling behavior, antibacterial activity, and general availability.[24]

7. Agar and Treated Agar:

Agar, a complex polysaccharide consisting of gelatin and drying, is primarily derived from the following species: Gelidium, Gracilaria, Acantkopeltis, Ceramium, and Pterocladia. Agarose and agaropectin are the two primary fractions that make up agar. The viscosity of agar solutions is caused by agaropectin, while the vigor of gels is attributed to agarose. Agar's gelling and stabilizing qualities make it a popular ingredient. Agar tastes mucilaginous and has no color or smell. It can be found as coarse powder, sheet flakes, or strips. At low concentrations, usually between 0.5% and 2%, agar can create a hard gel.[25, 26]

8. Fenugreek Seed Mucilage:

Fenugreek is the popular name for Trigonella foenum-graceum, a herbaceous plant from to the leguminous family. In every area, it has been used extensively as a food, food supplement, and traditional medicine. The mucilage made of polysaccharides extracted from fenugreek seeds. Mucilage is an amorphous powder with a cream yellow tint. This dissolves fast in warm water to produce a colloidal solution that is viscous. After analysis, the physicochemical parameters are discovered to be 22.25oC, 0.64g/cc, 15.20% for the compressibility index, bulk density, and angle of repose, respectively. Fenugreek mucilage creates a sticky, gummy mass when it comes into contact with fluids; it does not dissolve in water. As an alternative to synthetic superdisintegrants, fenugreek seed mucilage can be employed as a super-disintegrating ingredient in the formulation of several fast-dissolving tablets.[27, 28]

9. Plantagoovata Seed Mucilage:

The mucilage found in ispaghula is derived from the epidermis of dried Plantagoovata seeds. The husk of plantagoovata seeds is ground off to produce the mucilage. Plantagoovata's mucilage possesses qualities such as binding, dissolving, and maintaining qualities. To increase patient compliance, prochlorperazine maleate fast-disintegrating tablets were created using Plantagoovata (2–8% w/w) as a superdisintegrant through direct compression.[29]

10. Locust Bean Gum:

We call it gum made from carob beans. A vegetable gum made of galactomannan that is derived from the seeds of the carob tree (Ceretonia siliqual), which grows throughout the Mediterranean region, is called locust bean gum. Locust bean gum is a bioadhesive, thickening and gelling ingredient that also improves solubility. The gum is a powder that has no smell and is white to yellowish-white in color. Most organic solvents do not dissolve it. It dissolves easily in both hot and cold water, generating a sol that can be gelled and has a pH of 5.4 to 7.0. It dissolves partially in cold water and completely in hot water. Heating it over 85°C is necessary for

11. Hibiscus Rosa Sinensis Mucilage:

It is a member of the Malvaceae family and is also known as the Chinese hibiscus, shoe flower plant, and China rose. Mucilages serve as disintegrants, thickeners, suspending agents, and agents that retain water. Mucilage is present in the plant's leaves, which are easily obtained. L-rhamnose, D-galactose, D-galacturonic acid, and D-glucuronic acid are the components of mucilages. The range of the mucilage yield percentage is 15% to 20%. Mucilage's other physicochemical characteristics are also assessed. The observed values for swelling ratio, bulk density, compressibility index, and angle of repose are 9, 26.5oC, 0.65g/cc, and 16%, respectively.[32, 33]

12. Dehydrated Banana Powder (DBP):
Another name for a banana is a plantain. DBP is a member of the Musaceae family. Because it includes vitamin A, it is used to cure diarrhea and stomach ulcers. Additionally, it has vitamin B6, which is claimed to lessen anxiety and solicitude. Because of its high carbohydrate content and potassium content, which contributes to more predominant brain functioning, it is an excellent source of energy.[34, 35]

13. Xanthan gum:
A high molecular weight polymer called xanthan gum is produced by fermenting the bacteria Xanthomonas campestris. Xanthan gum has a low gelling propensity and a high hydrophilicity. Its large swelling capabilities and limited water solubility aid in its quick disintegration. Excellent stability of xanthan gum viscosity is observed over a broad pH and temperature range. Xanthan gum is not easily broken down by enzymes.[36]

14. Maltodextrin:
An oligosaccharide called maltodextrin is created when starch undergoes partial hydrolysis. Typically, it is a white, easily absorbed powder that has been hygroscopic and spray-dried. It is also rather sweet or nearly flavorless. The primary building block of maltodextrin is a combination of chains with lengths ranging from three to seventeen glucose units. Maltodextrin comes in powdered form and is edible and non-toxic.[37]

15. Sodium alginate:
Brown seaweeds create an indigestible biomaterial called alginate. It provides dietary fiber. Sodium alginate is primarily the sodium salt of alginicacid, a combination of polyuronic acids made up of D-mannuronic and L-guluronic acid residues. Due to its colloidal characteristics, alginate is used in the formation of biopolymer films and coatings, which have the ability to thicken, stabilize, suspend, form films, produce gel, and stabilize emulsions. In the presence of calcium, an alginate solution can gel. Because they are hydrophillic, edible films made from alginate have weak water resistance and create strong films. The mechanical qualities of an edible film are enhanced by combining starch with alginate.38

16 Gum acacia:
Gum acacia, a member of the Leguminosae family, is also referred to as Arabic gum, acacia, Senegal gum, and Indian gum. It is composed of the acacia tree's hardened sap. Gum acacia's primary ingredient is arabinogalactan, a biopolymer made up of galactose and arabinose monosaccharides. Gum Acacia is widely used in industry as a tablet binder, emulsifying and suspending agent, stabilizer, and thickening agent. The gum acacia is water soluble and ranges in color from light orange to pale white.[39]

17. Gum tragacanth:
With a molecular weight of roughly 840 kDa, tragacanth gum is a plant-derived polymer that is extracted from the stems and branches of Astragalus. It is water soluble, tasteless, odorless, and viscous. It is an anionic, branching carbohydrate made up of an intricate blend of polysaccharides. The two main constituents of tragacanth gum are water soluble (tragacanthin) and water swellable (bassorin), which is not soluble. Tragacanth is a thickening, stabilizing, emulsifying, and suspending agent. A pH of 4 to 8 is stable for tragacanth. [40, 41]

18. Chitin and Chitosan:
A long chain polymer of β-(1→4)-N-acetyl-D-glucosamine is called chitin. This natural polysaccharide is derived from the shells of crabs and shrimp. Unlike the free amino group in chitosan, it has an amino group covalently bonded to the acetyl group. N-deacetylation of chitin, the structural component of the exoskeleton of crustaceans (such as crabs and shrimp) and the cell walls of fungus, produces chitosan, a cationic polymer. It is the most prevalent non-toxic natural polymer found in the natural world. Products made with chitosan have a viscosity similar to that of natural gums.[42]

CONCLUSION:
The article covered a summary of the several kinds of natural super disintegrants that are now on the market. They have a major impact on how long it takes for pills to dissolve in vitro. Compared to synthetic polymers, the use of natural polymers has a significant impact on the design of fast-dissolving tablets. Natural polymers decreased the dissolving and disintegration time and increased the medication release rate from the tablet. Because they are naturally extracted, easily obtained at a low cost, used in low concentrations, and non-toxic,

natural polymers are chosen over synthetic ones. Natural polymers have higher bioavailability and quicker medication solubility, which leads to more effective treatment and better patient compliance.

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