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Polymers used in mouth dissolving film: A review

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Abstract

The oral route is one of the most important routes for local and systemic drug delivery, as it has a large surface, high permeability, and rich blood supply. Mouth dissolving films, are now becoming more popular than fast-dissolving tablets. The films are designed to disintegrate quickly when they come into touch with a surface that contains water, such the tongue. This allows the consumer to consume the product without the use of water. It can boost patient compliance and provide you a marketing advantage. The polymer used in mouth dissolving films is crucial to their quick dissolution and disintegration. The polymer must be non-toxic, non-irritating, flavorless, and simple to use. Natural and synthetic polymers are the two types of polymers that are employed. Natural polymers used in formulation of film include chitosan, gaur gum, xanthan gum, soy polysaccharide, gellan gum, locust bean gum, maltodextrin, and rosin. Hydroxypropyl cellulose, polyvinyl pyrrolidone, Hydroxypropyl Methylcellulose, Polyethylene Oxide, and Polyvinyl Alcohol are synthetic polymers that are frequently used to make films. The current overview gives a description of the numerous polymers that are utilized to make films that dissolve in the mouth.

Keyword: Mouth dissolving film; Polymers; Natural; HPMC; Gums

1 Introduction

The most popular and patient-friendly method of medicine administration is through the oral route. Almost all patients, including those who are adult, pediatric, and geriatric patients, take the majority of the medications in the form of tablets and capsules. However, between 26 and 50 percent of individuals have trouble swallowing tablets and hard gelatin capsules(1).A new drug delivery method for oral the administration of drugs is an orally fast-dissolving film (2) (3). Due to their simplicity, ability to prevent pain, adaptability (to fit a variety of drug candidates), and, most significantly, patient compliance, oral routes of drug administration are widely accepted, account for between 50-60 % of all dosage forms. Additionally, since they don't need to be manufactured under sterile conditions, solid oral administration devices are less expensive(4). The medicine is either dissolved or swallowed, after which the desired effect is produced by the drug's systemic circulation (5) (6). A film or strip is a dosage form that uses a water-soluble polymer to immediately hydrate, adhere, and dissolve when placed on the tongue or in the oral cavity to deliver drugs locally or systemically. Changing the rate at which the films dissolve allows for either a fast or slow but steady release of the drug (7)

Oral Dissolving Films are thin, rapidly dissolving films with a zone that measures 5 to 20 cm^2 in size what is the solidified form of the drug is a hydrophilic polymer matrix. The current Ingredients used in medicine are usually combined to 15 mg with relation to various excipients like plasticizers, sweeteners, flavors, enhancers, colorants, etc. The stacking of prescription drugs in buccal adhesive films legitimately absorbed through a layer of buccal tissue that passes it on to the fundamental flow to demonstrate its effect (8). The Greek terms poly, which means "many," and meros, which means "pieces or units of large molecular mass," are combined to form the word "polymer." Each molecule is made up of an enormous number of individual structural components that are regularly connected to one another by covalent bonds.

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By joining together numerous small molecules, known as monomers, polymers are the giant, highly molecularly weighted macromolecules. Polymerization is the process of combining monomers to create polymer (9). The polymers used in the oral film formulation cannot be toxic and irritant, free of leachable impurities, tasteless, have good wetting and spread ability characteristics, capability to utilize peel, shear, and tensile strength, be easily accessible, inexpensive, have an adequate shelf life, and not contribute to the production of secondary infections in the oral mucosa or dental regions (8).

Orodispersible dosage formulations can employ both synthetic and natural polymers. To achieve the required finished product qualities, the composition of the polymeric matrix that compose oral films may be altered. The kind, quantity, or grade of the polymers can be changed to fine-tune a number of parameters, including muco-adhesiveness, disintegration time, percentage of drug load, mechanical/handling capabilities, among others (10). The polymers produced by natural inchoation are more reliable and effective. They are selected instead of synthetic polymers as they are easily accessible in natural areas all over the world. Naturally occurring polymers are used in most preparations and are preferable to synthetic ones since they are more affordable, easy to get in large enough quantities, and economical. Natural polymers are harmless and do not harm the body in any way. Natural polymers are pollution-free since they are biodegradable in nature and do not harm the environment. As they come from a natural source, natural polymers are free of adverse effects. Consumers often like natural polymers over synthetic ones since they are more effective and safer and have higher patient compliance. Natural polymers are renewable since they are used again in various processes and serve as a nutritional supplement (11).

1.1 Advantage

- Large surface area allows for rapid dissolution and disintegration in the mouth cavity, reducing dosing intervals and improving the therapy's beginning of action, effectiveness, and safety profile.
- Oral films are more adaptable, conforming, and do not as fragile as Orally Disintegrating Tablets.
- Easy to handle, store, and transport (12).
- The delivered dose's accuracy is guaranteed by every strip or film.
- Water is not required for administration.
- Oral strip technology offers a different path to drugs with presystemic metabolism (2).

1.2 Disadvantage

- It needs specific packing because it is delicate and has to be shielded from moisture(2).
- There is no way to combine larger doses.
- Dose accuracy is a difficult technical problem(13).

Table 1 Difference between Fast Dissolving Oral Film and Fast Dissolving Tablet.

Fast Dissolving Oral Film	Fast Dissolving Tablet
It is a film.	It is a tablet.
Larger surface area leads to more disintegration.	Less surface area results in less dissolution.
Have a greater durability than oral disintegrating tablet.	It as lows level of durability than oral films.
Better compliance from patients over fast dissolving tablet.	Less compliance from patients than oral film.
Only low doses can be included.	High dose can be consolidated.
Low chance of choking.	It worried about choking.

1.3 Importance of Natural Polymers over Synthetic is

They are also readily available, affordable, safe, and side effect-free also biodegradable, biocompatible, and non-toxic.

As a result of these earlier superiorities of natural polymers is selected above synthesized polymers nowadays prefer above synthetic ones (9).

2 Classification of polymers used in mouth dissolving film

- Natural polymer
- Synthetic polymer

Natural polymer-These come in a broad range of plant-based forms. The following supports using plant-based materials rather than synthetic ones:

- Local access
- Environmentally friendly
- Bio-acceptability
- Being less expensive and coming from a renewable source than synthetic substances

The following are some of the many benefits of natural plant-based compounds.

- Biodegradable: Biodegradable due to their availability in nature and the truth is that all living organism produce them.
- Biocompatible and non-toxic: In general, all of these plant components products are repetitive sugar polysaccharides
- Low cost: Using them as natural sources is less expensive. The production cost is less than that of synthetic material. India and may other emerging nations depend a lot on agriculture, and significant amounts of funds are invested in it.
- Environmentally friendly processing: Due to the straightforward production procedures involved, a variety of natural chemicals produced from various plant sources are frequently used in the pharmaceutical sector and gathered in enormously vast numbers.
- Local availability (especially in developing nations): Because of broad range of uses for gum and mucilage in many sectors, the government of India and other similar developing nations actively promotes the cultivation of plants as pharmaceutical excipients.
- Patient acceptability as well as public acceptance: Natural materials be at a lower risk of side effects and adverse outcomes than synthetic ones (14).

2.1 Natural polymers

2.1.1 Chitosan and Chitin

A biopolymer with a lot of promise is apply in the biomedical field is chitosan. Many uses for polymer-based drug delivery systems have been considered as an alternative to traditional medical therapeutics(15). Chitinβ-(1→4)-N-acetyl-D-glucosamine) is a polysaccharide found naturally in the shells of crab and shrimp. As opposed to the liberated amino group in chitosan, it has an amino group that is covalently bonded to an acetyl group. Chitin, the structural component of crustacean exoskeletons (such those of crabs and shrimp), and the cell walls of fungus are used to make chitosan for commercial use. In spite of the drug's solubility, Bruscato and Danti (1978) found that addition of chitin to traditional tablet leads to dissolution time of 5 to 10 minutes. Surface free energy was useful to examine both the wetting time and the vitro dispersion time in the oral cavity. Chitosan is well-known natural polysaccharide used for pharmaceutical sector for its broad range of uses(16).

2.1.2 Guar Gum

Guar gum is an aqueously soluble, naturally occurring polysaccharide gum made from Cyamopsis tetragonoloba seeds, a member of the Leguminosae family. Chemically speaking, it is made up of (1/6) linkages connecting linear polymeric chains of (1/4)-b-D-mannopyranosyl units and a-D-galactopyranosyl units. The GI tract microorganisms, which create a lot of fatty acids with a short chain and cannot be metabolize by humans or animals, do a good job of fermenting the galactomannan residues. Because of advantageous characteristics, including biocompatibility and biodegradability, Guar gum is more significant in the area of biomedical applications and in drug delivery. It has several different qualities, including bioavailability, mechanical strength, and physicochemical stability. GG(Guar Gum) is useful as thickening agent, suspending agent, stabilizing agent, and emulsifier in pharmaceutical technology(17).

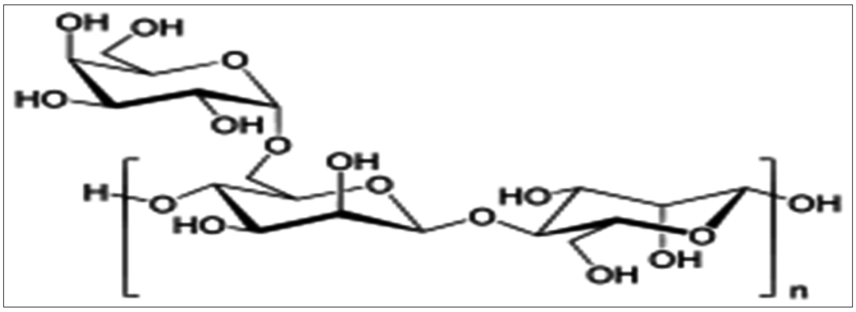

Figure 1 Structure of Gaur Gum

2.1.3 Gum-karaya

Gum Karaya, is polysaccharide which is complex in nature with a high molecular weight, is produced by the exudation of trees of to the Sterculiaceae family, specifically the genus Sterculia. Its other names include Kadaya, Katilo, Kullo, Kuterra, Karaya, gum karaya, Sterculia, gum sterculia, and others. Gum Karaya is an acid anionic polysaccharide that contains 43% D-galacturonic Acid, 13% D-galactose, and 15% L-proteins, and carbohydrates can all be combined with gum karaya. In medicines, it serves as an adhesive and binding agent. A gum karaya powder might be off white, pink, or tan in color. It can be utilized in place of gum tragacanth. The gum has the capacity to absorb water, swelling 70–100 times greater than its original volume. Gum's high viscosity prevent its application as a adhering agent and disintegration aid in the manufacturing of traditional dosage forms (18)(19).

2.1.4 Xanthan Gum

Xanthomonas campestris, a bacteria commonly found on cabbage plants, produces xanthan gum, a high molecular weight polymer that is naturally occurring. The free-flowing, white to cream-colored xanthan gum powder is soluble in both hot and cold water but insoluble in the majority of organic solvents. Even at low concentrations, xanthan gum solutions exhibit significantly higher viscosity than other polysaccharide solutions. It is more effective as a thickening and stabiliser because of this characteristic. Although not thixotropic, xanthan gum solutions are rather pseudoplastic. The pseudoplasticity of xanthan gum facilitates processing, assures high pourability, Additionally, xanthan gum exceeds the majority of other water-soluble polysaccharides due to its greater thermal stability. Since xanthan gum has no flavour, it has no impact on the flavour of other culinary ingredients. and improves sensory attributes in finished goods. The pH-variations resistance of xanthan gum solutions means that they maintain their stability in both acidic and alkaline environments(20).

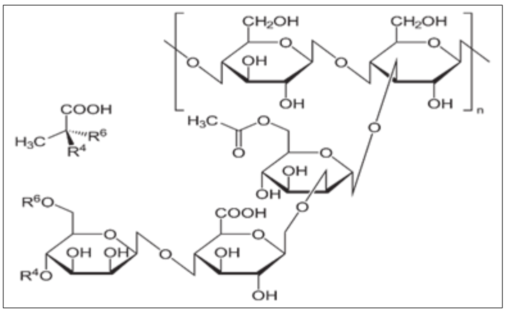

Figure 2 Xanthan Gum

2.1.5 Agar and Treated Agar

Agar is dehydrated gelatinous product made from the red algae Gelidium amansii (Gelidanceae) and several of other species, including Gracilaria. Pterocadia and (Gracilariaceae) (Gelidaceae). Agar comes in the form of strips, sheet flakes, or coarse powder and is available in shades of yellowish grey, white, or practically colourless. It has a mucilaginous flavour and has no odour. Agarose and agaropectin are the two polysaccharides that make up agar. The viscosity of agar is result of Agaropectin, while Agarose is responsible for the stability of the gel solutions. As its high gel strength, it as viable candidate to function as a disintegrant. Gums are utilised in concentrations ranging from 1 to 10%. Although these are less effective disintegration agents than others due to their comparatively limited capacity development(21).

2.1.6 Sodium Alginate

Sodium salt of alginic acid, a mixture of polyuronic acids made up of remains of D-mannuronic acid and L-guluronic acid, makes up the majority of sodium alginate(22). Brown seaweeds produce the inedible biomaterial alginate (Phaeophyceae, mainly Laminaria). The calcium, magnesium, and sodium salts of alginic acid can be identified in the walls of cell of brown algae. Due to its special colloidal qualities, which include thickening, stabilising, suspending, film-forming, gel-producing, and emulsion stabilising, alginate has the ability to make biopolymer films or coating components(23). Alginate is hydrophilic, making edible films made from it robust but with low water resistance. When compared to synthetic films, the mechanical properties and water permeability can be regarded as moderate. Starch is add to alginate films to improve their mechanical qualities(24).

2.1.7 Gelatin

A complex mixture of highly molecular-weighted water-soluble proteins makes up gelatin. Gelatin is transparent, brittle, in flakes or powder form, nearly flavourless, odourless, and slightly yellow in colour. In aqueous solutions between 30-35°C, gelatin swells and absorbs 5–10 times its weight in water to form a gel. Gelatin is a natural protein derived from collagen and is used extensively in the food and pharmaceutical industries. Gelatin films produce a smooth mouth feel, dissolve quickly, and make excellent flavour carriers. Gelatin films have been discovered to have an in-vivo dissolution time of 40 seconds and an in-vivo disintegration time of 8 seconds. In addition, gelatin is less suitable for use in MDF due to its ability to create a highly viscous gel when hydrated with saliva in the mouth(1).

2.1.8 Fenugreek Seed Mucilage

Trigonella Foenum-Graceum, an herbaceous plant from the family *leguminous* that is also known as fenugreek. In every location, it has several uses as a nutritional, a foodie additive, and a traditional medicinal. The mucilage made of polysaccharides and derived from fenugreek seeds. Mucilage is an amorphous powder with a cream color. In warm water, this rapidly dissolves to create a thick colloidal solution. Angle of repose, bulk density, and compressibility index are determined to be 22.25 oC, 0.64 g/cc, and 15.20 % of its physicochemical properties, respectively. Fenugreek mucilage creates a thick, gelatinous substance when it comes into contact with liquids; water does not cause it disintegration. In place of synthetic polymer, it can be utilized as a super-disintegrating ingredient in the preparation of a variety of fast-dissolving film(18) (25).

2.1.9 Soy Polysaccharide

Defatted and dehulled soybean flakes are the source of soy polysaccharide, a fibrous powder that is soft white to light tan in color and free of starch or sugar. It contains five different higher polysaccharides, including cellulose, hemicellulose, pectin, gum, and mucilage, contributing up the majority of its 75% dietary fiber. Because of high fiber content, soy polysaccharide is useful in dietary supplements. In compressed tablets, the commercially available soy polysaccharide (Emcosoy®) serves as a super disintegrant. We developed and evaluated simvastatin orodispersible tablets with soy polysaccharide as a novel super disintegrant. The least period of time was needed to wet and dissolve an orodispersible tablet, and it dissolved at the fastest rates(26). Amlodipine besylate oral disintegrating tablet formulation, development, and evaluation used soy polysaccharide and croscarmellose sodium as natural and artificial super disintegrants, respectively. They came to the conclusion that the accelerated disintegration of the tablet may have been produced by the wicking and swelling activities of soy polysaccharide and croscarmellose sodium working together(27).

2.1.10 Plantago ovata seed mucilage

Psyllium is the common name for a many of Plantago plant species. When the words "psyllium" and "ispaghula husk" are used interchangeably in the text, psyllium refers to a substance made from the dried, ripe seeds of Plantago psyllium and Plantago indica L., whereas ispaghula husk refers to a substance made from the enriched seeds of Plantago ovata Forsskaol. Psyllium seeds are utilized in the manufacturing of mucilage on a commercial scale. The mucilage formed from the seed coat after the seeds' outer coating has been mechanically milled or ground. It is a white, fibrous hydrophilic substance that absorbs water to create a transparent, translucent mucilaginous gel. The polysaccharides taken out of P. ovata seeds have a gel-like texture, and their content(28). The manufacturing and analysis of FDTs employing various quantities of Plantago ovata mucilage, a regular super disintegrant, was explored in the current work. Plantago ovata mucilage was chosen because of its high swelling index. Plantago ovata's mucilage possesses a collection of qualities, including binding, dissolving, and sustaining capabilities(29).

2.1.11 Gellan Gum

Pseudomonas elodea, a bacteria, provides the source of gellan gum. This is a biodegradable, high molecular weight linear anionic polysaccharide that is mostly compose a repeating unit of tetra-saccharide, which consists of two residues of D-glucose and one residue of each of D-glucuronic acid and L-rhamnose. By using fermentation, it is produced. It provides in two varieties: High acyl (HA) and Low acyl (LA). Due to its high hydrophilic nature, Gellan Gum is utilized as a tablet excipient since tablets swell quickly after coming in touch with water. With a gellan gum concentration of 4% w/w in the current trial, the pill totally destroyed in 4 minutes, and 90% of the medication was dissolved in 23 minutes(30)(31).

2.1.12 Lepidium sativum Mucilage

Lepidium sativum, also called as asaliyo, belongs to the *Cruciferae* family and it is common herbal remedy in India. Lepidium sativum Mucilage is inexpensive and generally accessible in the market. Leaf, root, oil, seeds, and other components are utilized. The seeds include additional mucilage, lepidine B, C, D, E, and F as well as two novel monomeric imidazole alkaloids, semi-lepidinoside A and B. Lepidium sativum's mucilage has a wide range of properties, including binding, dissolving, gelling, and others(32).

2.1.13 Locust Bean Gum

The carob tree, Ceratonia siliqua, which grow in Mediterranean nations, produces seeds that are useful to make locust bean gum. Carob bean gum is another name for it. Two more well-known polysaccharides are starch and cellulose, which are made of lengthy chains of the carbohydrate. Because locust bean gum has a higher mannose to galactose ratio than guar gum, it has some unique properties and the two gums can combine to make a thicker gel than either one could alone. It exhibits both a disintegrant and a binder property depending on the concentration. Locust bean gum is useful in a variety of cutting-edge medication delivery methods in the pharmaceutical industry. In the food sector, it is frequently used as a thickening and gelling ingredient. Additionally, it is said to have the ability to increase solubility and act as a bio-adhesive. Various sources claim that it can be utilized for biotechnological and medicinal purposes (33).

2.1.14 Pullulan

The extracellular polysaccharide produced by Aureobasidium pullulans that polysaccharide was initially observed by Bauer in 1938. A. pullulans, is also called as Pullularia pullulans, it is a broad and typical fungus that may be found in sewage and untreated water(34). It has the chemical structure of a copolymer that repeats itself frequently{→6)-α-D-glucopyranosyl-(1→4)-α-D-glucopyranosyl-(1→4)-α-D-glucopyranosyl-(1→}$_n$ and viewed as a succession of α-(1→6)-linked (1→4)-α-D-triglucosides i.e., maltotriose (G_3). There are several industrial uses for pullulan in the biomedical and food sectors. Pullulan is a well-defined model material and a particularly useful tool in fundamental research as its precisely linear structure(35).

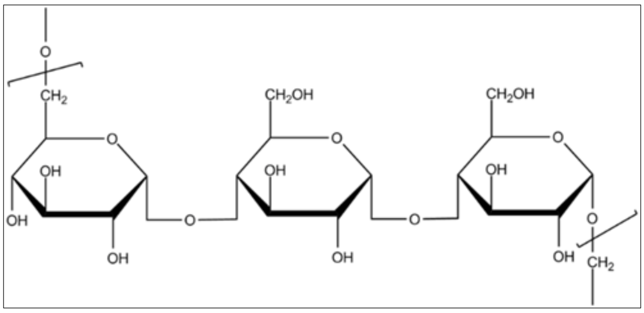

Figure 3 Structure of Pullulan

2.1.15 Dehydrated Banana Powder (DBP)

Plantain is another name for banana in several regions of the world. The DBP is a natural dietary supplement that is made from bananas, specifically the same kind known as Ethan. It is a member of the Musaceae family. Because they contain vitamin A, it is thought to be effective in treating diarrhea and stomach ulcers. They are an excellent source of energy, with a high carbohydrate content, and include a lot of B6 vitamin, which helps to lower tension and anxiety. They also contain a lot of potassium, which helps with improved brain function (36).

2.1.16 Pectin

Pectic as a broad range of b-1, 4-linked D-galacturonic acid residue and acidic structural polysaccharide linkage. Pectin is produced from fruits, vegetables, and their leftover parts in two different ways: either fully (LMP, low methyl esterified pectin) or partially (HMP, high methyl esterified pectin). Pectin is mostly made from citrus peels and apple pomace. The moisture barrier of food and food items is also inadequate(37).

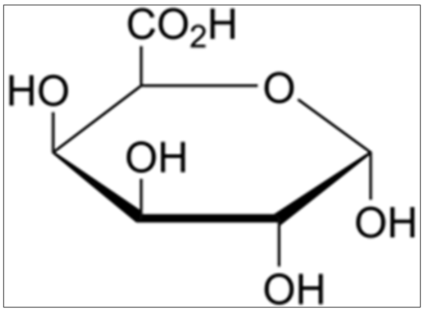

Figure 4 Structure of Pectin

2.1.17 Maltodextrin

Maltodextrin is a linear-chain polymer of glucose that has a wide range of industrial applications as an inexpensive, nearly tasteless, non-crystallizing carrier for many different substance medicines and food additives. Typically, it is produced from starch through enzymatic or combining enzymatic-heat processing(38). It is a complex mixture of high and low molecular weight carbohydrates that is produced when starch is hydrolyzed and has a dextrose equivalent (DE) value less than 20 heavy substances. The type of starch hydrolysis and how it works utilized have a significant impact on the final product's composition and characteristics. Various DE value of maltodextrins have different physiochemical characteristics, such as viscosity, solubility, freezing temperature, etc. (39).

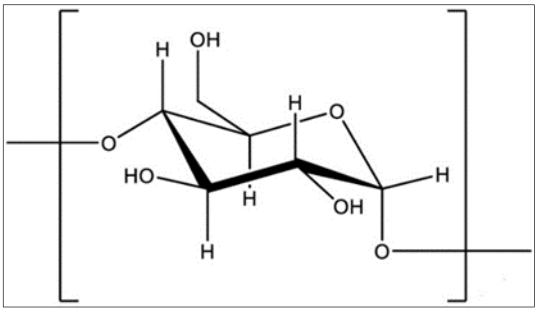

Figure 5 Structure of Maltodextrin

2.1.18 Polymerize rosin

Rosin is a biopolymer with a low molecular weight (400 Da) that is made from the oleoresin of Pinus longifolium, Pinus stoeda, and Pinus soxburghui. The pimaric acids and abietic are its constituents. The rosin and its derivatives in pharmacy it uses is increases. They have been researched for their capabilities as matrix materials in tablets for sustained and controlled release, as well as for microencapsulation, film-forming, and coating properties. Studies on the film-forming and coating capabilities of rosin and the glycerol ester of maleic rosin demonstrated that rosin had exceptional film-forming capabilities that make it a good choice for coating pharmaceutical products along with sustained-release drug delivery systems. The rosin films had good degradability and biocompatibility. By combining maleic anhydride and polyethylene glycol 200, rosin derivatives have been formed(40).

2.2 Synthetic polymers

Synthetic polymer is created artificially in lab by human being. A variety of chemical reactions since they do not exist in nature. It is further classified in two major categories i.e.,

- Biodegradable synthetic polymers.
- Non-biodegradable synthetic polymer(41).

The various film former used to form film like Polyvinyl alcohol, Polyvinyl pyrrolidone (PVP), Maltodextrin, Hydroxy Propyl Methyl Cellulose (HPMC), Hydroxy Propyl Cellulose (HPC), Methyl Cellulose (MC), Sodium Carboxy Methyl Cellulose (Na CMC) etc. are used as synthetic polymer.

- Disadvantage(42)
  - They cost more money.
  - They produce toxicity and are not biodegradable in nature.
  - The production procedure is challenging.
  - They are very marginally soluble in water.

2.2.1 Hydroxypropyl cellulose

Hydroxypropyl cellulose (HPC) is a thermoplastic non-ionic polymer that is water soluble. Poly (hydroxypropyl)ether of cellulose that has been partly replaced with hydroxypropyl cellulose. It could include another appropriate anti-caking agent or NMT 0.6% silica. Commercially, HPC is offered in a many of grades with varied solution viscosities (43). It is well known that films made of polymers with extremely high glass transition temperatures have a rigid consistency. The produced films were found to be stiff, with a high elastic modulus and a very low percent elongation (less than 5%), and were demonstrated to display brittle fracture due to HPC's comparatively high glass transition temperatures (compared to other film forming polymers). The films have a strong carrying capacity and decent clarity, and they often dissolve slowly. HPC has a strong ability to create films. As the sole water-soluble thermoplastic cellulose derivative, it was selected as the main matrix-forming polymer. Depending on its molecular weight, HPC can soften at temperatures between 100 and 1500°C.It may be employed alone or in cooperation with hypromellose to make flexible films since it gives its solution low surface and interfacial tension (44).

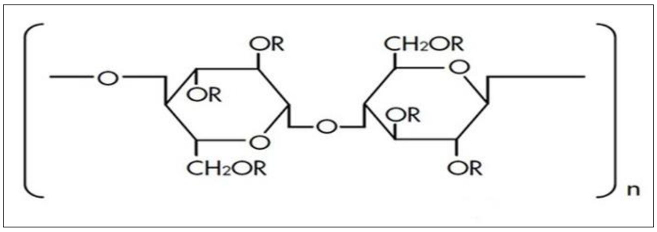

Figure 6 Structure of Hydroxypropyl cellulose

2.2.2 Poly Vinyl Pyrrolidone

The water-soluble polymer Polyvinyl Pyrrolidone (PVP), often known as Polyvidone or Povidone, is created by N-vinyl Pyrrolidone. It forms films easily in solution and has excellent wetting characteristics. It is non-toxic, largely chemically inert, physiologically compatible, temperature resistant, pH-stable, non-ionic, and colorless. Due to the brittle character of polyvinyl pyrrolidone films, povidone is combined with them to create flexible, rapidly dissolving strips(45).The production of films has utilized polyvinyl alcohol, polyvinyl pyrrolidone, maltodextrin, microcrystalline cellulose, HPMC, modified starch, chitosan, gums, or mixtures of these polymers(5).

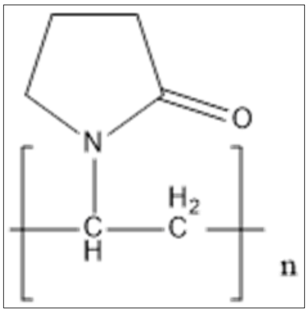

Figure 7 Structure of Poly Vinyl Pyrrolidone

2.2.3 Hydroxypropyl methylcellulose

To regulate medication release, hydroxypropyl methylcellulose (HPMC) polymers are frequently utilised as excipients in the manufacture of hydrophilic tablet matrices. There are many grades of HPMC available. The most appropriate

HPMC may be chosen on the bases of molecular size (viscosity), chemical substitution (proportion of size (viscosity), OCH, or methoxy-, and OCH CHOHCH, or hydroxy-propyl substituents), and particle size of each. To get repeatable and predictable drug release profiles from batch to batch, it is vital to manage the variables and characteristics accountable for the behaviour of the distinct replacement types during prowidely utilized as excipients in the manufacturing of hydrophilic cessing(46). It was discovered that the dissolving profile and drug substance release depended on this property of polymeric film matrices. The release of the DS from the oral film matrix was found to be delayed by HPMC grades with higher Hydroxypropyl/Methoxy ratios because these materials produced a thick matrix gel when in contact with the dissolving or biologic medium. (47).

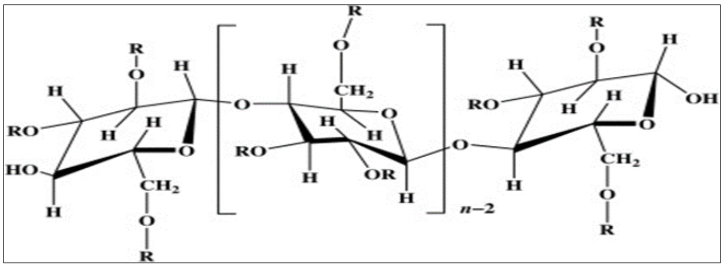

Figure 8 Structure of Hydroxypropyl methylcellulose

2.2.4 Sodium Carboxy Methyl Cellulose

Na CMC, or sodium carboxymethylcellulose, is made from alkali and mono-chloro-acetic acid treatment of cellulose the sodium salt, etc. Na CMC is cellulose ether non-ionic used frequently in hydrophilic matrix- controlled release systems. It can accommodate, and it is non-toxic higher medication loadings. Na CMC is also an excellent film developer. Products containing Na CMC or other hydrophilic polymers with significant potential are xanthan and HPMC medication distribution to wet surfaces. In an enzymatic way modified CMC (carboxymethyl cellulose) is effective at forming films property. According to reports, it is used with other films creating polymers for oral film preparation(48).

2.2.5 Croscarmellose Sodium

Cross-linked polymer of cellulose carboxymethyl is the term used to describe croscarmellose sodium. In addition to differences in the starch and cellulose polymer backbones, there are changes in the synthetic techniques used to modify the polymer. Most significantly, croscarmellose sodium has a greater DS than sodium starch glycolate and uses a distinct cross-linking mechanism. The sodium salt of carboxymethylcellulose is produced through the replacement with Williamson's ether synthesis. A significant departure from the chemistry of SSG the cellulose chains is the use of some of the carboxymethyl groups themselves to produce cross-links, with dehydration acting as the mechanism. Therefore, rather than phosphate ester links as in Primojel, the cross-links are carboxyl ester links(49).

2.2.6 Polyvinyl alcohol

A polymer that dissolves in water is polyvinyl alcohol. Its water-soluble properties are caused by the hydroxyl group (-OH) that is present in its structure. It is produced by polymerizing vinyl acetate to create polyvinyl acetate, which is subsequently hydrolysed to produce PVA. Polyvinyl alcohol's ability to crystallise and dissolve depend on number of acetate groups present and to the rate of hydrolysis. Any alteration to these variables is going to affect the type of hydrogen bonding in the aqueous solution and, ultimately, PVA solubility. PVA's viscosity, solubility, and surface tension are all influenced by the substance's concentration, temperature, molecular weight, and degree of hydrolysis. PVA has a high number of hydroxyl groups on its side chain, which allows it to self-crosslink(50).

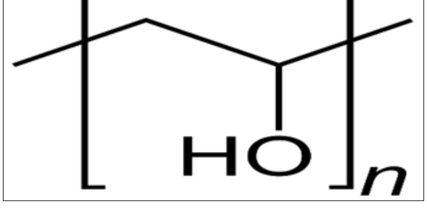

Figure 9 Structure of Polyvinyl alcohol

2.2.7 Polyethylene Glycol

Pharmaceutical formulations for parenteral, topical, ophthalmic, oral, and rectal administration frequently contain polyethylene glycols (PEGs). In controlled-release devices, it has been tested in biodegradable polymeric matrices(51). Almost completely non-irritating to the skin, polyethylene glycols are stable, hydrophilic compounds. The polyethylene glycols do not easily permeate the skin, though are easily removed from the skin by water and are water-soluble. They can be used as ointment bases after washing(52). By creating solid dispersions with the suitable polyethylene glycol, polyethylene glycols can also be utilized to improve the water solubility or dissolution characteristics of poorly soluble substances(53).

3 Conclusion

The novel method in oral drug delivery system is the fast-dissolving films (orally dissolving films). In the case of pediatric and geriatric patients, it improves patient compliance. They are superior to conventional dose forms in several ways. Polymer selection in orally dissolving films is important because it affects the film dissolving or dispersing in the oral.

Compliance with ethical standards

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There is no conflict of interest to be disclosed.

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