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REVIEW ON POLYMERS USED IN ORAL DISSOLVING FILM

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ABSTRACT:
The oral route is an important route for local and systemic drug delivery due to its large surface area, significant porosity, and high blood volume. Orally dissolving films (ODF) have become more popular compared to orally dissolving tablets. ODF is designed to dissolve rapidly upon contact with aqueous surfaces such as oral mucosa. Therefore, enable customers to use the product without needing water. Rapid cracking and breaking is achieved by using appropriate polymers. The polymers used must be non-toxic, non-irritating, odorless and effective. There are two types of polymers used: natural polymers and synthetic polymers. Polymers commonly used in the film industry include "chitosan, guar gum, xanthan gum, soybean polysaccharides, gellan gum, locust bean gum, maltodextrin, and rosin." Commonly used synthetic materials include "hydroxypropyl cellulose, polyvinylpyrrolidone, hydroxypropyl methylcellulose, polyethylene oxide, and polyvinyl alcohol." The purpose of this review is to provide a description of the various polymeric materials used in the production of oral films.

Keyword: *Mouth dissolving film; Polymers; Natural. polymers; HPMC; Gums*

INTRODUCTION:

The oral route is the most widely accepted and used route to deliver drugs to consumers. Most patients, regardless of age (adults, children, elderly), usually take the drug in the form of tablets and capsules. However, the majority of people (26% to 50%) have difficulty swallowing oral materials such as tablets and hard gelatin capsules. [1]. An innovative drug delivery technique for administering medications orally is via the use of orally fast-dissolving films [2] [3]. Oral routes of medication administration are generally recognised and account for around 50-60% of all dose forms because to their simplicity, pain prevention capabilities, flexibility to different drug candidates, and high patient compliance. Furthermore, solid oral delivery devices are more cost-effective due to the absence of the need for sterile manufacturing conditions [4]. The medication may be either dissolved or eaten, and then it produces the desired effect via the drug's systemic circulation [5] [6]. A film or strip is a pharmaceutical formulation that uses a water-soluble polymeric substance that quickly adheres to oral mucosa, hydrates, and dissolves upon contact, making it easier to administer medications locally or systemically. By altering the rate of film dissolution, it is possible to achieve either a rapid or gradual but consistent drug release [7].

One of the main qualities of the Oral Dissolving Films is they dissolve quickly. They have a zone of 5 to 20 cm2, and the solidified form of the medication is a hydrophilic polymer matrix. The present formulation of medicinal ingredients often involves a combination of 15 mg, along with numerous excipients such as plasticizers, sweeteners, flavours, enhancers, colourants, and so on. The prescription medications are stacked in buccal adhesive films, which are absorbed via a layer of buccal tissue. This absorption allows the pharmaceuticals to enter the bloodstream and display their impact. The origin of the word "Polymer" has a Greek origin where Poly means many while meros means molecules hence Many molecules which are bound together. Every molecule consists of a vast number of unique structural components that are consistently linked to each other by covalent bonds. Polymers are macromolecules formed by the combination of many

monomers, resulting in their large size and high molecular weight. Polymerization is the chemical process in which monomers are joined together to form a polymer [9]. The polymers utilised in the formulation of the oral film must possess the following characteristics: non-toxic and non-irritating, devoid of any leachable impurities, tasteless, exhibit good wetting and spreading abilities, capable of withstanding peel, shear, and tensile forces, easily obtainable, cost-effective, have a sufficient shelf life, and not promote the occurrence of Secondary infection of the oral mucosa or dental clinic [8].

Orodispersible dosage compositions may use both artificial and natural origin polymers. Get the required properties of the end result, it may be necessary to alter the composition of the polymeric matrix in oral films. The properties, quantity, or nature of the polymers may be altered to precisely manipulate several parameters, including muco-adhesiveness, disintegration duration, drug load %, mechanical/handling capabilities, and others [10]. The polymers produced by spontaneous initiation are more reliable and effective. Due to their abundant presence in many natural places around the globe, natural polymers are favoured over synthetic polymers. Naturally occurring crude polymers are frequently used in many compositions and are preferred over synthetic polymers due to their cost effectiveness, availability, and economy. Biocompatible natural polymers are non-harmful to the body. Natural polymers are ecologically sustainable since they possess intrinsic biodegradability and do not inflict harm onto the ecosystem. Natural polymers do not cause side effects because they are obtained from natural materials. Consumers often choose natural products over synthetic products due to better results, safety and greater patient compliance. Due to their capacity for multiple reuse and provision of nutritional enrichment, natural polymers are regarded as sustainable [11].

1.1 **Advantages**

- The large surface area of the medication enables it to dissolve and break down rapidly in the mouth. This leads to shorter time intervals between doses and improves the speed, effectiveness, and safety of the treatment.
- Oral films exhibit greater flexibility, malleability, and reduced brittleness in comparison to Orally Disintegrating Tablets.
- They are also convenient to handle, store, and transport [12].
- Each strip or film guarantees the accuracy of the delivered dose.
- Water is not required for ingestion [2].

1.2 **Disadvantages**

- Specialised packing is necessary for this item owing to its fragility and the need to shield it from moisture.
- It is not feasible to combine larger amounts.
- The difficulty of achieving precise dosage offers a complex technical challenge [13].

Table No.:1 What is the difference between instant oral film and instant tablet?

Instant Tablet	Instant Oral Film
It is a tablet as a dosage form.	It's a film as a dosage form.
More disintegration occurs when the surface area is larger.	Dissolution is reduced when the surface area is reduced.
It has a lower durability than oral films.	Have a longer shelf life than an oral disintegrating tablet.

Patients' compliance is lower than with oral film.	Patients are more likely to comply with a fast-dissolving pill.
High doses may be combined.	Only modest dosages are permitted.
It was concerned about choking.	Choking is unlikely.

1.3 Natural Polymers Outperform Synthetic Polymers:

In addition, natural polymers have the advantages of being simple, effective, safe and free of side effects. They are also biodegradable, biocompatible and non-toxic. Therefore, natural polymers are now preferred over synthetic polymers due to the above advantages. [9].

Classification of polymers used in mouth dissolving film:

- Natural polymer
- Artificial polymer

A natural polymer refers to a kind of compound that is derived from natural origin, such as plants or animals, and is composed of repeating units. These are available in a wide variety of plant-derived forms. The following evidence advocates for the use of botanical substances instead of artificial ones:

• Locally accessible

• Environmentally conscious • Harmonious with the natural ecosystem • Economically advantageous and sourced from renewable materials as opposed to synthetic substances Below are many benefits associated with natural plant-derived compounds.

• Biodegradable: Since these chemicals occur in nature and are produced by all living things, they are destroyed by natural processes.

• Cost-effective: It is more economical to use them as natural resources. Production costs are lower than human use costs.

• Eco-friendly processing: The pharmaceutical industry often utilises a wide range of natural compounds derived from diverse plants, thanks to their simple manufacturing methods and abundant availability.

• Local accessibility (particularly in developing countries): Due to the wide array of applications for gum and mucilage in many industries, the government of India and other comparable developing nations actively encourages the growing of plants as pharmaceutical excipients.

• Patient acceptability and public acceptance: Natural materials have a reduced risk of side effects and bad outcomes compared to synthetic ones [14].

2.1 Non – synthetic polymers

2.1.1 Sulphated O-Carboxymethylchitosan:

Chitosan is a very promising biopolymer that is being used in the biomedical arena. Polymer-based medication delivery methods have been extensively explored as a substitute for conventional medical treatments [15]. Chitin, specifically chitin β-(1 → 4)-N-acetyl-D-glucosamine, is a polysaccharide that can be found in the exoskeletons of crustaceans such as crabs and shrimps. Unlike chitosan, it has an amino group chemically bonded to an acetyl group instead of free. Chitin is found in the exoskeletons of crustaceans such as crabs and shrimps and in the cell walls of fungi, and is used in the commercial production of chitosan. Despite the drug's ability to dissolve, Bruscato and Danti (1978) discovered that including chitin into conventional tablets resulted in a dissolving time of 5 to 10 minutes. Surface tension is used to measure wetting time and breaking time in the mouth. Chitosan is a well-known natural polysaccharide used in the pharmaceutical industry due to its many uses. [16].

2.1.2 Gum Kino:

Gum kino Is a naturally originated polysaccharide gum obtained from the seeds of Cyamopsis tetragonoloba, which be the properties of the Leguminosae family. Chemically, it has (1/6) connections between (1/4)-b-D-mannopyranosyl units and the electron chain of a-D-galactopyranosyl units. Good gut bacteria break down galactomannan residues, producing short-lived fatty acids that cannot be metabolized by humans or animals. Due to its advantages such as biocompatibility and biodegradability, guar gum has gained more importance in biomedical and pharmaceutical applications. It has several characteristics, such as bioavailability, mechanical strength, and physicochemical stability. Guar Gum (GG) serves as a valuable additive in pharmaceutical technology, functioning as a thickening agent, suspending agent, stabilising agent, and emulsifier [17].

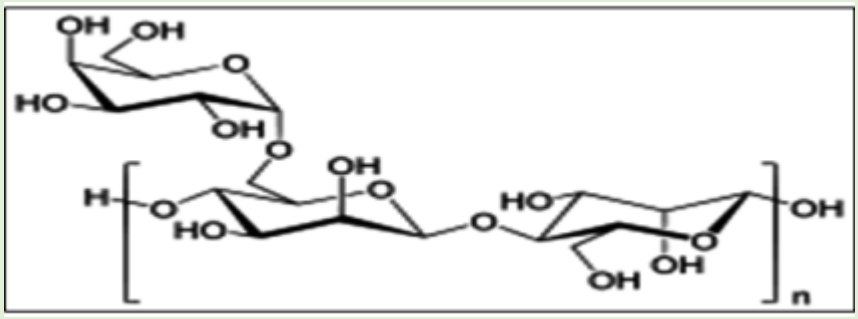


Figure No.: 1 Structure Of Gaur Gum

2.1.3 Indian gum tragacanth:

Indian gum tragacanth. is a complex polysaccharide with a macro molecular weight. It is derived from the exudation of trees of to the Sterculiaceae family, notably the plant Sterculia. Alternate appellations for this substance include Kadaya, Katilo, Kullo, Kuterra, Karaya, gum karaya, Sterculia, gum sterculia, and several more. Can form bonds with other carbohydrates. Within the field of medicine, it functions as both an adhesive and a binding agent. The gum karaya powder may have an off-white, pink, or brown colour. It may be used as a substitute for gum tragacanth. The gum has the ability to assimilate water, expanding 70-100 times more than its initial size. The high viscosity of gum prevents it from being used as a binder and disintegration aid in the production of high-dose materials. [18,19].

2.1.4 Xanthan Gum:

Xanthomonas campestris, a pathogen of cabbage plants, produces xanthan gum, a naturally occurring high molecular weight polymer. Xanthan gum powder is white to cream in color, has a smooth consistency, and is soluble in hot and cold water. However, it is insoluble in most organic solvents. Xanthan gum solutions have much greater viscosity than other polysaccharide solutions, even at low concentrations. This feature makes it more efficient as a thickening and stabilising agent. Xanthan gum solutions exhibit pseudoplastic behaviour, yet they are not thixotropic.

Xanthan gum's pseudoplasticity enables easy processing and ensures excellent pourability. Moreover, xanthan gum surpasses most other water-soluble polysaccharides in terms of its superior heat stability. Due to its lack of flavour, xanthan gum does not affect the taste of other culinary ingredients. and enhances sensory characteristics in the final products.

Xanthan gum solutions exhibit pH-resilience, allowing them to remain stable in both acidic and alkaline conditions [20].

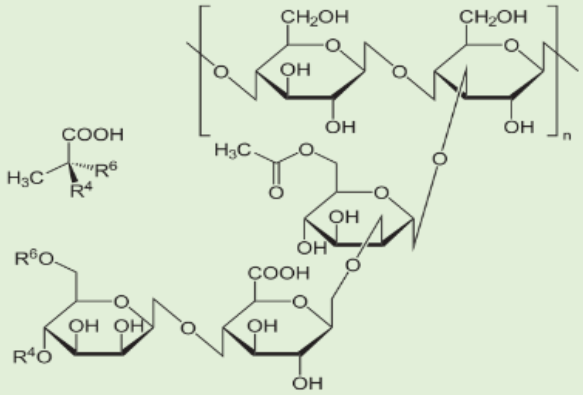


Figure No.: 2 Xanthan Gum

2.1.5 Agar Agar:

Agar is a dried gel-like product made from the red alga Gelidium amansii (Gelidium family) and many other algae, including Gracilaria. Pterocadia and (Gracilariaceae) (Gelidaceae). Agar is in the form of strips, flakes, or fine powder and may be yellow-gray, white, or nearly colorless. It has a slimy smell and is odorless. Agarose and agarose are the two polysaccharides that make up agar. The viscosity of the agar is determined by the agarose, which is accountable for the stability of the gel. It is a valid applicant as a non-conformist due to its maximum gel power. Epoxy resin is utilised in concentrations ranging from 1 -10%. Although this is less effective disintegration agents than others due to their comparatively limited capacity development [21]

2.1.6 Sodium Alginate:

The majority of sodium alginate [22] contains sodium alginate, which is a mixture of polyuronic acids containing residues of D-mannuronic acid and L-guluronic acid. Brown seaweeds, class Phaeophyceae, especially kelp, produce nonfood products called alginates. The presence of calcium, magnesium and sodium salts of alginic acid can be detected in cell membrane of brown algae. Alginate has special colloidal properties such as thickening, stabilization, suspension formation, film formation, gel and emulsion stabilization ability. As a result, it may be used to create biopolymer films or coating components [23]. Alginate exhibits hydrophilic properties, resulting in the production of edible films that are sturdy but possess limited water resistance. When comparing synthetic films to natural ones, the mechanical characteristics and water permeability might be considered intermediate. Starch is included into alginate films to enhance their mechanical properties [24].

2.1.7 Gelatine:

Gelatine is composed of a diverse combination of water-soluble proteins with large molecular weights. Gelatine is a clear, brittle substance that may be found in the form of powder. It is almost tasteless, has no smell, and has a little yellow tint. Gelatine undergoes significant expansion and absorbs water to create a gel when placed in aqueous solutions with temperatures ranging from 30 to 35°C. The

amount of water absorbed may be 5 to 10 times the weight of the gelatine. Gelatine, a natural protein obtained from collagen, finds widespread use in the culinary and medicinal sectors. Gelatine films have a velvety texture, rapidly disintegrate, and serve as exceptional vehicles for flavours. Research has shown that gelatine films dissolve in the body after 40 seconds and disintegrate within 8 seconds. Additionally, gelatin is not suitable for use on MDF as it tends to production a viscous gel when combined with saliva in mouth. [(1)].

2.1.8 Fenugreek Seed Mucilage:

Fenugreek an herbaceous plant belongs to the family leguminous sometimes referred to as fenugreek. It serves several purposes in various settings, including nutrition, culinary enhancement, and traditional medicine. The mucilage is composed of polysaccharides and is obtained from fenugreek seeds. Mucilage is a formless powder that has a cream hue. When exposed to warm water, this substance quickly dissolves, resulting in the formation of a dense colloidal solution. It was measured that the angle of repose, bulk density and electrical parameters of this substance are 22.64 g/CC and it has 15.20% of the total energy. The mucilage of fenugreek forms a viscous and gel-like material upon contact with liquids, and it does not disintegrate in water. Instead of using synthetic polymer, it may be used as a very effective disintegrating component in the production of various rapidly dissolving films [(18), 25)].

2.1.9 Soy Polysaccharide:

Soy polysaccharide, a fibrous powder that is soft white to light tan in colour and devoid of carbohydrate or sugar, is derived from defatted and dehulled soybean flakes. The composition of this product consists of five different carbohydrates such as cellulose, hemicellulose, pectin, gum and mucilage, which combine most of the dietary fiber content of 75%. Soy polysaccharides are useful as a dietary supplement due to their high fiber content. A commercial product containing fruit juice polysaccharide (Emcosoy®) is used in tablets as an excellent antibacterial agent. We created and assessed simvastatin orodispersible tablets using soy polysaccharide as an innovative super disintegrant. The orodispersible tablet required the shortest time to get wet and dissolve, and it dissolved at the most rapid rates [(26)]. Design, expansion and assessment of amlodipine besylate orally disintegrating tablets using soybean polysaccharide and croscarmellose sodium as natural and artificial superdisintegrants, respectively. The researchers determined that the rapid breakdown of the pill may have been caused by the combined effects of soy polysaccharide and croscarmellose sodium, which led to wicking and swelling activities [(27)].

2.1.10 Plantago ovata seed mucilage:

Banana is a popular name of many types of plants. When “banana” and “ispaghula peel” are used interchangeably in the text, plantain refers to a product made from the dried, ripe seeds of plantain and plantain, while ispaghula peel refers to a product made from concentrated psyllium. Products made from psyllium and plantain. Noob. Banana seeds oval Forsskaol. Psyllium seeds are used commercially in slime production. After the layer of the seed, the slime produced by the shell was mechanically in or in the soil. It is a white, fibrous, hydrophilic substance that absorbs water to become a clear, translucent mucus gel. Polysaccharides extracted from P. ovata seeds have a gel-like texture as well as their content (28). The current study investigates the use of various forms of Psyllium oval mucilage, an excellent synergistic agent for producing and analyzing PDTs. Banana slime was chosen due to its high swelling. Psyllium ovate’s slimes have many benefits, including binding, dispersing, and stimulating abilities. (29)

2.1.11 Gellan Gum:

Pseudomonas elodea is the bacterium that produces gellan gum. It is a biodegradable, high-molecular-weight linear anionic polysaccharide consisting only of tetrasaccharide repeats, including two D-glucose residues

and a D-glucuronic acid and L-rhamnose residue. It is produced through fermentation. It found in two forms: high acyl (HA) and low acyl (LA). Due to its high hydrophilicity, gellan gum is used as a tablet excipient because the tablets swell rapidly when in contact with water. In the present experiment, when the gellan gum concentration was 4% w/w, the tablet was completely destroyed in 4 min and 90% of the drug was dissolved in 23 min. [30, 31].

2.1.12 Asaliyo:

Lepidium sativum, also known as Asaliyo, is a member of the Brassicaceae family and is a plant commonly used in India.

Garden cress is the scientific name for Asaliyo. Mucilage is affordable and widely available on the market. The leaf, root, oil, seeds, and other constituents are used. The seeds also contain mucilage and the mucilage of Lepidium sativum has properties like binding, dissolution, gelation, etc [32].

2.1.13 Ceratonia Gum:

The carob tree, whose scientific name is Ceratonia siliqua, is native to the Mediterranean countries and its seeds are used in the production of carob gum. Carob bean gum is an alternative term for it. Starch and cellulose are two prominent polysaccharides composed of elongated carbohydrate chains. Due to its greater mannose to galactose ratio compared to guar gum, locust bean gum has distinct qualities. When combined, these two gums may create a denser gel than what each gum could achieve alone. Depending on the concentration, it demonstrates both disintegrant and binder properties. Locust bean gum is valuable in several state-of-the-art medicine administration techniques in the pharmaceutical business It is also said to increase solubility and act as a bioadhesive. Multiple authors assert its potential for use in biotechnology and medicine [33].

2.1.14 Pullulan:

The extracellular polysaccharide generated by Aureobasidium pullulans was first identified by Bauer in 1938. A. pullulans, also known as Pullularia pullulans, is a widespread and common fungus that may be found in sewage and untreated water [34]. The compound has a copolymeric structure characterised by frequent repetition. The structure Is α-D-glucopyranosyl-(1 → 4)-α-D-glucopyranosyl-(1 → 4). This structure can be described as a chain of α-(1 → 6)-linked α-D-glucopyranosyl bind with α-(1 → 4) linkages between them. Maltotriose (G3) is an example of α-D-triglycoside. Pullulan has many uses in the pharmaceutical and food industries. Pullulan is a well-defined data structure that is particularly useful in fundamental research due to its linear structure. [35].

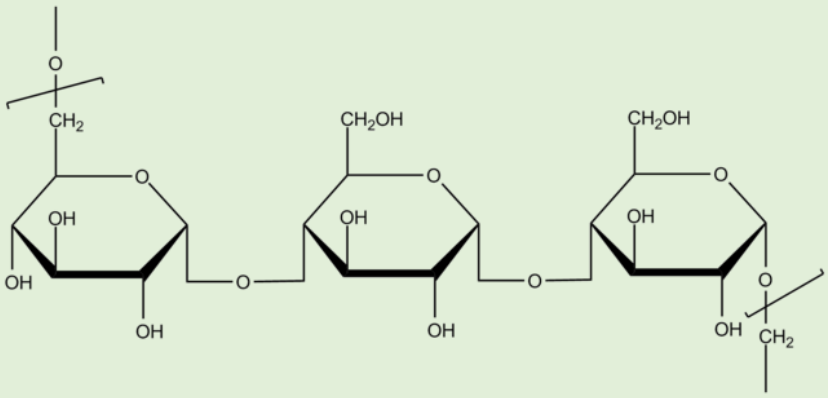


Figure No.: 3 Structure Of Pullulan

2.1.15 Dehydrated Banana Powder (DBP):

Plantain is a synonym for banana in several geographical areas. The DBP is a naturally derived nutritional supplement sourced from a special kind of bananas called Ethan. It belongs to the Musaceae family. Due to their vitamin A content, they are believed to have efficacy in the treatment of diarrhoea and stomach ulcers. Rich in carbohydrates and vitamin B6, it is an excellent source of energy that helps reduce stress and anxiety.

In addition, they are rich in potassium, which enhances cognitive function [36].

2.1.16 Pectin:

Pectin is an acidic structural polysaccharide comprised of various b-1, 4-linked D-galacturonic acid residues. Pectin is obtained from fruits, vegetables and their products by two different methods: full or partial extraction. Pectin is mostly derived from citrus peels and apple pomace. The moisture resistance of food and food products is insufficient [37].

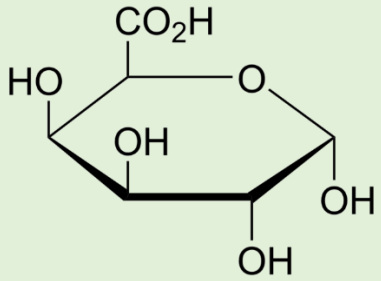
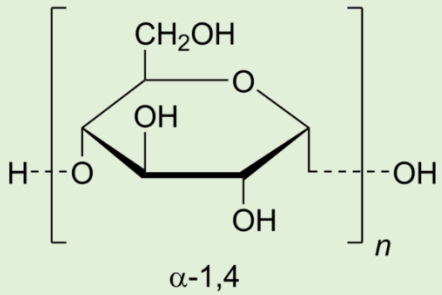


Figure No.:4 Structure Of Pectin

2.1.17 Maltodextrin:

Maltodextrin is a glucose-based polymer with a linear structure that is widely used in many industries as a cost-effective, almost flavourless, and non-crystallizing agent to transport a variety of substances, including medications and food additives. Usually, it is derived from starch via enzymatic or enzymatic-heat processing [38]. It is a combination of carbohydrates of various molecular weight, formed by hydrolysis of starch, with a sugar equivalent (DE) value of less than 20 by weight. The specific process and working process of starch hydrolysis are related to the content and properties of the final product. Maltodextrins with different DE values vary in viscosity, solubility, freezing temperature, etc. They exhibit different physical properties [39].



$2 < n < 20$

Figure No.: 5 Structure of Maltodextrin

2.1.18 Polymerize rosin:

Rosin is a biopolymer derived from the oleoresin of Pinus longifolium, Pinus stoeda, and Pinus soxburghui. Its main products are pimaric acid and abietic acid. The use of resin and its derivatives in medicine continues to become widespread. Their ability to form matrix materials in tablets for release and modification as well as their ability to provide microencapsulation, film formation, and processes have also been examined. Studies on the film-forming and coating-strengthening abilities of rosin and maleyl rosin glycerides have shown that rosin has film-forming properties, making it an excellent choice for chemical coatings and sustained-release chemical delivery systems. Rosin films show excellent degradability and biocompatibility. Rosin derivatives were produced by reacting maleic anhydride with polyethylene glycol 200 [(40)].

2.2 Artificial polymers:

Artificial polymers are manufactured in the laboratory. Many reactions do not occur. So, it is divided into two main categories:

- Decomposed Artificial polymers.
- Non-decomposed Artificial polymer [(41)]

Synthetic polymers used in filmmaking include polyvinyl alcohol, polyvinyl pyrrolidone, maltodextrin, hydroxypropyl methylcellulose, hydroxypropyl cellulose, methylcellulose, sodium carboxymethylcellulose, and others.

Drawback [(42)]:

They incur higher expenses.

They exhibit toxicity and are not capable of undergoing biodegradation in the natural environment.

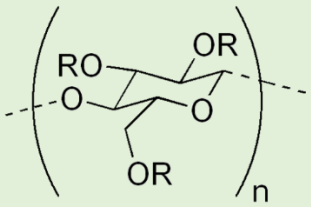
The manufacturing process is arduous.

They have very low solubility in water.

2.2.1 Hydroxypropyl cellulose:

HPC is a hydrophilic thermoplastic resin with non-ionic properties. The cellulose-based compound, known as poly(hydroxypropyl)ether, has undergone partial substitution with hydroxypropyl cellulose. It may include an additional suitable anti-caking ingredient or a maximum of 0.6% silica. Commercially, High Performance Computing (HPC) is available in many classes with different solution viscosities [(43)]. Films made from polymers with glass transition temperatures are known to have a tough skin.

The films that were made were discovered to have a rigid structure, with a high level of stiffness and a very limited ability to stretch (less than 5% elongation). Additionally, it was observed that these films were prone to breaking easily because of the very high glass transition temperatures of the HPC material, which are higher than those of other polymers used for film production. The films possess a robust capability for conveying information and exhibit satisfactory clarity, often undergoing gradual dissolution. HPC have a formidable capacity for film production. It was chosen as the first polymer to form the matrix due to its water-soluble and thermoplastic properties. HPC exhibits different optical properties at temperatures between 100 and 1500 °C depending on its molecular weight. Due to its surface reducing properties and the effect of its solutions, it can be used alone or in combination with hydroxypropyl methylcellulose to form flexible films [(44)].



R = H or $CH_2CH(OH)CH_3$

Figure No.: 6 Structure Of Hydroxypropyl cellulose

2.2.2 Povidone:

It readily forms thin layers when dissolved and has exceptional ability to spread and cover surfaces. The substance is non-toxic, chemically unreactive, compatible with the body, resistant to high temperatures, stable at different pH levels, without an electric charge, and without colour. Povidone is added to polyvinyl pyrrolidone films to enhance their flexibility and promote fast dissolution [45]. Production of films using a variety of polymers such as poly ethanol, povidone, maltodextrin, microcrystalline cellulose, HPMC, polyglusam, gum or a combination thereof. [5].

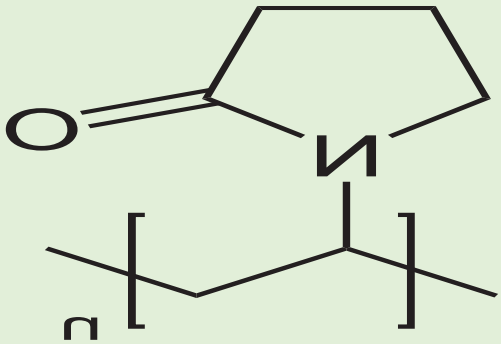
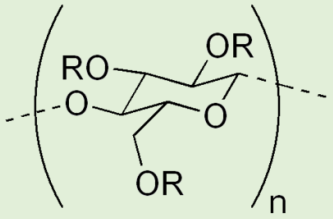


Figure No.: 7 Structure of Poly Vinyl Pyrrolidone

2.2.3 Hydroxypropyl methylcellulose:

Hydroxypropylmethylcellulose (HPMC) polymer is frequently used as an additive in the formulation of hydrophilic tablet matrices to control drug release. Various levels hydroxypropyl methylcellulose are readily obtainable. Selection of the best HPMC may be based on properties such as molecular size (viscosity), chemical modification (percentage of OCH or methoxy substituent and OCH CH2OHCH or hydroxypropyl substituents), and particle size. To get consistent and predictable drug release patterns from one group to another, it is principle to control the traits and characteristics that influence the behavior of various species. This modification is frequently used as an additive in the production of hydrophilic capsules [46] Decomposition profile and drug release properties were found based on the belongings of the polymeric film matrix. HPMC grades with higher hydroxypropyl/methoxy ratio have been noticed to delay the release of DS from the oral film matrix due to the formation of a dense gel matrix when subjected to dissolution or biological action. [47].



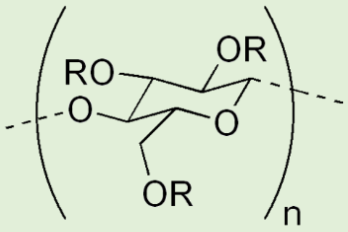
R = H or CH_3 or $CH_2CH(OH)CH_3$

Figure No.: 8 Structure of Hydroxypropyl methylcellulose

2.2.4 Sodium Carboxy Methyl Cellulose:

The production process of sodium carboxymethylcellulose (CMC) includes the step of treating the cellulose with alkali and monochloroacetic acid to produce the sodium salt. Sodium carboxymethylcellulose is a non-ionized cellulose ether widely used in hydrophilic matrix-controlled release.

It has the capacity to handle bigger amounts of drugs without becoming harmful. Furthermore, Na CMC is a really commendable film developer. Products that have the capacity to distribute medicine to wet surfaces include xanthan and HPMC, which are hydrophilic polymers such as Na CMC. Enzymatically modified carboxymethyl cellulose (CMC) is very successful in the formation of film properties. According to reports, it is used in conjunction with other films to produce polymers for the creation of oral films [48].



R = H or CH_2CO_2H

Figure No.: 9 Structure Of Carboxy Methylcellulose

2.2.5 Croscarmellose Sodium:

There are variations not only in the starch and cellulose polymer structures, but also in the methods used to alter the polymer. Croscarmellose sodium has a higher degree of substitution (DS) compared to sodium starch glycolate and employs a unique method of cross-linking. The production of the sodium salt of carboxymethylcellulose involves the substitution reaction using Williamson's ether synthesis. One notable difference in the chemistry of SSG's cellulose chains is the utilisation of certain carboxymethyl groups to create cross-links, facilitated by the process of dehydration. Instead of phosphate ester connections as in Primojel, the cross-links in this case are carboxyl ester links [49].

2.2.6 Polyvinyl alcohol:

The water solubility of this product is due to the existence of hydroxyl groups (-OH) in its structure. Polyvinyl acetate is synthesised by the polymerization of vinyl acetate, and then it is hydrolyzed to yield PVA. The crystallisation and solubility of polyvinyl alcohol are contingent upon the quantity of acetate groups present and the rate of hydrolysis. Any modification of these variables will have an impact on the nature of hydrogen bonding in the water-based solution and, therefore, the solubility of PVA. The

concentration, temperature, molecular weight, and degree of hydrolysis of a material all have an impact on the viscosity, solubility, and surface tension of PVA. Polyvinyl alcohol (PVA) has a significant quantity of hydroxyl groups on its side chain, enabling it to undergo self-crosslinking. [50].

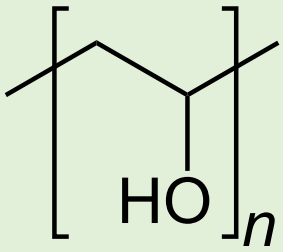


Figure No.: 10 Structure of Polyvinyl Alcohol

2.2.7 Polyethylene Glycol:

Pharmaceutical formulations intended for injection, application on the skin, in the eyes, by mouth, or in the rectum sometimes include polyethylene glycols (PEGs) It has been tested in a biodegradable polymer matrix in a controlled-release device [51].

Polyethylene glycol is a stable hydrophilic molecule that is virtually non-irritating to the skin. Polyethylene glycol has low skin permeability, but due to its water solubility, it can be easily washed from the skin with water. They can be used as cosmetics after washing [52]. Polyethylene glycol can improve the water solubility or separation properties of poor material by forming the explosive with a suitable polyethylene glycol. [53].

CONCLUSION:

One new approach to oral medication administration is the use of fast-dissolving films. It enhances patient compliance in the cases of paediatric and elderly patients. In comparison to more traditional dosage forms, they provide a number of advantages. When making films that dissolve or disperse orally, it's crucial to use the right polymer.

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