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ROLE OF NATURAL POLYMER IN SUSTAINED AND CONTROLLED RELEASE

Vaishali S. Kadam, G. R. Shendarkar
CRPS, Nanded college of Pharmacy, Nanded, Maharashtra India.

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ABSTRACT

Now a day there has been an important development in different dosage forms for existing and newly designed drugs and natural products, and synthetic as well as semi-synthetic excipients always need to be used for a variety of purposes. Gums and mucilages are widely used as natural materials for conventional and novel dosage forms. With the increasing interest in polymers of natural origin, the pharmaceutical world has compliance to use most of them in their formulations. Moreover, the tremendous orientation of Pharmaceutical world towards these naturally derived polymers has become a subject of increasing interest to discover, extract and purify such compounds from the reported origin. These polymers such as natural gums and mucilage are bio-compatible, cheap and easily available and are preferred to synthetic and semi synthetic excipients because of their lack of toxicity, low cost, availability, soothing action and non irritant nature. In the present review gums and mucilage's, used as a excipients as well as carrier for sustained or controlled release.

Corresponding author
Vaishali S. Kadam
CRPS Nanded College of Pharmacy,
Shyam nage,r Nanded, Maharashtra India
735041625
kjvaishali@gmail.com

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INTRODUCTION

Great variety of flora and fauna has been gifted to India by nature. For centuries man has made effective use of materials of natural origin in the medical and pharmaceutical field. Now days, the whole world is increasingly interested in natural drugs and excipients. In recent years, plant derived polymers have evoked tremendous interest due to their different pharmaceutical applications such as diluent, binder, disintegrant in tablets, thickeners in oral liquids, protective colloids in suspensions, gelling agents in gels and bases in suppository , they are also used in cosmetics, textiles, paints and paper-making. These polymers such as natural gums and mucilage are bio-compatible, cheap and easily available and are preferred to semi synthetic and synthetic excipients because of their low cost, availability, lack of toxicity, soothing action and non irritant nature.

Because of the availability of natural polymer easily ,biocompatible ,nontoxic in nature the natural polymer had been used in various formulations. Furthermore, they can be modified to obtain tailor made materials for drug delivery systems allowing them to compete with the synthetic products that are commercially available. Different kinds of natural gums are used in the food industry and are regarded as safe for human consumption. It should be noted that many 'old' materials are still popular today after almost a century of efforts to replace them. It is usual to strike a balance between economics and performance in the face of commercial realities. Demand for these substances is increasing and new sources are being developed. In India, because of its geographical and environmental position, has traditionally been a good source for such products among the Asian countries. Still, large quantities are imported from Europe to meet increasing demand[1].

Advances in polymer science have led to the development of novel delivery systems. The introduction of new polymers has resulted in development of polymers with unique properties. Initially polymers were used as stabilizers solubilisers, and mechanical supports for sustained release of drugs.

The polymers have been synthesized for specific needs and to solve specific problems leading with development of drug delivery systems. So there is need to understand the role of polymers[2].

The specific application of plant-derived polymers in pharmaceutical formulations include their use in the manufacture of solid monolithic matrix systems, implants, films, beads, microparticles, nanoparticles, inhalable and injectable systems as well as viscous liquid formulations.4-6 Within these dosage forms, polymeric materials have fulfilled different roles such as binders, matrix formers or drug release modifiers, film coating formers, thickeners or viscosity enhancers, stabilizers, disintegrants, solubilisers, emulsifiers, suspending agents, gelling agents.

Classification of polymers:

Polymer is a generic name given to a vast number of materials of high molecular weight. These materials exist in countless form and numbers because of very large number and type of atoms present in their molecule. Polymer can have different chemical structure, physical properties, mechanical behavior, thermal characteristics, etc., and on the basis of these properties polymer can be classified in different ways. Whereas, important classification of polymers is as follow:

Classification Polymer Type

Origin - Natural, Semi synthetic, Synthetic
Thermal Response - Thermoplastic, Thermosetting
Mode of formation - Addition, Condensation
Line structure - Linear, Branched, Cross-linked
Application and Physical Properties - Rubber, Plastic, Fibers
Crystallinity
Non crystalline(amorphous), Semi-crystalline, Crystalline
Polarity - Polar, Non polar
Chain - Hetro, Homo-chain

Classification on Basis of Nature

Natural polymer:-

The polymers, which occur in nature are called natural polymer. Natural polymers are also known as biopolymers. Examples of such polymers are natural rubber, natural silk, cellulose, starch, proteins, etc.

Semi synthetic polymer: -

Semi synthetic polymers are the chemically modified natural polymers such as hydrogenated, natural rubber, cellulosic, cellulose nitrate, methyl cellulose, etc.

Synthetic polymer: -

The polymers which are synthesized in the laboratory are known as synthetic polymer. Synthetic polymers are also known as manmade polymers. Examples of such polymers are polyvinyl alcohol, polyethylene, polystyrene, polysulfone[3].

Advantages of Natural Gums and Mucilages:

The following are the advantages of natural plant based materials:

Biodegradable *: -*

Naturally available biodegradable polymers are produced by all living organisms. They represent truly renewable source and being natural they have no adverse impact on humans or environmental health (*e.g.*, skin and eye irritation).

Biocompatible and non-toxic *: -*

Chemically, most of these plant materials are carbohydrates composed of repeating sugar (monosaccharides) units. Hence, they are nontoxic.

Low cost *: -*

These polymers are always cheaper to use natural sources. The production cost is also much lower compared with that for synthetic material. India and many developing countries are dependent on agriculture.

Environmental-friendly processing *: -*

Gums and mucilage's from different sources are easily collected in different seasons in large quantities due to the simple production processes involved.

Local availability (especially in developing countries) *: -*

In developing countries, governments promote the production of plant like guar gum and tragacanth because of the wide applications in a variety of industries.

Better patient tolerance as well as public acceptance *: -*

There is less chance of side and adverse effects with natural materials compared with synthetic one. For example, PMMA, povidone.

Edible sources: -

Most gums and mucilages are obtained from edible sources[4].

Disadvantages of Natural Gums and Mucilages

Microbial contamination *: -*

The equilibrium moisture content present in the gums and mucilages is normally 10% or more and structurally, they are carbohydrates and during production, they are exposed to the external environment and so there is a chance of microbial contamination. However, this can be prevented by proper handling and the use of preservatives.

Batch to batch variation *: -*

Synthetic manufacturing is a controlled procedure with fixed quantities of ingredients, while the production of gums and mucilages is dependent on environmental and seasonal factors.

Uncontrolled rate of hydration: -

Due to differences in the collection of natural materials at different times, as well as differences in region, species, and climate conditions the percentage of chemical constituents present in a given material may vary. There is a need to develop suitable monographs on available gums and mucilages.

Reduced viscosity on storage *: -*

Normally, when gums and mucilages come into contact with water there is an increase in the viscosity of the formulations. Due to the complex nature of gums and mucilages (monosaccharide stop olyo saccharides and their derivatives), it has been found that after storage there is reduced in viscosity[5].

Characterization and standardization of gums and mucilages

A suitable strategy is required to save money and time. Over-characterization is not desirable, because excessive use of time and resources could actually delay the launch of innovative excipients. The characterization of gums and mucilages is initially achieved by only a multiple technique approach. For excipient analysis, analytical techniques can be classified according to the type of information generated.

Structural: -

Gums and mucilage's are polysaccharides and contain sugars. So, confirmation of the different sugars is carried out by chromatography and structure elucidation can be carried out by NMR and mass spectroscopy.

Purity: *-*

For the determination of the purity of the selected gum and mucilage, tests for alkaloids, glycosides, carbohydrates, flavanoids, steroids, amino acids, terpenes, saponins, oils and fats, and tannins and phenols are carried out.

Impurity profile: -
Testing for impurities must be carried out using suitable analytical techniques.

Physico-chemical properties: -

Color, odor, shape, taste, touch, texture, solubility, pH, swelling index ,loss on drying, hygroscopic nature, angle of repose, bulk and true densities, porosity and surface tension. Different ash values are also estimated. The microbial load and presence of specific pathogens are also determined. *In vitro* cytotoxicity is also determined. Gums and mucilages are highly viscous in nature. So, the rheological properties of excipients are important criteria for deciding their commercial use. The flow behavior of the samples is determined.

Toxicity: -

The acute toxicity of gums and mucilages are determined by the followings fixed-dose method as per OECD guideline No. 425. A sub-acute toxicity study, determination of the LD50 etc., is carried out in rats and guine pigs of both sexes. Once analysis is complete, determination of the structure, composition and impurity profile enables scientific dossier to be prepared describing the excipient. This information is of value for the regulatory dossier of the final pharmaceutical product that would contain the given excipient. Finally, gums and mucialges are added to pharmaceutical formulations. So a compatibility study is important. The compatibility studies of gum, mucilage, drugs are performed using Spectrophotometry[6].

Modification of existing gums and mucilages:

It should be noted that many ‘‘old’’ materials compete successfully today after almost a century of efforts to replace them. It is the usual balance of economics and performance that determines the commercial realities. Natural gums have been modified to overcome certain drawbacks, like uncontrolled rate of hydration, thickening, drop in viscosity on storage, and microbial contamination .Since the implementation of polymeric materials in the field of pharmaceutical technology ,numerous attempts have been made to modify their physical and chemical properties, and thus, their potential ability in various areas of drug formulations. Various methods are available to modify the state of molecular interaction between polymers. Basically two methods are available as the Physical method and chemical method.

Physical method:

A molecular interaction between polymers can be achieved by exposure to dry heat, saturated steam, microwave technology, UV 30-31, and gamma radiation32.

Chemical method:

Polymers are treated with chemicals like aldehydes, epichlorhydrin, borax or Glutaraldehyde. Temperature is one of the most favourable methods of cross-linking because it avoids both the application of harsh chemical materials for large-scale production and the diversity of equipment and methods used in their application.

Properties of Polymers:

Polymer properties are broadly divided into several classes based on the scale at which the property is defined as well as upon its physical basis. The most basic property of a polymer is the identity of its constituent monomers. A second set of properties, known as microstructure, essentially describe the arrangement of these monomers within the polymer at the scale of a single chain. These basic structural properties play a major role in determining bulk physical properties of the polymer, which describe how the polymer behaves as a continuous macroscopic material. Chemical properties, at the nano-scale, describe how the chains interact through various physical forces. At the macro-scale, they describe how the bulk polymer interacts with other chemicals and solvents.

In general, polymeric mixtures are far less miscible than mixtures of small molecule materials. This effect results from the fact that the driving force for mixing is usually entropy, not interaction energy. In other words, miscible materials usually form a solution not because their interaction with each other is more favorable than their self-interaction, but because of an increase in entropy and hence free energy associated with increasing the amount of volume available to each component. This increase in entropy scales with the number of particles (or moles) being mixed. Since polymeric molecules are much larger and hence generally have much higher specific volumes than small molecules, the number of molecules involved in a polymeric mixture is far smaller than the number in a small molecule mixture of equal volume.

In dilute solution, the properties of the polymer are characterized by the interaction between the solvent and the polymer. In a good solvent, the polymer appears swollen and occupies a large volume. In this scenario, intermolecular forces between the solvent and monomer subunits dominate over intramolecular interactions. In a bad solvent or poor solvent, intermolecular forces dominate and the chain contracts. In the theta solvent or the state of the polymer solution where the value of the second virial coefficient becomes 0, the intermolecular polymer-solvent repulsion balances exactly the intramolecular monomer-monomer attraction.

Chemical properties:

The attractive forces between polymer chains play a large part in determining polymer's properties. Because polymer chains are so long, these interchain forces are amplified far beyond the attractions between conventional molecules. Different side groups on the polymer can lend the polymer to hydrogen bonding between its own chains. These stronger forces typically result in higher tensile strength and higher crystalline melting points.

The intermolecular forces in polymers can be affected by dipole in the monomer units. Polymers containing amide or carbonyl groups can form hydrogen bond between adjacent chains; the partially positively charged hydrogen atoms in N-H groups of one chain are strongly attracted to the partially negatively charged oxygen atoms in C=O groups on another. These strong hydrogen bonds, for example, result in the high tensile strength and melting point of polymers containing urea linkages. Polyesters have dipole dipole bondinng between the oxygen atoms in C=O groups and the hydrogen atoms in H-C groups. Dipole bonding is not as strong as hydrogen bonding, so a polyester's melting point and strength are lower than Kevlaron (Twaron), but polyesters have greater flexibility .Ethene, however, has no permanent dipole. The attractive forces between polyethylene chains arise from weak van der Waals forces Molecules can be thought of as being surrounded by a cloud of negative electrons. As two polymer chains approach, their electron clouds repel one another. This has the effect of lowering the electron density on one side of a polymer chain, creating a slight positive dipole on this side. This charge is enough to attract the second polymer chain. Van der Waals forces are quite weak, however, so polyethylene can have a lower melting temperature compared to other polymers.

Optical properties:

Polymers such as PMMA and HEMA:MMA are used as matrices in the gum medium of solid state dye lyser that are also known as polymer lasers. These polymers have a high surface quality and are also highly transparent so that the laser properties are dominated by the laser dye used to dope the polymer matrix. These type of lasers, that also belong to the class of organic lasers are known to yield very narrow line widths which is useful for spectroscopy and analytical applications. An important optical parameter in the polymer used in laser applications is the change in refractive inde .[7].

Applications of Gums and Mucilages:

Gums and mucilages of different sources and their derivatives represent a group of polymers widely used in pharmaceutical dosage forms. Various kinds of gums are used in the food industry and are regarded as safe for human consumption. However, there is growing concern about the safety of pharmaceutical excipients derived from natural sources .Plant gums and exudates are now screened for their useas pharmaceutical adjuvants. Mucilages of different origins are also used in conventional dosage forms of various drugs for their binding, thickening, stabilizing and humidifying properties in medicine. A newer use of different gums and mucilages in cosmetics and textiles has increased the demand and screening of gums has become an important pharmaceutical area. However different gums and mucilages used as pharmaceutical adjuvants have stringent specifications, which few natural agents can fulfill. Gums and mucilages have the following applications.

Applications in the Food Industry

Gums and mucilages have a variety of applications in the food industry. Different gums have different uses like water retention and stabilization (guar and locust bean gum), stabilizers forice-cream, meat products and instant pudding (carrageenanas), dairy, confectionary and meatproducts (agar), confectionary, beverages, backed product, and sauces (gum arabic, tragacanth, pectins,alginates and xanthan gum).

Pharmaceutical applications

Gums and mucilages have a variety of applications in pharmacy. They are used in medicine for their demulcent properties for cough suppression. They are ingredients of dental and other adhesives and can be used as bulk laxatives. These hydrophilic

Polymers are useful as tablet binders, disintegrants, emulsifiers, suspending agents, gelling agents, stabilizing agents, thickening agents, film forming agents in transdermal and periodontal films, buccal tablets as well as sustaining agents in matrix tablets and coating agents in microcapsules including those used for protein delivery. Various gums and mucilages with their common names, biological sources, family and applications are listed in lists the different applications of gums and mucilages in novel drug delivery systems

Industrial application

Gums used in cosmetics (acacia, tragacanth and karayagum), textiles (starch, dextrin, cellulose, pectins, and tamarind gum), adhesives (acacia gum, and tragacanth), lithography (gum arabic, tragacanth, and locust bean gum), paints (pectins, hemicellulose, and resins) and paper manufacturer (tamarind, and cellulose[8].

Gums and mucilage in sustained drug delivery system:

Among various dosage drug delivery system, Matrix system is the specific type of release system, which prolongs and controls the release of drug that is dissolved or dispersed. Making drug-embedded matrix tablets through the direct compression of a blend of drug, retardant material and additives is one of the dosage forms-Disperse system and simplest formulation approaches. polymeric materials in a matrix system is a common method of modulating drug release.

Gums and mucilages have been examined as polymer for versatile sustained release formulations. The use of natural excipients for pharmaceutical formulations, polymers and their semi-synthetic derivative in drug delivery continues to be an area of active research. Drug-release retarding polymers are the key performers Academic Press, London. in matrix systems. Various polymers have been A study on investigated as drug retarding agents, each presenting a binding properties of guggal different approach to the matrix system. Based on the features of the retarding polymer, matrix systems are usually classified into three main groups: Hyprophilic hydrophobic and plastic[9].

Guar gum

Guar gum is derived from the seeds of the cyomopsistetragonolobus (fam. Leguminosae). Chemically, guar gum is a polysaccharide composed of the sugars galactose and mannose. The backbone is a linear chain of β 1,4-link residues to which galactose 1,6-linked at every second mannose, forming short side-branches fig Guar gum is hydrophilic in nature and swells in cold water forming viscous colloidal dispersions or sols. This gelling property retards release of the drug from the dosage form as well as it is susceptible to degradation in the colonic environment. So it can be used for controlled release and targeted drug delivery systems due to its drug release retarding property and susceptibility to intestine microbial degradation.

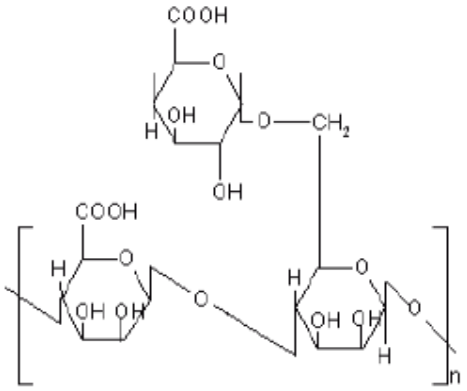
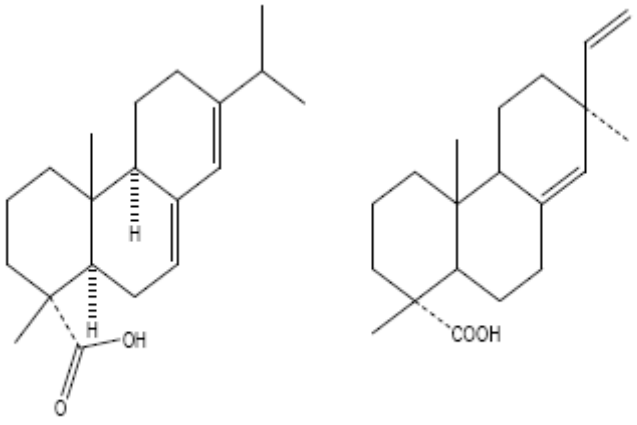


Figure 1: chemical structure of guar gum.

Homogenized and diluted feces from human source were incubated with the guar gum to investigate the degradation of polysaccharide by intestinal microflora. It produced a rapid decrease in viscosity and fall in ph while no such results were observed when it was incubated with autoclaved fecal homogenates. Wong *et al* studied the dissolution of dexamethasone and budesonide from guar gum-based formulations using reciprocating cylinder dissolution apparatus (USP dissolution apparatus iii) and observed that the drug release in simulated colonic fluid was markedly increased at galactomannanase concentrations >0.01 mg/ml. Krishnaiah*et al* Performed a gamma scintigraphic study on guar gum matrix tablet using technetium-99m-dtpa as a tracer, in human volunteers. The scintigraphs showed that some amount of tracer present on the surface of the tablets was released in stomach and small intestine and the bulk of the tracer present in the tablet mass was delivered to the colon. These results indicated that guar gum, in the form of directly compressed matrix tablets, is a potential carrier for colon-specific drug delivery.



Abietic acid Pimaric acid

Rosin

From pinupal ustrismiller and other species such as pinuslinnae rosin is obtained a natural non-volatile resinous mass. Some rosin biopolymers are reported to have excellent biocompatibility and biodegradation features. It primarily contains resin tricyclic diterpene carboxylic acids (abietic and pimaric) figure-2 and a few amounts of nonacidic components. Rosin contains approximately 90% rosin acids. The rosin acids are monocarboxylic acids and have a typical molecular formula $C_{20}H_{30}O_2$ [10].

Chitosan –

Chitosan is a deacetylated derivative of chitin, which is a naturally occurring polysaccharide comprising copolymers of glucosamine and N-acetylglucosamine. Chitosan is biocompatible and biodegradable cationic polymer which is most widely used due to its reduced toxicity and better patient compliance. The cationic amino groups on the C2 position of the repeating glucopyranose units of chitosan can interact electrostatically with the anionic groups (usually carboxylic acid groups) of other polyions to form polyelectrolyte complexes. Many different polyions from natural origin [11].

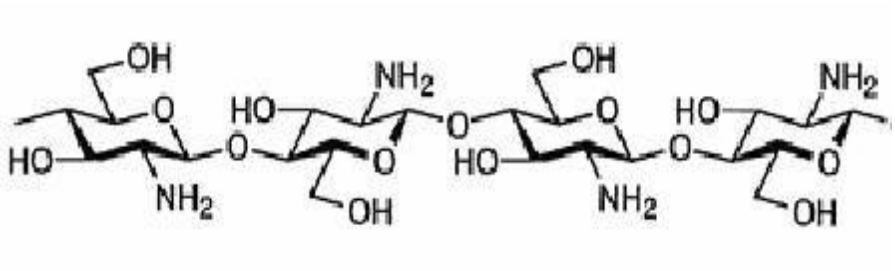


Fig. 2: Chemical structure of a chitosan polymer chain.

Gellan Gum

Gellan gum is a bacterial exo polysaccharide commercially prepared by aerobic\ submerged fermentation of .Gellan gum is a linear tetrasaccharide built up by 4)- L-rhamnopyrano - with O(2) L-glyceryl and O(6) acetyl substitute nts on the 3-linked glucose. It consists of about 50,000 residues and it is normally de-esterified by alkali treatment before use. Gellan gum forms a 3-fold double helix from two left-handed chains with the acetate residues on theperiphery, and glyceryl groups and hydrogen-bonds stabilizing the inter chain associations.

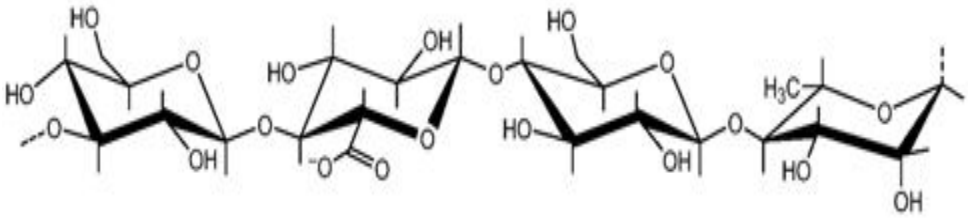


Fig. 3: Structure of gellan gum.

Xanthan gum

Xanthan is an extracellular heteropolysaccharide produced by fermentation of the bacterium The primary structure (Fig. 7)of this naturally produced cellulose derivative contains a cellulose backbone (-D-glucoseresidues) and a trisaccharide side chain of -D-mannose- -Dgluronicacid – -D-mannose attached with alternate glucose residues of the main chain.

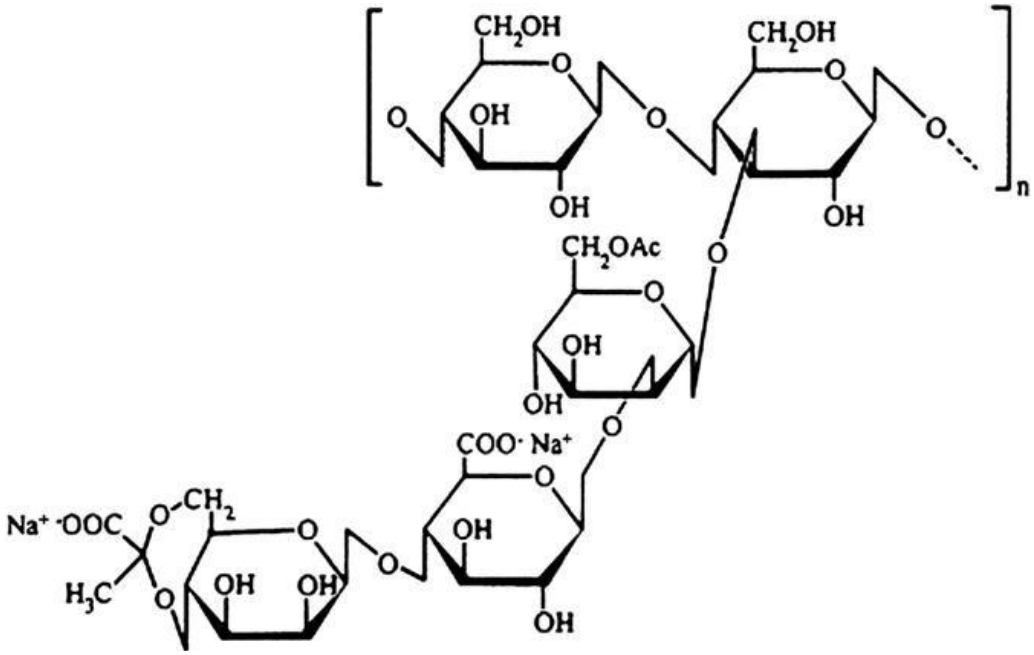


Fig. 4: Structure of Xanthan160.

Gelatin

From the collagen inside animals skin and bones Gelatin is obtained it is a translucent, colorless, brittle (when dry), flavorless solid substance. It is commonly used as a gelling agent in food and pharmaceuticals. Gelatin is produced by partial hydrolysis of collagen extracted from the boiled bones, connective tissues, organs and some intestines of animals such as domesticated cattle and pigs. The approximate amino acid composition of gelatin is glycine 21%, proline 12%, hydroxyproline 12%, glutamic acid 10%, alanine 9%, arginine 8%, aspartic acid 6%, lysine 4%, serine 4%, leucine 3%, valine 2%, phenylalanine 2%, threonine 2%, isoleucine 1%, hydroxylysine 1%, methionine and histidine<1%and tyrosine<0.5%. Gelatin is used in nanoparticles as drug carrier system for uptake in lymphocytes, agar modified gelatin A and gelatin B,thiolmodified gelatin nanoparticles for intracellular DNA delivery , hydrophobic hexanoyl anhydrides grafting to the amino groups of primitive gelatin ,cationiced gelatin ,DNA-loaded gelatin nanoparticles ,modified gelatin microspheres impregnated collagen scaffold [12].

Hemicellulose

A hemicellulose is a heteropolymer (matrixpolysaccharides), such as arabinoxylans, present along with cellulose in almost all plant cell walls.While cellulose is crystalline, strong, and resistant to hydrolysis, hemicellulose has a random, amorphous structure with little strength.Unlike cellulose, hemicellulose (also apolysaccharide) consists of shorter chains - 500-3,000 sugar units. In addition, hemicellulose is a branched polymer, while cellulose is unbranched. Hemicellulose polysaccharides consist of xyloglucans, xylans and mannans that can be extracted from the plant cell wall with a strong alkali. They have backbones made up of β-1,4-linked Dglycans. Xyloglucan has a similar backbone as cellulose, but contains xylose branches on 3 out of every 4 glucose monomers. The β-1,4-linked DXylan backbone of arabinoxylan contains arabinose [13].

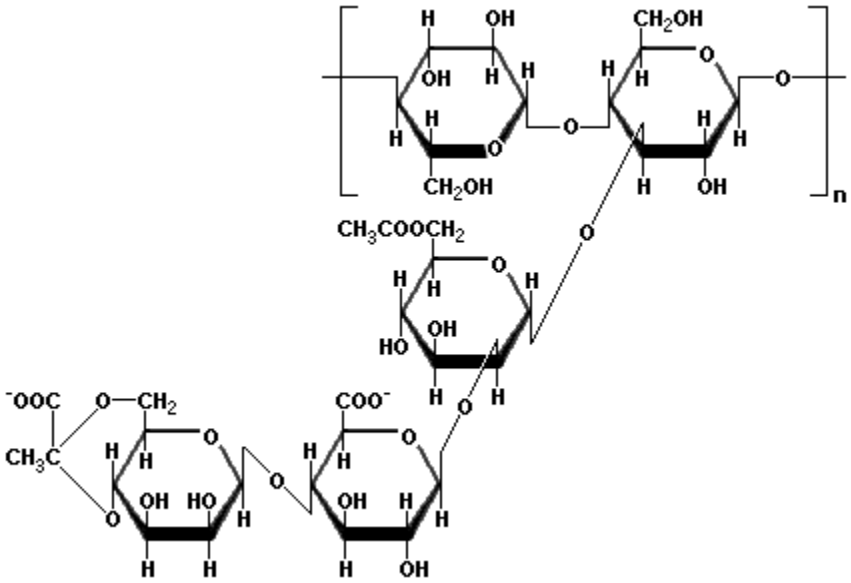


Fig. 5: Structure of Hemicellulose.

Tara Gum:

Tara gum is obtained from the endosperm of seed of Caesal piniaspinosa, common known as tara. It is small tree of the family Leguminosae or Fabaceae. Tara gum is a white, nearly odorless powder. It is produced by separating and56 grinding the endosperm of the mature black color seeds .The major component of the gum is a galactomannan polymer similar to the main components of guar and locust bean gums, consist of a linear main chain of (1-4)-! Dmanno pyranoseunits with "-D-galactopyranose unitsattached by (1-6) linkages. The ratio of mannose togalactoseintara gum is 3:1. produce highly viscous solutions, even at1% concentration. Tara gum requires heating to disruptaggregation and full dissolution, whereas guar gum is soluble in cold water .Tara gum is used as a thickening agent and stabilizer in a widerange of food applications around the world. The use of tara gum as a controlled release carrier in the formulation of gastro retentive controlled release tablets and emulsions for drugslike metformin hydrochloride, ciprofloxacin hydrochloridenimodipine, nifedipine, carvedilol, clozapine has been claimed in patents

Aloe Mucilage:

Many compounds with diverse structures have been isolated from both the central parenchyma tissue of Aloe mucilage is obtained from the leaves of *Aloe barbadensis* Miller. *Aloe vera* leaves and the exudate arising from the cells adjacent to the vascular bundles. The bitter yellow exudates contains 1,8dihydroxyanthraquinone derivatives and their63 glycosides . The aloe parenchyma tissue or pulp has been shown to contain proteins, lipids, amino acids, vitamins, enzymes, inorganic compounds and small organic compounds in addition to the different carbohydrates. Many investigators have identified partially acetylated mannan (oracemannan) as the primary polysaccharide of the gel, while others found pectic substance as the primary polysaccharide galacto uranic acid containing polysaccharides have been 64 isolated from the Aloe vera inner leaf gel part .*Aloe vera* has been used for many centuries for its curative and therapeutic properties. In the pharmaceutical industry, it has been used for the manufacture of topical products such as ointments and gel preparations, as well as in the production of tablets and capsules. Important pharmaceutical properties that have been recently discovered for both the *Aloe vera* gel and whole leaf extract include the ability to improve the bioavailability of co-administered vitamins in human 67 subjects. Dried *Aloe vera* leaf gel (acetone precipitated component of the pulp) was directly compressed in different ratios with a model drug to form matrix type tablets, including ratios of 1:0.5, 1:1, 1:1.5 and 1:2. These matrix systems showed good swelling properties that increased with an increase of aloe gel concentration in the formulation. The directly compressed matrix type tablets also showed modified release behavior with 35.45% and 30.70% of the dose released during the first hour and the remaining of the dose was released over a 6 hour period for those formulations containing the lower ratios of gel to drug, namely 1:0.5 and 1:1. The formulation that contained the highest ratio of gel to drug, namely 1:2 exhibited only a 23.25% drug release during the first hour with the remaining of the dose being released over an 8 hour period. The dried *A. vera* gel polysaccharide component ttherefore showed excellent potential to be used as an excipient in the formulation of direct compressible sustained- 68 release matrix type tablets.

Gum Damar:

Whitish to yellowish natural gum obtained from plant Shorea wiesneri (family Dipterocarpaceae). Gum damar (GD) contains about 40% alpha-resin (resin that dissolves in alcohol), 22% 13 beta resin, 23%dammarol acid and 2.5% water. It has been used for water-resistant coating and in pharmaceutical and dental industries for its strong binding 90 properties . In India, Sal damar has been widely utilized in 91 the indigenous system of medicine .Natural gum copal and gum damar as novel sustained release matrix forming materials in tablet formulation was evaluated. Matrix tablets were prepared by wet granulation technique using isopropyl alcohol as a granulating agent. Diclofenac sodium was used as a model drug. Effect of gum concentration (10, 20 and 30% w/w with respect to total tablet weight) on *in vitro* drug release profile was examined. Matrix tablets with 30% w/w gum copal and gum damar showed sustained drug delivery beyond 10 h. Drug release from gum copal matrix tablets followed zero order kinetics while gum damar (10 and 20% w/w) was found suitable to formulate the insoluble plastic matrix that releases the drug by diffusion. It was concluded that both gums possess substantial matrix forming property that could be used for sustained drug delivery.

Tamarind Gum:

From the endosperm of the seed of the tamarind tree tamarind xyloglucan is obtained, Tamarind usindica, a member of the evergreen family. Tamarind Gum, also known as Tamarind Kernel Powder (TKP) is extracted from the seeds. Tamarind gum is a polysaccharide composed of glucosyl: xylosyl: galactosyl in the ratio of 3:2:1. Xyloglucan is a major structural polysaccharide in the primary cell walls of higher plants. Tamarind xyloglucan has a (1 4)-D-glucan backbone that is partially substituted at the O-6 position of its glucopyranosyl residues with "-D-xylopyranose". It is insoluble in organic solvents and disperses in hot water to form a highly viscous gel such as a mucilaginous solution with a broad pH tolerance and adhesivety. The properties of tamarind gum include non carcinogenicity, mucoadhesivity, biocompatibility, high drug holding capacity and high thermal stability[14]

Bhara Gum:

From the plant of Terminalia *bellerica* roxb gum Bhara is obtained it is a yellowish natural gum belonging to family Combretaceae. Bahera gum, extracted from the bark of Terminalia bellerica. Main chemical constitutents are tannins which mainly include ß- sitosterol, gallic acid, ellagic acid,ethyl gallate, galloylglucose and chebulaginic acid It has been mainly used as a demulcent and purgative. It is also used as an emulgent in cosmetic industries. Wide applications of bhara gum indicate their hydrophilic nature, and compatibility with the physiologic environment. A new sustained release microencapsulated drug delivery system employing bhara gum has been proposed, were formulated by ionic gelation technique using famotidine as the model drug. The effect of different drug: bhara gum ratio on *in vitro* drug release profile was examined and compared with guar gum. Remaining all parameters was constant. Microcapsules employing bhara gum exhibited slow release of famotidine over 10 hr. Fickian release was observed from most of the formulations with bhara gum. It was concluded that this gum possesses substantial release controlling properties that could be used for sustained drug delivery[15].

CONCLUSION

Natural gums are promising biodegradable polymeric materials. In food technology and pharmaceuticals Many studies have been carried out using gums and mucilages. It is clear that gums and mucilages have many advantages over synthetic materials. Various applications of gums and mucilages have been established in the field of pharmaceuticals. However, there is a need to develop other natural sources as well as with modifying existing natural materials for the formulation of novel drug delivery systems, biotechnological applications and other delivery systems. Therefore, in future there will be continuous interest in natural gums and their modifications aimed at the development of better materials for drug delivery systems.

REFERENCES

1. Umesh kumarm.Deogade, Vilas N.Deshmukh, Dinesh M. Sakarkar, Gums and Mucilagesi in Ndds applications and recent approaches, International Journal of Pharm tech Research, 2012, 799-814.
2. Veeran Kadajji, Guru Betageri , Water soluble polymers for Pharmaceutical applications, review on natural polymer, Polymers 2011, 1972-2009.
3. Kulkarni Vishakha S , Butte Kishor D And Rathod Sudha S, Natural Polymers – A Comprehensive Review, International Journal of Research in Pharmaceutical and Biomedical Sciences 2012, 2229-3701.
4. Sunil Goswami, Dr. Sonali Naik, Natural Gums and Its Pharmaceutical Application, Journal of scientific and Innovative Research 2014, 112-121.
5. Jan iGk, Shah Dp, PrajapatiVd,V.C Jain Et Al, Gums and Mucilage versatile excipients for Pharmaceutical formulations. Asian Journal of Pharmaceutical Sciences. 2009; 4 (5): 308-322.
6. Rohit Rajendra Bhosale, Riyaz Ali M. Osmani, Afrasim Moin, Natural Gums and Mucilages: a review on multifaceted Excipients In Pharmaceutical Science and research, International Journal of Pharmacognosy and Phytochemical Research 2014, 901-912.
7. Farzana Hussain, Mehdi Hojjati, Polymer-Matrix Nanocomposites, Processing, Manufacturing, and application: an overvie, Journal of Composite Materials, 2006, 1531-1534.
8. Ofoefule Si And Chukwu, Application of Abelmoschus Esculents Gum as a Mini-Matrix for furosemide and Diclofenac Sodium Tablets, Indian Journal of Pharmaceutical Science 2001, 532-535.
9. Rishab hamalviya, Pranati1 Srivastava and T. Kulkarni, Modified Gum with their applications in Sustained drug delivery system ,Advances in Biological Research, 2011,01-07.

10. Kiran Sharma, Vijender Singh, Alka Arora,Natural biodegradable Polymers as Matrices in Transdermal drug delivery" Asian Journal of Pharmaceutical science 2013,201-206.
11. Ajay Aravamudhan, Daisy M. Ramos, Ahmed A. Nada, Sangamesh G. Kumbar, Natural Polymers: Polysaccharides and their Derivatives for Biomedical Applications, Eur J Pharma, 2014, 67-79.
12. Lakshmi S. Naira, Cato T. Laurencina,Biodegradable Polymers As Biomaterials, Department of ortho paedic Surgery, The University of Virginia, 2010 ,1201-1210
13. P.F.H. Harmsen, W.J.J. Huijgen L.M. Bermúdez López R.R.C. Bakker1, Literature Review of Physical and chemical Pretreatment Processes For Lignocellulosic Biomass, Food & Biobased Research, September 2010.10-13.
14. Priyanka Tiwari, Preeti Panthari, Deepshikha P Katare, Harsha Kharkwal, Natural Polymers In Drug Delivery, -World journal of pharmaceutical science, 2013 1395-1409
15. Amelia M. Avachat, Rakesh R. Dash And Shilpa N. Shrotriya, Recent investigation of Plant based Natural Gum And Mucilage innuvel drug delivery system, Indian Journal of Pharmaceutical education and, 2011 86-99.

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