International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 4 Apr. 2021, pp: 460-472 www.ijaem.net ISSN: 2395-5252

A Review on: Natural Gums and Mucilages: Used as Excipients and Pharmaceutical Sciences

Snehal Munot[*1], Bhagyashree Padwal[*2], Pratima Shinde[*3]
[*1]*Department of Pharmaceutics,Siddhant College of Pharmacy,Sudumbare,Pune,Maharashtra,India*
[*2]*Department of Pharmaceutics,Siddhant College of Pharmacy,Sudumbare,Pune,Maharashtra,India*
[*3]*Assistant Professor,Department/HOD of Pharmaceutics,Siddhant College of Pharmacy,Sudumbare,Pune,Maharashtra,India.*

Submitted: 15-04-2021 Revised: 28-04-2021 Accepted: 30-04-2021

ABSTRACT: In recent years there have been important developments in different dosage forms for existing and newly designed drugs and natural products and semi-synthetic as well as synthetic excipients often need to be used for a variety of purposes.Gums and mucilages are widely used natural materials for conventional and novel dosage forms. The use of natural gum excipients to deliver the bioactive agent is beneficial than synthetic gums. Gums functions as thickner, stabilizer, suspending agent, gelling agent, film former, aeration agent, flocculants, texturing and structuring agent, suspending agents, emulsifiers, binders and disintegrants in tablets.Both the synthetic and natural polymers have been investigated extensively for this purpose, but use of natural polymers for pharmaceutical applications is attractive because they are economical,chemically inert, readily available, non-toxic and capable of chemical modifications, potentially biodegradable and biocompatible also.Gums and mucilages can be modified in different ways to obtain tailor-made materials for drug delivery systems and thus can compete with available synthetic excipients.In this review, we describe the developments in natural gum used as excipients in various formulation and mucilages for use in the pharmaceutical sciences.

Keywords: Natural gums and Mucilages, Polymers, Excipients, Modification, Synthetic, Standardization.

I. INTRODUCTION

Gums are considerd to be pathological products formed following injury to the plant or owing to unfavorable conditions, such as drought , by a breakdown of cell walls(extra cellular formation: gummosis) while, Mucilages are generally normal products of metabolism, formed within cell(intracellular formation) or produced by without injury to the plant.

Today many gums are used in a wide varities of products and processes.Gums functions as thickner,stabilizer,suspending agent,gelling agent,film former,aeration agent, flocculants, texturing and structuring agent.Gums are primarily used to thicken or gel water and classified into two groups 1)Thickner 2)Gelling agent. Typical thickner include starch, gellan gum, locust bean gum, xanthan gum, gum Arabica,carboxymethyl cellulose,alginates,methyl cellulose,gum karaya and gum tragacanth.The major gelling agents are gelatin,starch,alginates functions as both thickners and gelling agent.However advantages offered by non-toxic, less expensive and freely available.They have major role in pharmaceutical formulation.

Gums readily dissolve in water,whereas,Mucilage form slimy masses.Gums are pathological products whereas mucilages are physiological products. They have certain similarities-both are plant hydrocolloids. They are also translucent amorphous substances and polymers of a monosaccharide or mixed monosaccharide's and many of them combined with uronic acids. Gums and mucilages have similar constituents and on hydrolysis yield a mixture to form viscous solutions and gels. Gums and mucilages contain hydrophilic molecules,which can combine with water to form viscous solutions or gels.

Advantages of natural gums and mucilages in pharmaceutical sciences:

The following are a number of the advantages of natural plant-based materials.

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

Biocompatible and non-toxic- Chemically,all of these plant materials are carbohydrates composed to repeating sugar units.Hence,they are non-toxic.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 4 Apr. 2021, pp: 460-472 www.ijaem.net ISSN: 2395-5252

Low cost-It is always cheaper to use natural source.The production cost is also much lower compared with that for synthetic material.

Environment-friendly processing-Gums and mucilages 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 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 source—Most gums and mucilages are obtained from edible sources.

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 that external environment and, so there is a chance of microbial contamination. However, this can be prevented by proper handing 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 environment and seasonal factors.

Uncontrolled rate of hydration – Due to difference in the collection of natural materials at different times, as well as difference 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, it has been found that after storage there is reduced in viscosity.

Disadvantages of synthetic polymers in pharmaceutical sciences:

The synthetic polymers have certain disadvantages such as high cost, toxicity, environment pollution during synthesis, non-renewable sources, side effect, and poor patient compliance. Acute and chronic adverse methacrylate and poly-(methy methacrylate) (PMMA).

Reports of adverse reactions to povidone primarily concern the formation of subcutaneous granulomas at the injection site produced by povidone. There is also evidence that povidone may accumulate in organs following intramuscular injections.

Acute oral toxicity studies in animals have indicated that carbomer-934P has a low oral toxicity at a does up of to 8 g/kg. Carbomer dust is irritating to the eyes, mucous membranes and respiratory tract. So gloves, eye protection and dust respirator are recommended during handling.

Studies in rats have shown that 5% polyvinyl alcohol aqueous solution injected subcutaneously can cause anemia and can infiltrate various organs and tissues.

Some disadvantages of biodegradable polymers used in tissue engineering applications are their poor biocompatibility, release of acidic degradation products, poor processing ability and rapid loss of mechanicals properties during degradation. It has been shown that poly glycosides, polyactides and their co-polymers have an acceptable biocompatibility but exhibit systemic or local reactions due to acidic degradation products. An initial mild inflammatory response has been reported when using poly-(propylene fumigate) in rat implant studies.

Objective:

To review application of natural gums and mucilages and their comparison with synthetic polymers.

Comparison of natural gums and mucilages with synthetic products.

Compatibility:

Some drugs show incompatibilities with many of the current range of excipients.For example,atenolol PVP, atenolol-mg-sterate. One of the common drug-excipient incompatibilities is the reaction between aldehyde sugars,such as lactose and primary and secondary amines,leading to the formation of Schiff bases.

These complex series of reactions lead to browning and discoloration of the dosage form.Despite being a carrier of choice for dry powder aerosol formulations,lactose may need to be replaced withdifferent carrier,such as mannitol or sucrose,when formulating primary and secondary amines.Mg-stearate is incompatible with aspirin,some vitamins and most Alkaloidal salts.There is a need for excipients that will allow faster manufacturing of formulations.Some future developments may require new delivery systems.For example,new drug delivery systems for oral administration of biotechnology products need new excipients which will avoid the inconvenience of multiple daily injections.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 4 Apr. 2021, pp: 460-472 www.ijaem.net ISSN: 2395-5252

Progress in the development of peptides as therapeutic drugs has been impeded in part by their rapid excretion,resulting in short circulating lifetimes.This has generated considerable interest in improving the duration of action of drugs through conjugation with the water-soluble,bio-compatible excipients,poly(ethylene glycol).Such conjugates have reduced enzymatic degradation rates and lengthened circulating lifetimes compared with the native compounds.

There are six FDA-approved PEGylated products on the market,vouching for the safety and commercial viability of this technology. Other novel lipophilic carbohydrate excipients,termed oligosaccharide ester derivatives,have been used to formulate drug molecules with modified release characterstics and improved bioavailability.In others areas, selected carbohydrate excipients,such as trehalose and sucrose to stabilize molecules in dry state, preventing their physical and chemical degradation and ambient temperature.

These patent-protected drug delivery technologies are suited to the delivery of macromolecules,such as proteins and peptides by the pulmonary,oral and injectable routes.

Cost:

The production cost is also much lower as compared with that for synthetic material so it is always cheaper to use natural sources.

Availability:

In many countries,govt.promote the production of plant like guar gum and tragacanth because wide application in variety of industries.

Natural gums and mucilages:

Definition:

Mucilage:It is a glutinous substance which mainly consist of polysaccharides,proteins and uranides.In other words,Mucilages are generally normal products of metabolism,formed within the cell(intracellular formation) or produced without injury to the plant.

Gums: These are considered to be pathological products formed following injury to the plant or owing to unfavorable conditions, such as drought , by a breakdown of cell walls(extra cellular formation: gummosis).Also.dried up mucilages or the concentrated mucilages is called as Gum.

General Information:

The main difference between them is that mucilage do not dissolve in water whereas gum dissolves in water.Mucilage is formed in the normal growth of plant by mucilage secreting glands. Mucilage and gum are well known since ancient times for their medicinal use.They are widely used in pharmaceutical industries as thickners,water retention agents,suspending agents and disintegrants.

Mucilage in plants is thought to aid in water storage and seed germination and to act as a membrane thickner and food reserve.Among the richest are cacti(succulents) and flax seeds.

Mucilage has a unique purpose in some carnivours plants.The plant genera Drosera Pinguicula and others have leaves studded with mucilage-secreting glands and use a “flypaper trap” to capture insects.

Classification:

Gums and mucilages are present in high quantities in a varities of plants,animals ,seaweeds,fungi and other microbial sources,where they perform a number of structural and metabolic functions;plant sources provide the largest amounts.The different available gums and mucilages can be classified as follows.

1.According to the charge:

Non-ionic seed gums:guar,locust bean, tamarind, xanthan,amylase,arabinans,cellulose,galactomannans.

Anionic gums:araabic,karaya,tragacanth,gellan,agar,algin,carrageenans,pectic acid.

2.According to the source:

Marine origin/algal(seaweed) gums:agar,carrageenans,alginic acid,laminarin.

Plant origin:

1) shrubs/tree exudates-gum Arabica,gum ghati, gum karaya, gum tragacanth,khaya and albizia gums;

2) seed gums-guar gum,locust bean gum,starch,amylase,cellulose;

3) extracts-pectin,larch gum;

4) tuber and roots-potato starch.

Animal origin: chitin and chitosan,chondroitin sulfate,hyaluronic acid.

Microbial origin(bacterial and fungal): xanthan, dextran, curdian, pullulan, zanflo, emulsan, Baker’syeas glycan, schizophyllan, lentian,krestin, scleroglucan.

3.Semi-synthetic:

Starch derivatives-hetastarch,starch acetate,starch phosphates.

Cellulose derivatives: carboxy methyl cellulose (CMC), hydroxyethylcellulose, hydroxypropyl methylcellulose (HPMC), methylcellulose (MC), microcrystalline cellulose (MCC).

4.According to shape:

Linear:aligns,amylase,cellulose,pectins.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 4 Apr. 2021, pp: 460-472 www.ijaem.net ISSN: 2395-5252

Branched:
1) short branches-xanthan,xylan,galactomanan.
2)branch-on-branch-amylopectin,gumarabic,tragacanth.
5.According to manomeric units in chemical structure:
Homoglycans-amylose,arabinanas,cellulose.
Diheteroglycans-algins,carragennans,galactomannans.

Overview of Pharmaceutical Excipients:

The international pharmaceutical excipients council defines an excipients as any substance other than the active drug or prodrug that is included in the manufacturing process or in finished pharmaceutical dosage form.Todays commercially available excipients provide a gamut of required functions,from processing aids that increase lubricity,enhance flowability and improve compressibility and compatibility to agents that impart a specific functional property to the final product.

The US Pharmacopeia-National Formulary(USP-NF) categorizes excipients as binders, disintegrants, diluents, lubricants, glidants, emulsifying-solubilizing agents, sweetening agents,coating agents,antimicrobial preservatives and so forth.In addition to their functional performance, ideally, excipients should be stable,non reactive with drug and other excipients,inert in human body,have low equipment and process sensitivity,have pleasing organoleptic properties and be well characterized and well accepted by the industry and regulatory agencies.A limited choice of excipients with all of these attributes and presently available in the market can make formulation design and excipients selection challenging.

Classification of excipients on the basis of their function they perform:

Sr.No.	Types	Example
1.	Acidulents	Tamarind,Lemon juice
2.	Adsorbents	Bentonite,Kaolin
3.	Anti-oxidants	Citric acid,Tocopherol,Lecithin, Vitamin-c
4.	Anti-adherants	Talc,Corn-starch,Magnesium stearate
5.	Anti-bacterials	Benzoin,Neem,Curcuma,Myrrh
6.	Astringents	Catechu,Tannic acid,Bahera
7.	Binding agents	Acacia,Gelatin,Tragacanth
8.	Buffers	Potassium phosphate,Sodium acetate
9.	Colurants	Chlorophyll,Caramel,Amaranth
10.	Dessicants	Silica,Fused calcium chloride
11.	Diluents	Lactose,Starch,Mannitol,Sucrose
12.	Disintegrating agents	Starch,Psyllium husk,CMC
13.	Emollients	Glycerin,Glycol,Olive oil
14.	Emulsifying agent	Acacia,Guar gum,Methyl cellulose
15.	Filter aids	Talc,Bentonite,Kieselguhr
16.	Flavours	Cardamom,Vanilla,Lemon oil,Orange oil
17.	Glidants	Corn starch,Talc
18.	Granulating agents	Acacia,Guar gum
19.	Hardening agents	Beeswax,Hard paraffin
20.	Humectants	Glycerin,Polyethylene glycol
21.	Lubricants	Cocoa butter,Stearic acid
22.	Ointment bases	Lanolin,Beeswax,Petroleum jelly
23.	Solvents	Glycerin,Mineral oil,Peanut oil
24.	Suspending agents	Alginic acid,Gelatin,Guar gum
25.	Suppository bases	Cocoa butter,Glycero gelatin
26.	Sweetening agent	Glycyrrhiza,Honey
27.	Tonicity agent	Dextrose,Sodium chloride

Isolation and Purification of gums/mucilages:

Plant material is dried in sunlight or in an oven at 105℃ to retain its properties unchanged.

Generally,chlorophyll or pigments are present in the plant which should be removed before isolating the mucilage.Plant material must

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 4 Apr. 2021, pp: 460-472 www.ijaem.net ISSN: 2395-5252

be treated with petroleum ether and chloroform and then with distilled water.Care should be taken when drying the final isolated/extracts mucilage.It must be dried at a very low temperature(not more than 50℃) or in a vaccum. The dried material is stored carefully in desiccators to prevent further moisture uptake or degradation.

The general isolation and purification processes for gums and mucilages .Bavejae al., and Wahiet al., reported the following method for the isolation of mucilage.The fresh plant materials were collected washed with water to remove dirt and debris and dried.Then,the powdered material was soaked in water for 5-6 hrs,boiled for 30 min and allows standing 1hr so that all the mucilage was released into the water.The material was then squeezed from an eight muslin bag to remove the marc from solution.Following this three volumes of acetone was added to the filtrate to precipitate the mucilage.

The mucilage was separated,dried in an oven at a temperature less than 50℃, and the dried powder was passed through a No.80 sieve and stored in a dessicator until required.The isolated mucilage from the plant was subjected to some preliminary confirmative testing.Extraction is one of the most crucial procedures to achieve complete recovery of target compounds from plants.

Recently,microwave energy has started to be used for the extraction of phytoconstituents from plants. It is a simple,fast,clean,eco-friendly and efficient method and saves energy,fuel and electricity.Microwave extraction follows the same principle as maceration or percolation,but the speed of breaking up of the plant cells anddd tissues is much higher.Microwave assisted extraction methods require a shorter time and less solvent and provide a higher extraction rate and better products at a lower cost.Plant material is powdered in a mechanical blender for 5m and then soaked in distilled water for 24 hrs in a 1000ml beaker.

It is kept in a microwave oven along with a glass tube to prevent bumping when subjected to microwave irradiation.The beaker is removed from the oven and allowed to stand for 2hrs to allow the mucilage to be released into the water.It is then processed in a similar way to the conventional procedure,weighed and stored.

General isolation/extraction procedure for mucilages:

Selection of part of plant for isolating gum/mucilage

Steps for plant identification,characters and chemical tests are taken

Take plant part in which gum/mucilage are present for drying,gining and sieving

Dried gum/mucilage is stirred in distilled water and heated initially for complete dispersion in distilled water and keep for 6-8hr at room temperature.

The supernant is obtained by centrifugation. The residue is washed with water and the washings are added to the separated supernant.The procedure is repeated four times.

Selection of solvents for moistening and precipitation.

Finally,the supernant is mixed with twice the volume of acetone by continous stirring.

Selection of part of plant for isolating gum/mucilage.The precipitated material is washed with distilled water and dried at 50-60℃ under vaccum.

Characterization/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 mucilage is initially achieved by only a multiple-technique approach.For excipients analysis,analytical techniques can be classified according to the type of information generated.

Structural-Gums and mucilages 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-

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

Impurity profile-

Testing for impurities must be carried out using suitable analytical techniques.

Physico-chemical properties-

Color,odour,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.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 4 Apr. 2021, pp: 460-472 www.ijaem.net ISSN: 2395-5252

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 guinepigs of both sexes.
Once analysis is complete,determination of the structure,composition and impurity profile enables a scientific dossier to be prepared describing the excipients.This information is of value for the regulatory dossier of the final pharmaceutical product that would contain the given excipients.
Finally,gums and mucilages are added to pharmaceutical formulations.so a compatibility study is important .The compatibility studies of gum/mucilage/drugs are performed using spectro photometry/FTIR/DSC.

Preliminary ConfirmativeTests for dried mucilage powder:

Test	Observation	Inferences
Molisch's test:100gm dried mucilage powder+molisch's reagent+conc.H2SO4 on the sides of test tube.	Violet green color observed at the junction of two layers	Carbohydrate present
Ruthenium test: take a small quantity of dried mucilage powder,mount it on a slide with ruthenium red solution and observe it under a microscope.	Pink colour develops	Mucilage present
Iodine test: 100 mg dried mucilage powder+1ml 0.2 N iodine solution.	No colour observed in solution	Polysacchrides present(starch is absent)
Enzyme test: dissolve 100mg dried mucilage powder in 20ml distilled water; add 0.5 ml of benzidine in alcohol(90%) shake and allow to stand for few minutes.	No blue color produced	Enzyme absent

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 applicability in various areas of drug formulation.

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 and gamma radiation.

Chemical method-polymers are treated with chemicals like Aldehydes, epichlorhydrin, borax or glutaraldehyde.Temperture is one of the most favourble 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.

Applications:

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 use as pharmaceutical adjuvants.Mucilages of different origins are also used in conventional dosage form of various drugs for their binding,thickening,stabilizing and humidifying properties in medicine.

Newer uses of different gums and mucilage's in cosmetics and textiles has increased the demand and screening of gums has become an important pharmaceutical area.However,different

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 4 Apr. 2021, pp: 460-472 www.ijaem.net ISSN: 2395-5252

gums and mucilages used as pharmaceutical adjuvaants have astringent applications,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 for ice-crem,meat products and instant pudding(carageenans),dairy,confectionary and meat products(agar),beverages,baked product and sauces(gum arabic tragacanth,pectins,alginates and xanthan gum)

Pharmaceuticals 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 used for protein delivery.

Industrial uses-

Gums used in cosmetics(acacia,tragacanth and karaya gum),textiles(starch,dextrin,cellulose,pectins and tamarind gum),adhesives(acacia gum and tragacanth),lithography(gum Arabic,tragacanth and locust bean gum),paints(pectins,hemicelluloses and resins) and paper manufacturer(tamarind and cellulose).

Applications of Gums and Mucilages in NDDS

S.N.	Common Name	Botanical Name	Family	Pharmaceutical Application
1.	Acacia	Acaciasenegal	Leguminosae	Osmotic drug delivery
2.	Bhara gum	Terminaliabellericaroxb	Combretaceae	Microencapsulation
3.	Cordia gum	Cordiaobliqua willed	Boranginaecae	Novel oral sustained release matrix forming agent in tablets
4.	Cactus mucilage	Opuntiaficus-indica	-	Gelling agent in sustained drug delivery
5.	Guar gum	Cyamompsis tetraganolobus	Leguminoseae	Colon targeted drug delivery
6.	Gellan gum	Pseudomonas elodea	-	Ophthalmic drug delivery,sustained agent.
7.	Pectin	Citrus aurantium	Rutaceae	Beads,floating beads,transdermal delivery,Iontophoresis
8.	Tamarind	Tamarindusindica	Leguminosae	Hydrogels,ocular purposes,spheroids, nasal drug delivery.
9.	Ispagol	Plantagoovata	Plantaginaceae	Colon drug delivery,hydrogels,gastrorentive drug delivery.
10.	Karaya gum	Sterculiaurens	Sterculiaceae	Mucoadhesive and buccoadhesive
11.	Okra	Hibiscus esculentus	Malvaceae	Hydrophilic matrix for controlled release drug delivery
12.	Sodium alginate	Macrocytispyrifera	Lessoniaceae	Bioadhesive,microspheres ,nanoparticles.
13.	Hakea	Hakeagibbosa	Leguminosae	Sustained release and peptide mucoadhesive for buccal delivery
14.	Locust bean gum	Cerataniasiliqua	Leguminosae	Controlled release agent
15.	Mucuna gum	Mucunaflagillepes	Papillionaceae	Microspheres

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 4 Apr. 2021, pp: 460-472 www.ijaem.net ISSN: 2395-5252

II. LITERATURE REVIEW:

1.Shah V.,Patel R.,"Studies on mucilages from Hibiscus Rosa Sinesis Linn as oral disintegrant" International Journal of Applied Pharmaceutics 2(1) 2010.

S.N.	SOURCE PLANT	ISOLATION METHOD	USE
1.	Hibiscus Rosa-Sinesis	Fresh leaves collected,washed with water,dried powdered and soaked in water for 5-6hr,boiled for 30min and kept aside for 1hr,then it was squeezed from an 8 fold muslin cloth,acetone was added to ppt the mucilage,separated,dried in an oven at a temp<50c collected,dried powdered,passed through sieve (no.80),stored.	Superdisintegrant

S.N.	Physicochemical Parameter	Results
1.	Percentage Yield	17%
2.	Average particle size	165um
3.	Loss on drying	10%
4.	Bulk density	0.65 g/cc
5.	Swelling ratio	9
6.	Angle of repose	26.5℃
7.	Compressibility index	16%

Evaluation of toxicity:

To determine the safety level of the extracted mucilage, acute as well as chronic toxicity studies were carried out.In both the studies no manifestation of the toxic syndromes were observed.To assess the suitability of gum for the oral delivery the body weight profile of the animals were recorded at regular interval of 10days for chronic studies.It was found that weight of test and control and the rate of increase in weight of test and control were comparable.Hence it can be inferred that chronic administration of mucilage might not influence either the food intake or growth.

Hematological parameters that were determined at the end of 30days continuous administration of mucilage were also comparable to that of control group.The effective concentration of the disintegrant in the conventional dosage form does not normally exceed beyond 10% of the formulation,which is approximately 15-20mg/kg of the dose.Hence it can be concluded that the mucilage is not likely to exert any toxic effect on the body.

Hematological parameters	Mucilage treated group1	Control group1
Bleeding time in minutes	4.25+0.12	4.19+0.07
Clotting time in minutes	38.17+0.22	37.37+0.15
Total count of RBC/mm3	9.55×106+0.19	9.28×106+0.25
Total count of WBC/mm3	4125+0.20	4130+0.27
Hemoglobin Content	14.0+0.07	14.3+0.03

2.Patel G,Patel M."Preliminary Evaluation of Sesbania Seed-Gum mucilage as gelling agent" International Journal of Pharm-Tech Research CODEN(USA):IJPRIF 1(3)

2.	Sesbania seed gum	Sample is collected and modified,SG was suspended in 9;1 acetone:chloroform mixture for 6hrs with intermittent stirring and supernant which contains extraneous impurities(organic solvent soluble impurities) was removed,the precipitated gum was filtered,washed two times with organic mixture and dried in a hot air oven at 45℃.the dried powder was passed through a 150# sieve and used for further investigation.	As a Gelling Agent

Evaluation Parameters:
1.Drug content studies
2.Measurements of Ph
3.Rheological studies
4.Extrudability3
3.Shah B.N, Seth A.K. and Nayak B.S."Microwave Assisted Isolation of Mucilage from the

Trichosanthes Dioica fruit" IJPSR 2010 1(5)

3.	Trichosanthes dioica	Trichosanthesdioica fruit(5 g) were powdered for 5 min in a mechanical blender and soaked in distilled water (150ml) for 24 hr in a RB flask.It was boiled for 1hr under reflux with occasional stirring and kept aside for 2 hr for the release of mucilage into water.The material was filtered through a muslin bag and hot distilled water(25ml) was added through the sides of the marc and squeezed well in order to remove the mucilage completely.Equal volume of ethanol was added to the filtrate to precipitate the mucilage and kept inside a refrigerator for one day for effective settling. It was filtered and dried completely in an incubator at 37℃, Powdered and weighed. It was subjected to chemical tests to confirm its identity.	Binding,thickening,emulsifying,suspending and stabilizing agents.

4.Deveswaran R., Futardo S., Bharth., Abraham S., Basvraj.,B.v.,Madhavan V."Evaluation of Disintegrant properties of plantago ovate mucilage in comparison with other superdisintegrants"Arch Pharma Sci & Res Jan 2010 2(1)

4.	PlantagoOvata	The dried seeds of isapghula were soaked in distilled water for 48hrs and then boiled for 10min.The resulting mass was squeezed through muslin cloth.To the filtrate an equal volume of acetone was added to precipitate the mucilage.The isolated mucilage was dried in an oven at 400℃ for 2hrs,powdered,passed through sieve No.80 and stored in a dessicator.	Superdisintegrant

Evaluation Parameters:
1.Friability
2.Wetting time
3.In-vitro disintegration time
4.Dissolution studies**Acknowledgement:**
The authors are very much thankful to Dr.Pratima Shinde, Assistant Professor,HOD, Department of Pharmaceutics,Siddhant College of Pharmacy,Sudumbare,Pune for her Support, guidance and encouragement.

III. CONCLUSION:

In recent years, there have been important developments in different dosage forms for existing and newly designed drugs and natural products and semi-synthetic as well as synthetic excipients often need to be used for a variety of purposes. Although natural excipients have traditionally been included in formulations as inert substances to mainly make up volume and assist in the manufacturing process, they are increasingly included in dosage forms to fulfill specialized functions for improved drug delivery because many new drugs have unfavorable physicochemical and pharmacokinetic properties. Gums and mucilage's are widely used natural materials for conventional and novel dosage forms. These natural materials have advantages over synthetic ones since they are chemically inert, non-toxic, less expensive, biodegradable and widely available. Several polymers from plant origin have been successfully used and others are being investigated as excipients in the design of dosage forms for effective drug delivery. They can also be modified in different ways to obtain tailor-made materials for drug delivery systems and thus can compete with the available excipients. In this review, we describe the developments in natural gums used as pharmaceutical excipients and mucilage's for use in the pharmaceutical sciences.

REFERENCES:

[1]. Guo J, Skinner GW and Harcum WW: Pharmaceutical application of naturally occurring water soluble polymers. Pharmaceutical Science and Technology Today 1998; 1: 254-261.
[2]. The joint IPEC-PQG good manufacturing practice guide for pharmaceutical excipients, Europe, 2006
[3]. Tommasina C and Matricardi P: Polysaccharide hydrogels for modified release formulations. Journal of Controlled Release 2007; 119: 5-24.
[4]. Hamman JH and Tarirai C: Functional excipients. Chem Today 2006; 24: 57-62.
[5]. Shirwaikar A and Prabhu SL: Herbal excipients in novel drug delivery systems. Indian Journal of Pharmaceutical Science 2008; 70: 415-422.
[6]. Beneke CE, Viljoen AM and Hamman JH: Polymeric plant derived excipients in drug delivery. Molecules 2009; 14: 2602-2620.
[7]. Stephen AM and Churms SC: Food polysaccharides and their applications. Taylor and Francies, CRC Press, New York, Edited by Stephen AM, Phillips GO and Williams PA, 2006: 1-24.
[8]. Koleng JJ, McGinity JW and Wiber WR: Handbook of pharmaceutical excipients. Pharmaceutical Press, Edition 6, Edited by Raymond C Rowe, Paul J Sheskey and Marian E Quinn, 2009: 1-3.
[9]. Kokate CK, Purohit AP and Gokhale SB: A Textbook of Pharmacognosy. Nirali Prakashan, Pune, Edition 22, 2003: 136-139.
[10]. Kottke KM: Modern Pharmaceutics. Marcel Dekker, New York, 2002: 287-333.
[11]. Richardson PH, Willmer J and Foster TJ: Dilute solution properties of guar and locust bean gum in sucrose solutions. Food Hydrocolloid 1998; 12: 339-348.
[12]. Evans WC, Trease and Evans: Pharmacognosy. Harcourt Brace & Co., Asia Pvt. Ltd, Singapore, Edition 14, 1996: 196-208, 213-215.
[13]. Edward MR: Modern Pharmaceutics. Marcel Dekker, New York, 2002: 287-298.
[14]. Aslam A and Parrott E: Effect of aging on some physical properties of hydrochlorthiazide tablets of Pharmaceutical Science 1971; 60: 263-266.

[15]. Kokate CK, Purohit AP and Gokhale SB: A Textbook of Pharmacognosy. Nirali Prakashan, Pune, Edition 21, 2003: 147-154, 157.
[16]. Rangari VD: Pharmacognosy and Phytochemistry. Career Publication, Nashik, India, 2006: 400-444.
[17]. Kulkarni GT: Microwave assisted fast extraction of mucilages and pectins. Indian Journal of Pharmaceutical Education and Research 2009; 43: 260-265.
[18]. Mohammed A: Text Book of Pharmacognosy. CBS Publishers and Distributors, New Delhi, India, Edition 3, 2005: 23-30.
[19]. Ansari SH: Essential of Pharmacognosy. Birla Publications Pvt. Ltd., New Delhi, India, 2006: 63-90.
[20]. Venkata RE: Chemical and biological aspects of selected polysaccharides. Indian Journal of Pharmaceutical Science 1992; 54: 90-97.
[21]. Stephen AM and Churms SC: Food Polysaccharides and Their Application. Taylor and Francies, CRC Press, New York, Edited by Stephen AM, Phillips GO and Williams PA, 2006: 1-24.
[22]. Baveja SK, Ranga Rao KV and Arora J: Examination of natural gums and mucilages as sustaining materials in tablet dosage forms. Indian Journal of Pharmaceutical Science 1988; 50: 89-92.
[23]. Wahi SP, Sharma VD and Jain VK: Studies on suspending property of mucilage of Hygrophila spinosa and Hibiscus esculents Linn. Indian Drug 1985; 22: 500-502.
[24]. Geetha B and Shivalinge Gowda KP: Microwave assisted fast extraction of mucilages and pectins. Indian Journal of Pharmaceutical Education and Research 2009; 43: 260-265.
[25]. www.dowcorning.com
[26]. Raymond CR, Paul JS and Marian EQ: Handbook of pharmaceutical excipients. Pharmaceutical Press, Edition 6, 2009: 298.
[27]. Marini A, Berbenni V and Pegoretti M: Drug excipient compatibility studies by physicochemical techniques: The case of Atenolol. Journal of Thermal Analysis and Calorimetry 2003; 73: 547-561.
[28]. Allen LV and Luner PE: Handbook of pharmaceutical excipients. Pharmaceutical Press, Edited by Raymond CR, Paul JS and Marian EQ, Edition 6, 2009: 685.
[29]. Collet J and Moreton C: Pharmaceutics: The Science of Dosage Form Design. Churchill Livingstone, U. K., 2002: 289-305.
[30]. Vatanasuchart N, Naivikul O, and Charoenrein S: Molecular properties of cassava starch modified with different UV irradiatons to enhance baking expansion. Carbohydrate Polymers 2005; 61: 80-87.
[31]. Khan MA, Bhattacharia SK and Kader MA: Preparation and characterization of ultra violet (UV) radiaton cured bio-degradable films of sago starch/PVA blend. Carbohydrate Polymers 2006; 63: 500-506.
[32]. Desai KG and Park HJ: Study of gammairradiation: effects on chitosan micropartcles. Drug Delivery 2006; 13: 39-50.
[33]. Micard V, Belamri R, Morel M and Guilbert S: Properties of chemically and physically treated heat gluten films. Journal of Agricultural Food Chemistry 2000; 48: 2948-2953.
[34]. Ofoefule SI and Chukwu A: Application of Abelmoschus esculents gum as a mini-matrix for furosemide and diclofenac sodium tablets. Indian Journal of Pharmaceutical Science 2001; 63: 532-535.
[35]. John GL, Declan MD and James EK: The use of Agar as a novel filler for monolithic matrices produced using hot melt extrusion. European Journal of Pharmaceutics and Biopharmaceutics 2006; 64: 75-81.
[36]. Oluwatoyin AO: Assessment of Albiziazygia gum as a binding agent in tablet formulations. Acta Pharmaceutica 2005; 55: 263–276
[37]. Jani GK, Shah DP and Jain VC: Evaluating mucilage from Aloe barbadensis Miller as a pharmaceutical excipient for sustained-release matrix tablets. Pharmaceutical Technology 2007; 31: 90-98.
[38]. Avachat MK and Dhamne AG: Oral controlled release drug delivery system with husk powder from Lepidium sativum seeds. Patent No. WO02100438.
[39]. Patel MM, Chauhan GM and Patel LD: Mucilage of lepidiumsativum, Linn (Asario) and ocimumcanum, sims. (Bavchi) as emulgents. Indian Journal of Hospital Pharmacy 1987; 24: 200-202.
[40]. Ahmed BJ and Al-Ghazawi M: Sustained release characteristics of tablets prepared with mixed matrix of sodium carragennan and chitosan: Effect of polymer weight

ratio, dissolution media and drug type. Drug Development and Industrial Pharmacy 2005; 31: 241-247.

[41]. Bonferoni MC, Rossi S, and Tamayo M: Employment of λ-carrageenan in a matrix system. Journal of Controlled Release 1994; 30: 175-182.

[42]. Pontes UR: Determination of HLB of Anacardium gum. Rev Farm Bioquim 1971; 2: 83-91.

[43]. Zakaria MB and Zainiah AR: Rhelological properties of cashew gum. Carbohydrate Polymers 1996; 29: 25-27.

[44]. Pawar H and D'mello PM: Isolation of seed gum from Cassia tora and preliminary studies of its applications as a binder for tablets. Indian Drugs 2004; 41: 465-468.

[45]. Gowthamrajan K, Kulkarni GT and Muthukumar: Evaluation of Fenugreek mucilage as gelling agent. International Journal of Pharmaceutical Excipient 2002; 3: 16-19.

[46]. Kulkarni GT, Gowthamarajan K and Rao BG: Evaluation of binding property of Plantago ovata & Trigonella foenum gracecum mucilage. Indian Drugs 2002; 39: 422-425.

[47]. Kale VV, Kasliwal R and Parida SK: Formulation and release characteristics of guar gum matrix tablet containing metformin HCl. International Journal of Pharmaceutical Excipient 2004; 2: 75-80.

[48]. Khullar P, Khar RK and Agrawal SR: Evaluation of guar gum in the preparation of sustained release matrix tablets. Drug Development and Industrial Pharmacy 1998; 24: 1095-1099.

[49]. Heda A and Shivhare U: Study of some natural hydrophilic polymers as matrix forming materials for sustained release tablet formulation. International Journal of Pharmaceutical Excipient 2004; 2: 69-74.

[50]. Shefter E: Handbook of pharmaceutical excipients. Pharmaceutical Press, Edited by Raymond CR, Paul JS and Marian EQ, Edition 6, 2009: 703.

[51]. Jain NK and Dixit VK: Studies on gums and their derivatives as binding agent. Indian Journal of Pharmaceutical Science 1988; 50: 113-114.

[52]. Owen SC: Handbook of pharmaceutical excipients. Pharmaceutical Press, Edited by Raymond CR, Paul JS and Marian EQ, Edition 6, 2009: 782.

[53]. Sharma VD: Studies on emulsifying property of mucilages of Hibiscus esculentus. Indian Journal of Natural Products 1985; 1: 3-6.

[54]. Wahi SP and Jain VK: Studies on suspending property of mucilages of Hygrophila spinosa and Hibiscus esculentus Linn. Indian Drugs 1985; 22: 500- 502.

[55]. Edwin J, Edwin S, and Dosi S: Application of Hibiscus leaves mucilage as suspending agent. Indian Journal of Pharmaceutical Education and Research 2007; 41: 373-375.

[56]. Jani GK and Shah DP: Evaluation of mucilage of Hibiscus rosasinensis Linn as rate controlling matrix for sustained release of diclofenac. Drug Development and Industrial Pharmacy 2008; 34: 807-816.

[57]. Prajapati ST, Prajapati VD and Acharya SR: Characterization of disintegration properties of Plantago ovata mucilage in the formulation of dispersible tablets. Indian Journal of Pharmaceutical Education and Research 2006; 40: 208-211.

[58]. Mithal BM and Kasid JL: Evaluation of the emulsifying properties of Plantago ovata (Ispaghula) seed husk. Indian Journal of Pharmaceutical Science 1964; 26: 316-319.

[59]. Mithal BM and Kasid JL: Evaluation of the suspending properties of Plantago ovate (Ispaghula) seed husk. Indian Journal of Pharmaceutical Science 1965; 27: 331-335.

[60]. Sreenivasa Rao B, Prasanna RY and Mary S: Design and studies of gum karaya matrix tablet. International Journal of Pharmaceutical Excipients 2000; 2: 239-242.

[61]. Munday DL and Philip JC: Compressed Xanthan and karaya gum matrices: hydration, erosion and drug release mechanisms. International Journal of Pharmaceutics 2000; 203: 179-192.

[62]. Odeku OA and Itiola OA: Evaluation of the effects of khaya gum on the mechanical and release properties of paracetamol tablets. Drug Development and Industrial Pharmacy 2003; 29: 311-320.

[63]. Razdan B: Evaluation of gum as suspending agent in sulphadimidine suspensions. Indian Journal of Pharmaceutical Science 2003; 65: 665-668.

[64]. Verma PRP: Evaluation of Leucaenal eucocephala seed gum in tabletting. STP Pharma Sciences 2002; 12: 109-112.

[65]. Verma PRP and Razdan B: Studies on Leucaenal eucocephala seed gum:

evaluation of suspending properties. STP Pharma Sciences 2001; 11: 289-293.

[66]. Anroop B, Bhatnagar SP and Ghosh B: Studies on Ocimum gratissimum seed mucilage: evaluation of suspending properties. Indian Journal of Pharmaceutical Science 2005; 67:206-209.

[67]. www.cpkelco.com/pectin/applications.html

[68]. http://www.ippa.info/applications_for_pectin.html

[69]. Kulkarni GT, Gowthamrajan K and Bramaji Rao G: Evaluation of binding properties of selected natural mucilages. Journal of Science and Industrial Research 2002; 61: 529-532.

[70]. Howard JR and Timmins P: Controlled release formulations. U.S. Patent No. 4792452.

[71]. Seiyaku F: Sustained-release dilazep hydrochloride tablets containing sodium alginate. Japan Patent No. 01025721.

[72]. Thierry N, George C and John F: Alginate and gellan gum as tablet coating. U.S. Patent No. 6326028 B1