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A Review of herbal excipients

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Abstract: In this review article we study different herbal excipients which are used in different herbal formulation dosage forms advantages, disadvantages and different properties And its classification based on various types and application with clearly mention in article. Though the utilization of natural excipients to deliver the bioactive agents has been hampered by the synthetic materials, but the added advantages offered by these natural excipients are their being non-toxic, less expensive and freely available. The performance of the excipients to some extent determines the quality of the medicines. The traditional concept of the excipients as any constituent other than the active substance has undergone a substantial evolution from an inert and cheap vehicle to an essential constituent of the formulation

Keywords: Herbal excipients; classification; pharmaceutical application.

Introduction:

Excipients are defined as 'the substance used as a medium for giving a medicament. The specific application of natural polysaccharide polymers in pharmaceutical formulations include to aid in the processing of the drug delivery system during its manufacture, protect, support or enhance stability, bioavailability or patient acceptability, assist in product identification, or enhance any other attribute of the overall safety, effectiveness or delivery of the drug during storage or use

Several pharmaceutical excipients of plant origin, like starch, agar, alginates, carrageen an, guar gum, xanthan gum, gelatin, pectin, acacia, tragacanth, and cellulose find applications in the pharmaceutical industry as binding agents, disintegrates, sustaining agents, protective's, colloids, thickening agents, gelling agents, bases in suppositories, stabilizers, and coating materials

Excipients are primarily used as diluents, binders, disintegrants, adhesives, glidants and sweeteners in conventional dosage forms like tablets and capsules . As the establishment of toxicity and approval from regulatory authorities poses a problem with synthetic excipients, of late more interest is being shown by researchers in herbal excipients. The drawback posed by heavy metal contamination often associated with herbal excipients is superseded by their lack of toxicity, easy availability, and economic considerations in pharmaceutical industry as compared to their synthetic counterparts. Present day consumers look for natural ingredients in food, drugs, and cosmetics as they believe that anything natural will be safer and more devoid of side effects

➢ Pharmaceutical Excipient

Pharmaceutical excipients can be defined as nonactive ingredients that are mixed with therapeutically active compounds to form medicines. The ingredient which is not an active compound is regarded as an excipients. Excipients affect the behavior and effectiveness of the drug product more and more functionality and significantly. The variability of active compounds, excipients and process are obvious components for the product variability [3]

➢ Classification Of Excipients

Excipients are commonly classified according to their application and function in the drug products:

1. Binders, Diluents
2. Lubricants, Glidants, Disintegrants
3. Polishing Film formers and coatings agents
4. Plasticizers, Colorings
5. Suspending agents Preservatives, antioxidants
6. Flavorings, Sweeteners, Taste improving agents
7. Printing inks, Dispersing agents Gums [1]

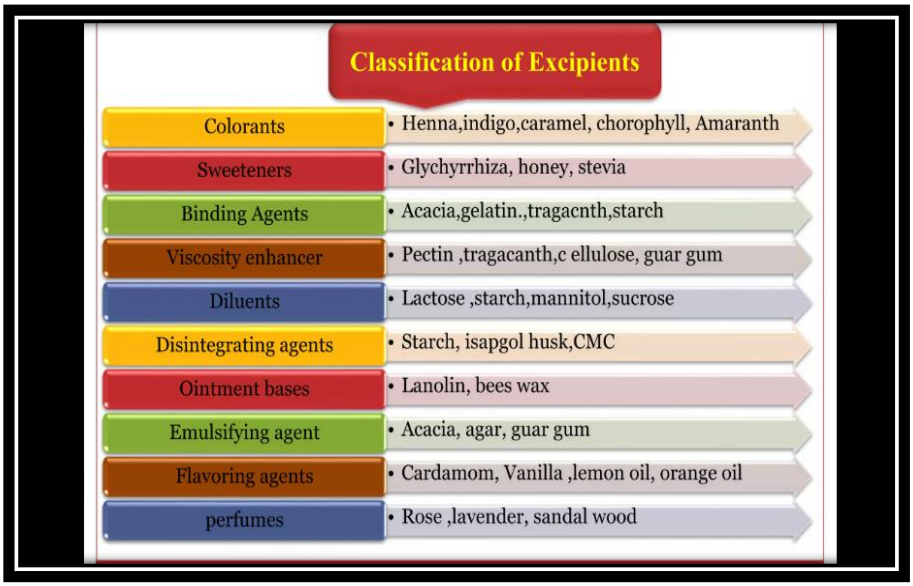


Fig 1:Classification of excipients

- **Classification based on sources of excipients**:

1. Products from animal sources: e.g. Beeswax, Cochineal, Gelatin, Honey, Spermaceti, Lanolin etc..
2. Products from vegetable sources: e.g. Kokum Butter, Pectin, Starch, Peppermint oil, Cardamon, Vanilla etc.
3. Products from mineral sources: e.g. Bentonite, Kieselghur, Kaolin, Paraffins, Talc, fullers earth etc.
4. Synthetic products: PEGs, Polysorbates, Povidone[8]

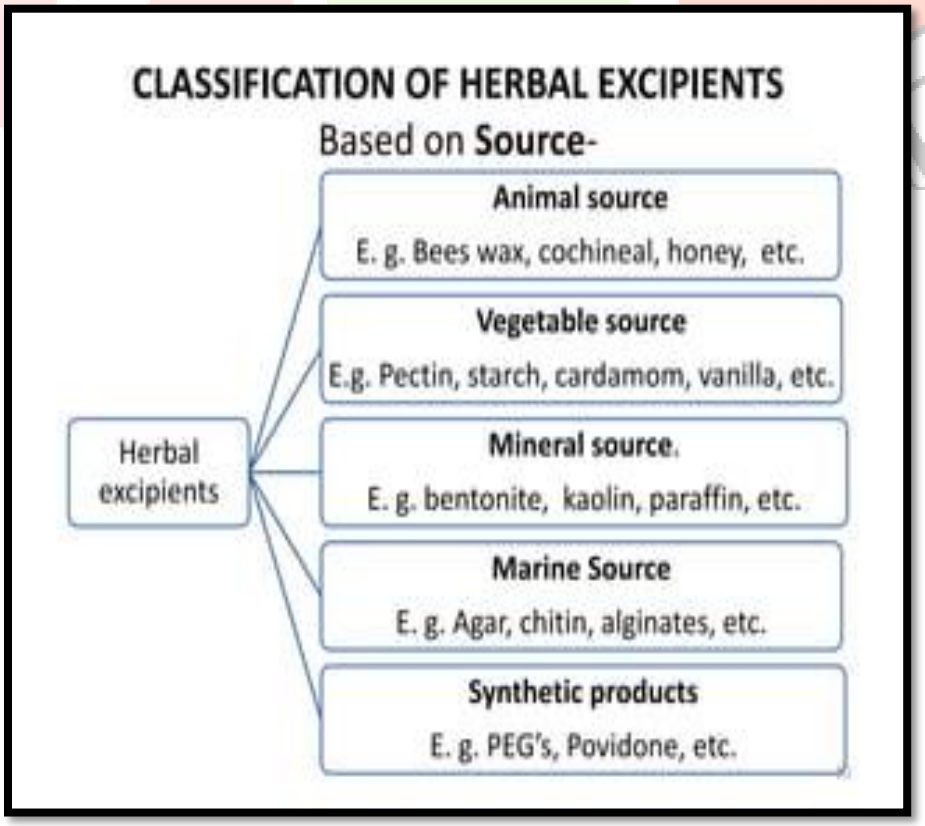


Fig 2. Classification of herbal excipients based on source

Table-1 Classification based on Chemical Nature [8]

S.No	Chemical Nature	Role	Examples
1.	Alcohols	For Patient compliance	Volatile oils, Lanolin, Polyphenolic compounds.
2.	Esters, Ethers, Aldehydes, Carboxylic acids.	For dose precision and accuracy.	Fixed oil, citric acid, vanillin.
3.	Glycerides and waxes	To enhance stability	Bees wax,lanolin.
4.	Carbohydrates	Assist in manufacturing process	Gums and Mucilages.
5.	Hydrocarbons and Halogen derivatives.	Drug tolerance	Paraffins, Polyphenolic compounds.
6.	Polymers(natural and Synthetic)	To avoid drug disaggregation	Cellulose, Pectin.
7.	Minerals	Help in drug dissolution	Bentonite, talc, calamine
8.	Protein	To prepare controlled release formulations.	Gelatin, soyabean
9.	Preservatives, dyes,sweeteners, sulfactants.	To enhance absorption, to preserve, to make bitter taste and colour.	Stevia, Honey, Henna, Cochineal, Antioxidants, Polysorbates, Emulsifying waxes.

Table 2Classification of Excipients based on Application [8]

Sr.No	Category	Examples
1.	Fillers	Plant cellulose, Gelatin, lactose, Sucrose, Glucose.
2.	Binders	Acacia, Alginic acid, Corn Starch.
3.	Disintegrating agents	Silicone, Guar gum, Agar.
4.	Coating agents	Gelatin, Shellac, Natural Polymers.
5.	Lubricants	Castor oil, Mineral oil, Paraffin oil.
6.	Antioxidants	Ascorbic acid, Potassium metabisulphite, Sodium metabisulphite, Gallic acid.
7.	Coloring agents	Annatto, Carotene, Chlorophyll, Cochineal, Curcumin.
8.	Flavoring agents	Strawberry, Raspberry, Lemon, Orange, Peppermint.
9.	Solvent	Purified water, Oils.
10.	Chelating agents	Onions, Garlic, Chlorella, Brazil nuts.
11.	Buffering agents	Lemon
12.	Surface active agents	Waxes, Saponins.

➢ Advantage Of Herbal Excipients

• Biodegradable – Naturally occurring polymers produced by all living organisms. They show no adverse effects on the environment or human being.

- Biocompatible and non-toxic – Chemically, nearly all of these plant materials are carbohydrates in nature and composed of repeating monosaccharide units. Hence they are non-toxic.
- Economic - They are cheaper and their production cost is less than synthetic material.
- Safe and devoid of side effects – They are from a natural source and hence, safe and without side effects
- Easy availability – In many countries, they are produced due to their application in many industries [3].

➢ Disadvantages Of Herbal Excipients

i. Microbial contamination – During production, they are exposed to external environment and hence, there are chances of microbial contamination

ii. Variation – Synthetic manufacturing is controlled procedure with fixed quantities of ingredients while production of natural polymers is dependent on environment and various physical factors.

iii. The 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.

iv. Slow Process – As the production rate is depends upon the environment and many other factors, it can't be changed. So natural polymers have a slow rate of production.

v. Heavy metal contamination – There are chances of Heavy metal contamination often associated with herbal excipients [3]

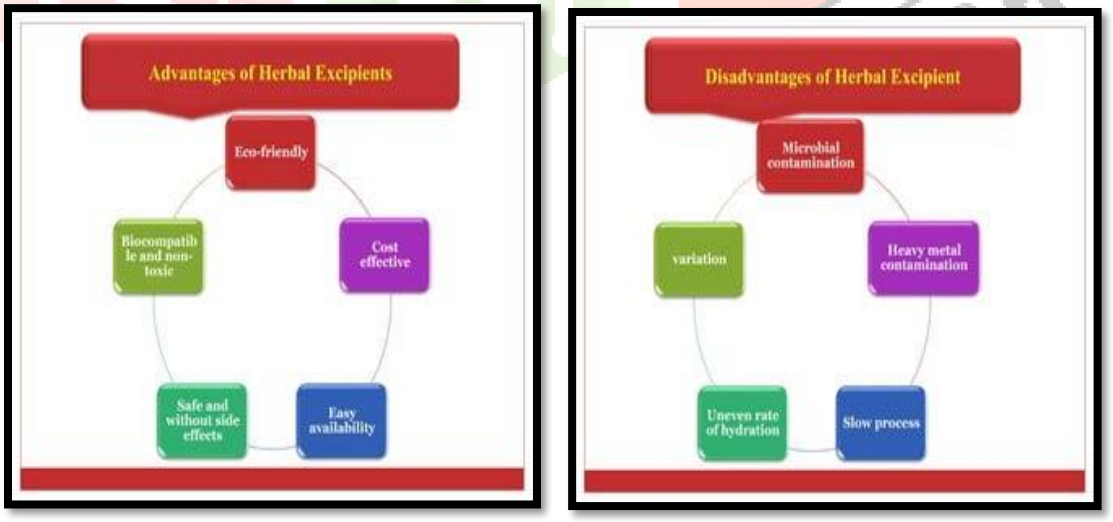


Fig 3&4 advantages and disadvantages of herbal excipients

➢ Functions of Excipients:

A. Add bulk to the formulation.

B. During manufacturing it helps to handle Active Pharmaceutical Ingredients.

C. Assist in drug administration.

D. Enhance patient compliance.

E. Enhance drug solubility and bioavailability of Active Pharmaceutical Ingredients.

F. Avoid drug degradation.

G. Give robust and reproducible result of formulation.

H. Modify the pH and osmolarity of the liquid dosage forms.

I. Prevents drug aggregation and helps in drug particles dispersion.

J. Helps to mask unpleasant taste, color and odor.\

K. Helps to maintain stability [8]

➢ Ideal Properties of Excipients:

1. They can be used practically.

2. They should be non-toxic and non-irritant in nature

3. They should be non-volatile in nature

4. They should not be affected by temperature, light and hydrolysis.

5. They should be easily available and cheap.

6. They should not have specific colour, odor, and taste

7. They should possess good water and lipid solubility.

8. They should be compatible with the active ingredient in the preparation and should not affect its function.

9. They should be pharmacologically inert [8]

Table 3: Herbal Excipients [3]

Sr.No.	Name of Excipients	Source	Category / Uses
1	Agar	Gelidium amansii (Gelidaceae)	Laxative, Suspending agent, emulsifying agent, gelling agent in suppositories, surgical lubricant, tablet disintegrates, medium for bacterial culture .
2	Gum Ghatti	Anogeissus latifolia (Combretaceae)	Binder, emulsifier, suspending agent .
3	tragakanth	Astragalus gummifer (Leguminosae)	Thickening agent, demulcent, Suspending agent, emulsifying agent, emollient in cosmetics and sustained release agent
4	Albizia gum	Albizia zygia (Leguminoseae)	Binder agent
5	Aloe mucilage	Aloe species (Liliaceae)	Gelling agent, sustained release agent
6	Bavchi mucilage	Ocimum canum (Gigarginaceae)	Suspending agent, emulsifying agent .
7	Cassia tora	Cassia tora Linn (Leguminoseae)	Binding agent
8	Gum acacia	Acacia arabica (Combretaceae)	Suspending agent, emulsifying agent, binder in tablets, demulcent and emollient in cosmetics .
9	Khaya gum	Khaya grandifolia (Labiatae)	Binding agent.
10	Satavari mucilage	Asparagus racemosus (Aapocynaceae)	Binding agent and sustaining agent in tablet
11	Tamarind seed	Tamarindus indica (Leguminoseae)	Binding agent, emulsifier,
12	Gellan gum	Pseudomonas elodea (Leguminoseae)	Disintegrating agent

1. **Natural Binders:** Excipients are additives used active pharmaceutical active ingredients convert in to pharmaceutical dosage form suitable for administration patients, Binders are added to the tablet formulation to impart plasticity as well as increases interparticle bonding strength in the tablet[8]

Table-4. List of some natural excipients used as Natural Binders [8]

S.No	Product	Examples of Use
1.	Acacia	Natural Binders for tablets, Thickener, Suspending and emulsifying agent
2.	Tragacanth	Binder and diluents in tablets
3.	Starch	Binder and diluents in tablets.
4.	Gelatin	Binder and thickener in tablets
5.	Accroides	Binder in fireworks and flares.
6.	Candelilla	Binder in chewing gum.
7.	Guar	Binder in baking, meat and tablets.
8.	Gum Arabic	Binder in baking, personal care products, incense, photography, watercolor paints, ceramic glazes and fireworks.
9.	Karaya	Binder in baking and paper manufacturing.
10.	Shellac	Binder in mascara, eyeliners, fireworks and pyrotechnics.
11.	Tragacanth	Binder in icing, tablets, incense and pastel paints.
12.	Xanthan	Binder in baking, laxatives and toothpaste.

2. Natural Diluents:

Generally, in any pharmaceutical dosage form Active Pharmaceutical Ingredients (API) shows the therapeutic effect, but API does not administered directly, they combines with excipients to get a suitable form for patient compatibility. Fillers and Diluents are those excipients which are used to enhance the bulk of any solid formulation or to dilute any liquid formulation. The major function of fillers and diluents is that, they provide a structural form and fill the size of dosage form and make them suitable for administration by enhancing the bulk volume[8]

Table 5 natural diluents [8]

Sr.No	Product	Examples of Use
1.	Cellulose	Adsorbent; suspending agent; tablet and capsule diluent; tablet disintegrant.(cellulose microcrystalline) Adsorbent; glidant; suspending agent; tablet and capsule diluent; tablet disintegrant (cellulose powdered) Tablet and capsule diluent.(cellulose Silicified)
2.	Lactose hydrous or anhydrous or monohydrate or spray dried	Binding agent; diluent for dry-powder inhalers; lyophilization aid; tablet binder; tablet and capsule diluent.(lactose anhydrous) Binding agent; diluent for dry-powder inhalers; tablet binder; tablet and capsule diluent(lactose monohydrate) Binding agent; diluent for dry-powder inhalations; tablet and capsule diluent; tablet and capsule filler.(lactose spray dried)
3.	Mannitol	Sweetening agent; tablet and capsule diluent; tonicity agent; vehicle (bulking agent) for lyophilized preparations
4.	Calcium carbonate	Tablet and capsule diluent; therapeutic agent
5.	Sodium alginate	Stabilizing agent; suspending agent; tablet and capsule disintegrant; tablet binder; viscosity-increasing agent.
6.	Sucrose	Base for medicated confectionery; granulating agent; sugar coating adjunct; suspending agent; sweetening agent; tablet and capsule diluent; viscosity-increasing agent.

3. Natural Lubricants:

Lubricates are the excipients which is used for the purpose of lubrication means making the process smooth by applying some substances. Lubricants are used for preventing the clumping of ingredients which is used in formulation during process. Lubricants decrease the friction between the particles and processing equipment and maintain the stickiness of formulation[8]

Table 6 natural lubricant [8]

S.no	Name of excipients	Sources
1.	Stearic acid	Animals
2.	Castor oils	Seeds of castor
3.	Sodium chloride	Minerals (sea)
4.	Paraffin oil	Paraffin plant

4. Coating agents:

Coating agents have various benefits in pharmaceutical solid dosage forms and also equally beneficial for humans. Coating agents are used to coat or to make a film over the dosage form. These coating techniques enhance the drug protection and also modified the drug release. According to the specific site of drug release coating agents are used such as to avoid the stomach and to absorb the drug from intestines coating agents play important role.[8]

Table 7 natural coating agent [8]

S.no	Name of excipients	Sources
1.	Gelatin	Animals
2.	Xanthan gum	Secreted from bacterium Xanthomona scampestris
3.	Guar gum	Seeds of Cyamopsistetra gonolobus L. Taub.
4.	Pectin	Inner portion of citrus fruits and vegetables.

5. Natural Perfumes and Flavoring Agents:

Flavors are the mixed sensation of taste, touch, smell & sight. Nowadays, many artificial flavors are manufactured with the help of technology in flavoring industries. Many pharmaceutical industries use flavors in many formulations like: cough syrups, sedatives, anti-malarial and anti-biotic. Flavors are also widely used in food industries. Flavoring agents comes under the category of organoleptic agents. Flavors are used as taste masking agents which hides the unpleasant taste or order of dosage form. A flavor enhances the likelihood of medicine and makes them more compatible for patient's administration[8]

Table 8 :natural perfumes [8]

Sr.No	Name of excipients	Source (Plants)	Family
1.	Lemon	Peel of Citrus limon	Rutaceae
2.	Orange	Peel of Citrus sinensis	Rutaceae
3.	Raspberry	Fruit of Rubusrosi folius	Rosaceae
4.	Peppermint	Leaf of Menthas picata	Lamiaceae
5.	Ginger	Roots of Zingiber officinale	Zingiberaceae
6.	Sandal wood oil	Heartwood of Santalum album	Santalaceae
7.	Ajowan	Trachyspermum ammi	Apiaceae
8.	Anise oil	Pimpinella anisum	Apiaceae
9.	Balsam of Peru	Myroxylon balsamum	Fabaceae
10.	Bay oil	Cinnamomum tamala	Lauraceae

6. Natural Preservatives::

Preservatives are chemical substances that are used in all Pharmaceutical, Cosmetics and food industries. They are added in formulation to prevent the decomposition of products by microbial growth. They also stop the undesirable chemical changes. Generally preservatives are of two types first one is anti-microbial preservatives and second one is anti-oxidants [8]

Ex. Clove oil, neem oil, cumin seeds etc.

➢ Pharmaceutical Application Of Herbal Excipients

1. Tamarind Gum

Tamarind xyloglucan is obtained from the endosperm of the seed of the tamarind tree, Tamarindus indica, a member of the 21 evergreen families. Tamarind Gum, also known as Tamarind Kernel Powder (TKP) is extracted from the seeds Microspheres formed was in the size range of 230 - 460µm. In another study Diclofenac sodium matrix tablets containing TSP was investigated. The tablets prepared by wet granulation technique were evaluated for its drug release Characteristics [1].

Fig 5 tamarind gum

2. Guar gum

Guar gum comes from the endosperm of the seed of the legume plant Cyamopsis tetragonolobus. Refined guar splits are obtained when the fine layer of fibrous material, which forms the husk, is removed and separated from the endosperm halves by polishing. Strong acids cause hydrolysis and loss of viscosity, and alkalis in strong concentration also tend to reduce viscosity. It is insoluble in most hydrocarbon solvents [1].

Fig 6: guar gum

3. Locust bean gum-

Locust Bean Gum (LBG) (also known as Carob Gum) is obtained from the refined endosperm of seeds from the carob tree Ceretonia siliqua L. It is an evergreen tree of the legume family. Carob bean gum is obtained by removing and processing the endosperm from seeds of the carob tree [1].

Fig.7 Locust bean gum

4. Honey locust gum

It is known botanically as Gleditsia triacanthos, and belongs to the order Leguminosae (suborder Mimoseae). The gum is obtained from the seeds [1].

fig .8: Honey locust gum

5. Khaya gum

Khaya gum is a polysaccharide obtained from the incised trunk of the tree Khaya grandifoliola (family Meliaceae). The fact that the gum is naturally available, inexpensive and non-toxic has also fostered the interest in developing the gum for pharmaceutical use. Further work has also shown its potential as a directly compressible matrix system in the formulation of 61 controlled release tablets [11].

Fig 9: Khaya gum

6. Aloe mucilage

It is obtained from the leaves of Aloe barbadensis Miller. 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 (or acemannan) as the primary polysaccharide of the gel, while others found pectic substance as the primary polysaccharide [1].

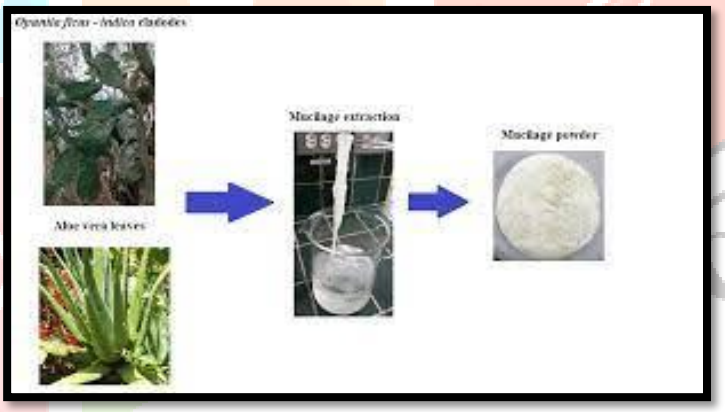


Fig. 10 Khaya gum

7. Hakea Gum

Hakea gum a dried exudates from the plant Hakea gibbosa family Proteaceae. Gums that are acidic arabinogalactans (type A). Molar proportions (%) of sugar constituents Glucuronic acid, Galactose, Arabinose, Mannose, Xylose is 12:43:32:5:8[1].

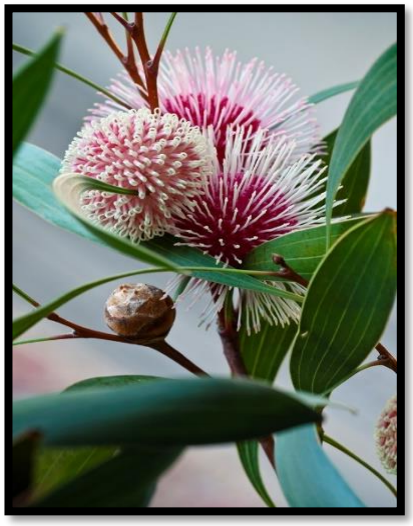


Fig.11 Hakea Gum

8. Pectin

Pectin's are non-starch, linear polysaccharides extracted from the plant cell walls . In the food industry, folic acid incorporated microcapsules were prepared using alginate and combinations of alginate and pectin polymers so as to improve stability of folic acid. The blended alginate and pectin polymer matrix increased the folic acid encapsulation efficiency and reduced leakage from the capsules as compared to those made with alginate alone; they showed higher folic acid retention after freeze drying and storage [].

Fig 12: pectin

9. Alginates

Alginates are natural polysaccharide polymers isolated from the brown sea weed (Phaeophyceae). Alginic acid can be converted into its salts, of which sodium alginate is the major form currently used. Alginates offer various applications in drug de-livery, such as in matrix type alginate gel beads, in liposomes, in modulating gastrointestinal transit time, for local applications and to deliver the bio molecules in tissue engineering applications [8]

Fig.13: Hakea Gum

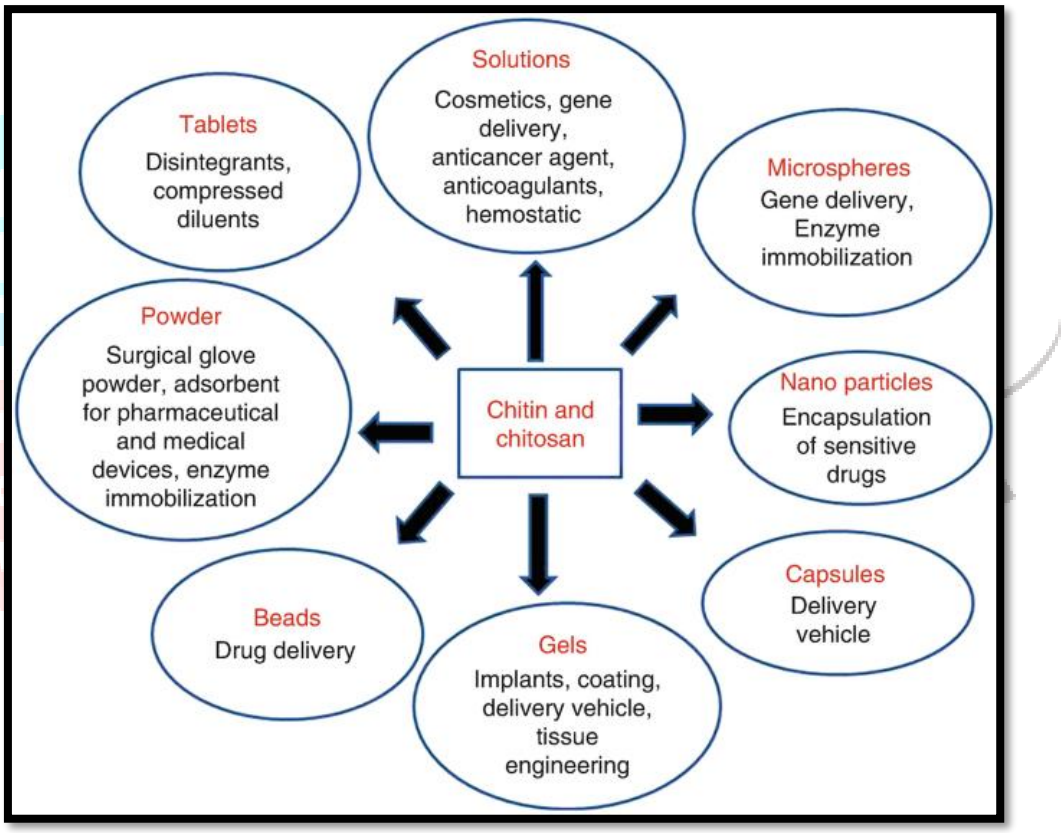


Fig.14 chitin and chitosan

➢ Pharmaceutical Applications of Gums

In the presence of counter ions, this polymer is capable of forming gels that are particularly strong when formed with divalent ions. Important parameters, like the gel strength, were studied to find a reliable indicator of the gel ocular bioavailability. A recent study reports the preparation of microspheres obtained by the emulsion cross-linking method of gellan and poly (vinyl alcohol) in the presence of different amonts of glutaraldehyde as a cross-linking agent and of an antihypertensive drug. The new microspheres were spherical, with smooth surfaces and with a narrow unimodal size distribution [1]

- **Polysaccharides in Pharmaceuticals**

Natural polysaccharides are extensively used for the development of solid dosage forms. These polymers of monosaccharides (sugars) are inexpensive and available in a variety of structures with a variety of properties. They are highly stable, safe, non-toxic, and hydrophilic and gel forming in nature. Pectin's, starch, guar gum, amylase and karaya gum are a few polysaccharides commonly used in dosage forms. Non-starch, linear polysaccharides remain intact in the physiological environment of the stomach and the small intestine, but are degraded by the bacterial inhabitants of the human colon which make them potentially useful in targeted delivery systems to the colon [].

A. **Pectin's**

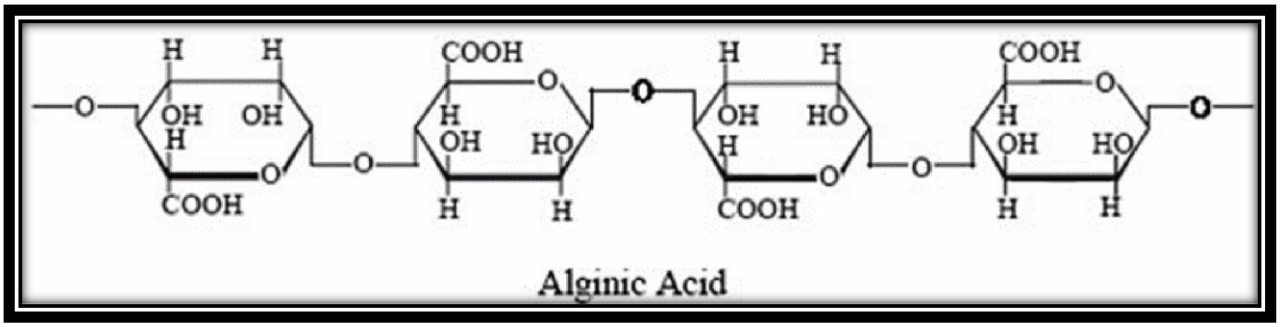
Pectin's are non-starch, linear polysaccharides extracted from the plant cell walls. They are predominantly linear polymers of mainly (1–4)-linked D-galacturonic acid residues interrupted by 1,2- linked L-rhamnose residues with a few hundred to about one thousand building blocks per molecule, corresponding to an average molecular weight of about 50,000 to about 1,80 00040. Being soluble in water, pectin is not able to shield its drug load effectively during its passage through the stomach and small intestine.

Focus was shifted to the development of less soluble derivatives of pectin which get degraded by the colonic microflora. To overcome the drawback of high solubility of pectin, mixed films of pectin with ethyl cellulose were investigated as a coating material for colon-specific drug delivery. Polymeric hydrogels are widely used as controlled-release matrix tablets. Sungthongjeen *et al*.,

In relation to cosmetics, using citronellal as a model compound, pectin gel formulations were evaluated for controlled fragrance release by kinetic and static methods. Pectin/calcium microparticles are promising materials for controlled fragrance release [].

B. Alginates

Alginates are natural polysaccharide polymers isolated from the brown sea weed (Phaeophyceae). Alginic acid can be converted into its salts, of which sodium alginate is the major form currently used. A linear polymer consisting of D-mannuronic acid and L-guluronic acid residues arranged in blocks in the polymer chain, these homogeneous blocks (composed of either acid residue alone) are separated by blocks made of random or alternating units of mannuronic and guluronic acids[7]



Structure of Alginic acid[7]

C. Starch

It is the principal form of carbohydrate reserve in green plants and especially present in seeds and underground organs. Starch occurs in the form of granules (starch grains), the shape and size of which are characteristic of the species, as is also the ratio of the content of the principal constituents, amylose and amylopectin. A number of starches are recognized for pharmaceutical use (fi g. 2). These include maize (Zea mays), rice (Oryza sativa), wheat (Triticum aestivum), and potato (Solanum tuberosum)[11]

Starch is classified into

I. Raw starch

II. II. Physical-modified starch or chemical-modified starch.

III. Modified starch was tested for general applicability of a new pregelatinized starch product in directly compressible controlled-release matrix system [1]

IV. Amphoteric Starch Amphoteric starches have been used as wet-end and size-press papermaking additives by aid in retention, drainage and strength properties. They can also be used as ceiling tile additives drilling fluid additives, viscosity modifiers and agents in ore recovery operations[1]

- **Natural Excipients-An Alternative to Synthetic Excipients**:

Natural Excipients:

Natural excipients and derivatives occur ubiquitously throughout the plant and animal kingdoms. Examples of polymers or derivatives that have been used or investigated as vaccine adjuvants are-

- Individual saponins derived from the South American tree Quillaja Saponaria
- Keyhole limpet hemocyanin (KLH), a nonheme copper containing protein found in anthropods.
- MPL, a monophosphorylate derivative of the Lipid A molecule found in gram-negative bacteria.
- Leishmania elongation initiation factor (LeIF), a protein produced by the parasite leishmania.
- Ricin, a potent immunotoxin obtained from the seeds of castor bean plants

Common name	Botanical name	Family	Pharmaceutical applications
Agar	*Gelidium amansii*	Gelidaceae	Suspending agent, emulsifying agent, gelling agent in suppositories, surgical lubricant, tablet disintegrates, medium for bacterial culture, laxative [19]
Albizia gum	*Albizia zygia*	Leguminosae	Tablet binder, coating materials in compression-coated tablets [20]
Abelmoschus gum (Orka gum)	*Abelmoschus esculentus*	Malvaceae	Suspending agent, disintegrant in low concentrations (4%) [21], poor floating capacity in sustained release tablet but with HPMC shows better results. Okra polysaccharide as a microbially triggered material for colon targeted tablet formulation [22]
Tamarind Seed Polysaccharide	*Tamarindus indica*	Fabaceae	Microspheres preparation (size range of 230-460µm). In another study, Diclofenac sodium matrix tablets containing TSP [23]
Locust Bean Gum (Carob gum)	*Ceratonia siliqua*	Leguminosae	Controlled release agent [24]
Fenugreek mucilage	*Trigonella foenum-graceum*	Leguminosae	Better release retardant [25]
Hibiscus mucilage	*Hibiscus rosasinensis*	Malvaceae	Sustained release [26]
Almond gum	*Prunus amygdalus*	Rosaceae	emulsifying, thickening, suspending, adhesive, glazing, and stabilizing properties. Drug release increased [27]
Neem gum	*Azadirachta indica*	Meliaceae	Controlled release agent [28]
Aloe Mucilage	*Aloe barbadensis*	Liliaceae	Controlled release agent [29]
Cashew Gum	*Anacardium occidentale*	Anacardiaceae	Gelling property, Controlled release agent [30]
***Moringa oleifera* gum**	*Moringa oleifera*	Moringaceae	Gelling property, Binding agent, Controlled release agent.

Acacia	*Acacia Senegal*	Combretaceae	Suspending agent, emulsifying agent, binder in tablets, demulcent and emollient in cosmetics Osmotic drug delivery [31]
Bhara gum	*Terminalia bellerica roxb*	Combretaceae	Microencapsulation [32]
Cactus mucilage	*Opuntia ficusindica*	----	Gelling agent in sustained drug delivery [33]
Chitosan	----	----	Colonspecific drug delivery, microspheres, carrier for protein as nanoparticles [34, 35]
Gellan gum	*Pseudomonas elodea*	----	Ophthalmic drug delivery, sustaining agent, beads, hydrogels, floating in-situ gelling, controlled release beads [36, 37]
Hakea	*Hakea gibbosa*	Proteaceae	Sustained release and peptide mucoadhesive for buccal delivery [38, 39]

Conclusion:

Nowadays the hassle is on patient compliance and to achieve this objective there is an eruption in the developing NDDS. As the herbal excipients are promising biodegradable materials, these can be chemically compatible with the excipients in drug delivery systems. Besides this, herbal excipients are non-toxic, freely available, and less expensive compared to their synthetic counterparts. They have a major task to play in pharmaceutical, industry. Therefore, in the years to come, there is going to be constant interest in the natural excipients to have better materials for drug delivery systems.

Referances:

1. Abhishek Jain 1 *, Pinky Radiya2 , Raju Wadekar 1 , Saleel Limaye 1 , Chetan Pawar, Review Article Natural Excipients-An Alternative to Synthetic Excipients: A Comprehensive Review , International Journal of Pharmaceutical and Medicinal Research, nt. J. Pharm. Med. Res. 2014; 2(4):123-127
2. Shobhit Kumar* , Satish Kumar Gupta Natural polymers, gums and mucilages as excipients in drug delivery, REVIEWS, Polim. Med. 2012, 42, 3–4, 191–197.
3. Prashant Singh*, Tarique Mahmood, Arshiya Shameem, Paramdeep Bagga, Nesar Ahmad Review Article A review on Herbal Excipients and their pharmaceutical applications , Scholars Academic Journal of Pharmacy (SAJP) ISSN 2320-4206 (Online) Sch. Acad. J. Pharm., 2016; 5(3): 53-57
4. Arpita singh1,∗ , Nidhi Gupta1 , Amresh Gupta, Review on Herbal Excipients, Int J Indig Herbs Drugs 2021;6(1):05–8

5. Harsh Pandey1 , Shivani Srivastava1 , Brahmeshwer Mishra2 , Riden Saxena3 , Yamini Bhusan Tripathi1,Development and Evaluation of Herbal Tablet Loaded with Pueraria tuberosa Water Extract with Use of Different Excipients , Asian Journal of Pharmaceutics • Apr -Jun 2018 (Suppl) • 12 (2) | S786
6. Sara Holm Freiesleben a , Jens Soelberg a,b , Anna K Jäger,Medicinal plants used as excipients in the history in Ghanaian herbal medicine , Journal of Ethnopharmacology,
7. Sarin. A. Chavhan*, Sushil Kumar. A. Shinde, Sandip B. Sapkal and Vinayak N. Shrikhande,Herbal excipients in Novel Drug Delivery Systems, International Journal of Research and Development in Pharmacy & Life Science April - May 2017; 6(3): 2597-2605 ©SRDE Group, All Rights Reserved. Int. J. Res. Dev. Pharm. L. Sci. 2597
8. S. Selvadurai1 *, S.Divya2 , A.Geetha2 , K.Rohini2 and S.Anbazhagan, Herbal Excipients-Significance of Substances of Natural Origin as Excipients, International Journal of PharmTech Research CODEN (USA): IJPRIF, ISSN: 0974-4304, ISSN(Online): 2455-9563 Vol.13, No.03, pp 242-252, 2020
9. Rashmi Saxena Pal* , Yogendra Pal, Ankita Wal and Pranay Wal ,Current Review on Plant based Pharmaceutical Excipients , Open Medicine Journal, 1874-2203/1
10. Prashant Singh*, Tarique Mahmood, Arshiya Shameem, Paramdeep Bagga, Nesar Ahmad A review on Herbal Excipients and their pharmaceutical applications, Scholars Academic Journal of Pharmacy (SAJP) ISSN 2320-4206 (Online) Sch. Acad. J. Pharm., 2016; 5(3): 53-57
11. A. SHIRWAIKAR*, ANNIE SHIRWAIKAR1, S. LAKSHMANA PRABU AND G. ARAVIND KUMAR Herbal Excipients in Novel Drug Delivery Systems , Indian Journal of Pharmaceutical Sciences 415-420
12. Harshal Ashok Pawar a,∗, Pravin Jadhav b ,Isolation, characterization and investigation of Cordia dichotoma fruit polysaccharide as a herbal excipient International Journal of Biological Macromolecules 72 (2015) 1228–1236
13. Dr. Raju Anarthe1 , Dr. Amit Mani2 , Dr. Preeti Kale3 , Dr. Shalakha Maniyar3 , Dr. Sekharmantri Anuraga3Herbal Approaches in Periodontics , Galore International Journal of Health Sciences and Research (www.gijhsr.com) Vol.2; Issue: 1; March 2017, page no. 21-25
14. https://images.app.goo.gl/RG3RtP6oGmALQR11A
15. https://images.app.goo.gl/k9aehDSVh47KAEfR7
16. . Sinha V., Rachna K., Polysaccharides in colon specific drug delivery, Int. J. Pharm,2001; 224:19-38.
17. Venkata R., Chemical and biological aspects of selected polysaccharides, Indian J. Pharm Sci. 1992; 54:90-97.

18. John G., Declan M., James E., The use of agar as a novel filler for monolithic matrices produced using hot melt extrusion, Eur. J. Pharm. Biopharm,2006; 64:75-81.

19. Oluwatoyin O., Assessment of Albizia zygia gum as a binding agent in tablet formulations, Acta. Pharm,2005; 55:263–276.

20. Jani G., Shah D., Jain V.,Evaluating mucilage from Aloe barbadensis Miller as a pharmaceutical excipient for sustainedrelease matrix tablets, Pharm. Tech, 2007;31: 90-98.

21. Patel M., Chauhan G., Patel L., Mucilage of Lepidium sativum Linn (Asario) and Ocimum canum sims. (Bavchi) as emulgents, Indian J. Hosp. Pharm, 1987; 24:200-202.

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

23. Nayak B., Nayak U., Patro K., Design and evaluation of controlled release Bhara gum microcapsules of famotidine for oral use, Research J. Pharm. and Tech,2008;1:433-437.

24. Satpathy T., Chitosan Used In Pharmaceutical Formulations: A Review. Pharmainfo, 2008; 6(3):1-18.

25. Dutta P., Dutta J., Tripathi V., Chitin and Chitosan: Chemistry, properties and Application. J. Scientific and Industrial Res, 2004; 63:20-31