

Application of natural polymers as pharmaceutical excipients

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Abstract

The use of natural polymer as excipients in pharmaceutical sector is expanding day by day. Low cost, safety issues, availability, bio-degradable are the main causes that make them differ from othersources. Natural sources have wide range of varieties and characteristics. So they can be used numerously in pharmaceutical products as excipients to serve the desired purposes. The aim of this article is to give an over view of the application of natural polymeric substances that can be used as excipients in pharmaceuticals.

Keywords: Natural polymer, Safe, Cost effective

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Introduction

Excipients play an important role to convert the Active Pharmaceuticals Ingredient (API) in to dosage form by ensuring its safety and efficacy so that administration can be suitable for the patients [1]. The use of natural polymeric excipients in pharmaceutical sectors is increasing day by over semi synthetic or synthetic excipients [2]. Low toxicity, availability, cost effectiveness, soothing action, non-irritant nature are the main reasons which make them superior from others sources [3-6]. Natural polymeric excipients can be used in different formulations like solid, liquid and semi-solid dosage forms where they act as disintegrates, binders, film formers, matrix formers, release modifiers, thickeners, stabilizers, emulsifiers, suspending agents, sweetener and mucoadhesives agent [7]. Solid monolithic matrix systems, implants, films, beads, micro particles, nanoparticles, inhalable and injectable systems, viscous liquid can be formulated and manufactured by the help of natural polymeric excipients [8-10].

Characteristics of an ideal pharmaceutical excipient

Pharmaceutical excipient should have some certain characteristics. Natural polymeric substances should have to fulfil these characteristics in order to be a successful candidate as pharmaceutical excipient. These are as follows:

1. Pharmacologically inert but pharmaceutically active.
2. Nontoxic and non-irritant.
3. No interaction with drug or with other substances present in the formulation and packaging.
4. Ease of handling.
5. Feasible.
6. Cost effective and readily available.

List of excipients used in pharmaceutical preparation

Commonly used excipients which are used in pharmaceutical preparations are: fillers, binders, disintegrants, coatings, sorbents, anti-adherent, lubricants, glidants, preservatives, antioxidants, flavoring agents, sweetening agents, coloring agents, solvent, co solvent, buffering agents, chelating agents, viscosity imparting agents, surface active agents and humectants.

Disadvantages of natural polymers

Although natural polymers have some superior advantages but some disadvantages are also present which should be taken under considerations. Most common disadvantages are:

1. Microbial contamination may be occurred.
2. Batch to batch variation is observed.
3. The rate of hydration is uncontrolled.
4. Viscosity of the formulation reduced during the storage.
5. Most of the natural polymers are seasonal.

Sources of natural polymers

Natural polymers can be obtained from one of the three sources. These are plants, microbes and animals. From these source, plants have the largest amount of polymeric substances as well as the varieties. Some polymeric substances are obtained from animal sources and very few are obtained from the microbes [2].

Types of natural polymeric excipients

Natural polymeric excipients may be categorized into the following classes [7].

1. Polysaccharides of the plant cell wall: These polymers are mainly obtained from plant cell wall and cellulose, hemicelluloses, pectin are the main polymers of this group.

2. Gums and mucilages: Gums and mucilages are natural plant hydrocolloids which can be further classified into anionic or nonionic polysaccharides. They may be salts of polysaccharides also.
3. Seaweed polysaccharides: Seaweeds are mainly macroscopic, multicellular marine algae. Seaweed polysaccharides mainly include carrageenans, agar and alginates.
4. Microbial polysaccharides: These types of polymers are obtained by the fermentation of carbohydrate products mainly. This fermentation is performed by specific bacteria or fungus. Xanthan gum, pullulan etc. are in this category.
5. Animal polysaccharides: Natural gums can be obtained from animal sources which are classified in this group. Chitin and chitosan are mostly used animal polysaccharides.
6. Exudates gums: Exudates gums are viscous, sticky fluid which is obtained after cutting the plant. They are actually seal-off infected sections of the plant and help to reduce the loss of moisture because of the physical injury or by the attack of fungi. Acacia gum, tragacanth gum, locust bean gum etc. are in this class.
7. Inulin: Inulin is obtained from plant source like onion, garlic, artichoke and chicory. It is actually a polysaccharide stored in the plants. Chemically it is gluco-fructants and multiple monomers are present.
8. Starches: Starches are polymeric carbohydrates which have a large glucose units joined by glycosidic bonds.
9. Dextran: Dextran is complex branched glucan which have different chain length.
10. Cyclodextrins: Cyclodextrins are mainly cyclic oligosaccharides having six to eight glucose units and they are joined with α -1,4 glucosidic bonds.
11. Curdlan: It is a neutral and linear β -glucan having intra or inter chain linkages.
12. Scleroglucan: It is a branched homo polysaccharide having a main chain of (1-3) linked b-D glucopyranosyl units.
13. Rosin: It is low molecular weight oleoresin.

Application of natural polymers as excipients

Natural polymers can act numerously as excipients in pharmaceutical preparation. A list of natural polymers and their pharmaceutical application are given below:

S.I	Natural Polymers	Pharmaceutical application
1.	Cellulose	Binder, filler, diluents, thickening and viscosity imparting agent, compressibility enhancer [11].
2.	Hemicellulose	Stabilizer of the gel phase of tablet and release modifier [12].
3.	Pectin	Colon specific drug delivery, controlled release drug delivery, patch and transdermal drug delivery, nano particle drug formulation [13-16].
4.	Alginates	Suspending agent, stabilizer, coating material, gelating agent,

- bioadhesive, microsphere [17-22].
5. Carageenans Gelling agent, stabilizer, demulcent, laxative [23-25].
 6. Gum agar Suspending agent, emulsifier, laxative, gelling agent, surgical lubricant, disintegrates, bacterial culture media [26].
 7. Xanthan gum Suspending agent, emulsifier, stabilizer, sustained release agent, pellets [27-29].
 8. Gellan gum Disintegrating agent, ophthalmic drug delivery, beads, floating *in-situ* gel [30-33].
 9. Pullulan Insulin preservation [34].
 10. Acacia gum Suspending agent, emulsifier, binder, demulcent, emollient, osmotic drug delivery system [35-37].
 11. Tragacanth gum Suspending agent, emulsifier, demulcent, emollient, sustained release agent [38].
 12. Locust bean gum Controlled release agent [39,40].
 13. Guar gum Binder, disintegrating agent, thicker, emulsifier, laxative, sustained release agent, colon targeted drug delivery, cross-linked microsphere [41-47].
 14. Grewia gum Binder, tablet property enhancer, improved drug release [48,49].
 15. Okra gum Binder, suspending agent, control release, sustained release, film coating and bio-adhesive material [50-58].
 16. Kyaha gum Binder [59].
 17. Moringaoleifer gum Tablet physical characteristics enhancer [60].
 18. Irvingiagabonensis Binder, emulsifier, suspending agent [61-63].
 19. Hakeagibbosa gum Muco-adhesive, sustained release property [64].
 20. Psyllium mucilage Binder, controlled release property [65,66].
 21. Inulin Colon specific drug delivery [67].
 22. Starch Binder, disintegrant, aiding drug delivery, film coating material [68,69].
 23. Dextran Colon specific drug delivery [70-72].
 24. Cyclodextrins Colonic drug deliver [73].
 25. Curdlan Stabilizer, gelling agent [74].
 26. Scleroglucan Laxative in tablet coating, stabilizer, hydrogel former [75].
 27. Rosin Microencapsulation, film former, coating material, sustained release property, nano particle drug delivery [76-79].
 28. Tamarind gum Binder, emulsifier, suspending and sustaining agent, mucoadhesive drug delivery [80-82].
 29. Gum ghatti Binder, emulsifier, suspending agent [83].
 30. Neem gum Aqueous film coating material [84]
 31. Albizia gum Binder [85].
 32. Cashew gum Suspending agent [86,87].
 33. Cassia toragum Binding agent [88].
 34. Bhara gum Microencapsulation [89].
 35. Leucaena seed gum Emulsifier, suspending agent, binder, disintegrating agent [90-94].
 36. Cordia gum Sustaining agent [95].
 37. Mimosa pudica Binder, disintegrating agent [96,97].

Conclusions

Natural excipients have certain advantages over other synthetic and semi synthetic excipients. So these excipients are getting preference day by day. Potential characteristics of them help the scientist to formulate better formulation. But, while working with these excipients or using them in dosage form, it should pass all the regulatory requirements. Experiments and researches should be done with natural excipients in order to get the most safe and suitable one for pharmaceutical application.

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