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 usednumerously in pharmaceutical products as excipients to serve the desired purposes. The aim of thisarticle is to give an overview of the application of natural polymeric substances that can be used as excipients in pharmaceuticals.

Keywords: Natural polymer, Safe, Cost effective


Received: September 21, 2018; Accepted: October 10, 2018; Published: October 15, 2018

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Competing Interests: The author has declared that no competing interests exist.

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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 day over 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 theses 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-glucanhaving 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:

<table>
<thead>
<tr>
<th>S.I</th>
<th>Natural Polymers</th>
<th>Pharmaceutical application</th>
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<tbody>
<tr>
<td>2.</td>
<td>Hemicellulose</td>
<td>Stabilizer of the gel phase of tablet and release modifier [12].</td>
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<td>4.</td>
<td>Alginates</td>
<td>Suspending agent, stabilizer, coating material, gelating agent,</td>
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<tr>
<td>No.</td>
<td>Gum Type</td>
<td>Applications</td>
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<td>5.</td>
<td>Carageenans</td>
<td>Bioadhesive, microsphere [17-22].</td>
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<td>6.</td>
<td>Gum agar</td>
<td>Gelling agent, stabilizer, demulcent, laxative [23-25].</td>
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<td>7.</td>
<td>Xanthan gum</td>
<td>Suspending agent, emulsifier, laxative, gelling agent, surgical lubricant,</td>
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<td></td>
<td></td>
<td>disintegrates, bacterial culture media [26].</td>
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<td>8.</td>
<td>Gellan gum</td>
<td>Disintegrating agent, ophthalmic drug delivery, beads, floating in-situ gel</td>
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<td></td>
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<td>[30-33].</td>
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<td>9.</td>
<td>Pullulan</td>
<td>Insulin preservation [34].</td>
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<td>10.</td>
<td>Acacia gum</td>
<td>Suspending agent, emulsifier, binder, demulcent, emollient, osmotic drug</td>
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<td></td>
<td></td>
<td>delivery system [35-37].</td>
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<td>11.</td>
<td>Tragacanth gum</td>
<td>Suspending agent, emulsifier, demulcent, emollient, sustained release agent</td>
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<td></td>
<td></td>
<td>[38].</td>
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<td>12.</td>
<td>Locust bean gum</td>
<td>Controlled release agent [39,40].</td>
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<td>13.</td>
<td>Guar gum</td>
<td>Binder, disintegrating agent, thicker, emulsifier, laxative, sustained release</td>
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<td></td>
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<td>agent, colon targeted drug delivery, cross-linked microsphere [41-47].</td>
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<td>14.</td>
<td>Grewia gum</td>
<td>Binder, tablet property enhancer, improved drug release [48,49].</td>
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<td>15.</td>
<td>Okra gum</td>
<td>Binder, suspending agent, control release, sustained release, film coating</td>
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<td></td>
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<td>and bio-adhesive material [50-58].</td>
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<td>16.</td>
<td>Kyaha gum</td>
<td>Binder [59].</td>
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<tr>
<td>17.</td>
<td>Moringaoleifer gum</td>
<td>Tablet physical characteristics enhancer [60].</td>
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<td>18.</td>
<td>Irvingiagabonensis</td>
<td>Binder, emulsifier, suspending agent [61-63].</td>
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<td>19.</td>
<td>Hakeagibbosa gum</td>
<td>Muco-adhesive, sustained release property [64].</td>
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<td>20.</td>
<td>Psyllium mucilage</td>
<td>Binder, controlled release property [65,66].</td>
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<td>21.</td>
<td>Inulin</td>
<td>Colon specific drug delivery [67].</td>
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<td>22.</td>
<td>Starch</td>
<td>Binder, disintegrant, aiding drug delivery, film coating material [68,69].</td>
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<tr>
<td>23.</td>
<td>Dextran</td>
<td>Colon specific drug delivery [70-72].</td>
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<td>24.</td>
<td>Cyclodextrins</td>
<td>Colonic drug deliver [73].</td>
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<td>25.</td>
<td>Curdlan</td>
<td>Stabilizer, gelling agent [74].</td>
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<td>26.</td>
<td>Scleroglucan</td>
<td>Laxative in tablet coating, stabilizer, hydrogel former [75].</td>
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<td>27.</td>
<td>Rosin</td>
<td>Microencapsulation, film former, coating material, sustained release property,</td>
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<td></td>
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<td>nano particle drug delivery [76-79].</td>
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<td>28.</td>
<td>Tamarind gum</td>
<td>Binder, emulsifier, suspending and sustaining agent, mucoadhesive drug delivery</td>
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<td>[80-82].</td>
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<td>29.</td>
<td>Gum ghatti</td>
<td>Binder, emulsifier, suspending agent [83].</td>
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<td>30.</td>
<td>Neem gum</td>
<td>Aqueous film coating material [84].</td>
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<td>31.</td>
<td>Albizia gum</td>
<td>Binder [85].</td>
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<td>32.</td>
<td>Cashew gum</td>
<td>Suspending agent [86,87].</td>
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<td>33.</td>
<td>Cassia toragum</td>
<td>Binding agent [88].</td>
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<tr>
<td>34.</td>
<td>Bhara gum</td>
<td>Microencapsulation [89].</td>
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<td>35.</td>
<td>Leucaena seed gum</td>
<td>Emulsifier, suspending agent, binder, disintegrating agent [90-94].</td>
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<tr>
<td>36.</td>
<td>Cordia gum</td>
<td>Sustaining agent [95].</td>
</tr>
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<td>37.</td>
<td>Mimosa pudica</td>
<td>Binder, disintegrating agent [96,97].</td>
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</table>
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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