Review Article

Pharma additives of natural origin: A mini-review

Rishav Gupta, Sharib Raza Khan, Rohit Bhatia*

Department of Pharmaceutical Chemistry and Analysis, ISF College of Pharmacy, Moga, Punjab, India

Correspondence:
Rohit Bhatia, Department of Pharmaceutical Chemistry and Analysis, ISF College of Pharmacy, Moga, Punjab, India. E-mail: bhatiarohit5678@gmail.com

How to cite this article: Gupta R, Khan SR, Bhatia R. Pharma additives of natural origin: A Mini-review. Pharmaspire 2019;11(1):10-13.

Source of Support: Nil,

Conflicts of Interest: None declared.

ABSTRACT

In the present time, a large number of natural additives are being used in the manufacturing of pharmaceutical products. Their demand is consistently increasing day by day due to several advantages offered by them. They are easily available, cheap, and stable and have very low incidence of toxicity. They are basically of plant and animal origins. The plant derived gums and mucilages comply with many requirements of pharmaceutical additives as they are non-toxic, stable, easily available, and associated with less regulatory issues as compared to their synthetic counterpart and inexpensive; also these can be easily modified to meet the specific need. In this article, authors have summarized various pharmaceutical additives of natural origin with their description and pharmaceutical applications.

Keywords: Additives, toxicity, gums, mucilages, volatile oils

INTRODUCTION

Pharmaceutical additive is a substance which is actually not the part of the product, but added deliberately to improve some properties of the product.[1] In the past recent years, plant derived additives have been used extensively in the manufacturing of pharmaceutical products. These additives may be polymers, mucilage, gums, resins, volatile oils, alkaloids, plant extracts, or various animal derived products.[2] These substances are generally added to the pharmaceutical preparation as coloring matter, flavoring agent, stabilizers, disintegrating agents, opacifying agents, emulsifying agents, absorption enhancers and antioxidants, etc.[3] The plant sources are renewable and we can reproduce them by harvesting at a large scale. Therefore, manufacturers have set their attention toward exploration of plant sources to obtain these additives. Hence, many waste products obtained from the food industry can be used to extract various herbal additives.[4] Animals and marine organisms are also very important sources of pharmaceutical additives.

CLASSIFICATION OF PHARMACEUTICAL ADDITIVES

Various additives which are used commonly in the pharmaceutical formulations fall under the following categories:[5]

Access this article online	
Website: www.isfcppharmaspire.com	**P-ISSN:** 2321-4732 **E-ISSN:** XXXX-XXXX

- Binding and diluting agents
- Lubricating agents and glidants
- Suspending and emulsifying agents
- Film forming and coating agents
- Coloring and flavoring agents
- Preservatives and antioxidants
- Taste enhancers and sweetening agents
- Moisturizing agents, etc.

MERITS OF NATURAL ADDITIVES[6]

- The natural additives are basically polymers which are almost produced by every plant. These polymers are biodegradable and do not produce any kind of adverse effect on human beings or environment
- Chemically almost all the natural additives are composed of carbohydrates and hence they do not produce any kind of toxicity on administration
- These additives are easily available and their cost of production is cheaper
- There are no major regulatory issues for the use of natural additives.

The most important and widely used pharmaceutical additives obtained from natural sources have been described hereunder with their source of availability and pharmaceutical applications.

GUMS

Gums are usually formed in the cell wall commonly by breakdown of cellulose when plant is damaged.[7] These have capacity to increase

the viscosity of the solutions even when these are used in small concentrations. They are used as thickening agents, stabilizing agent, emulsifier, adhesive, and binding agents.[8] Various types of gums which are used as pharmaceutical additives are discussed Table 1 with their sources and pharmaceutical application.[9-15]

Mucilages

Mucilage is a thick, gluey substance produced by nearly all plants and some microorganisms. It is a polar glycoprotein and an exopolysaccharide.[16] Mucilage in plants plays a role in the storage of water and food, seed germination, and thickening membranes.[17] The common pharmaceutical applications of mucilages are summarized in Table 2:[9,14,18,19]

Volatile oils

These are also known as essential oils and chemically these are mixtures of hydrocarbons and oxygenated derivatives of these hydrocarbons. Basically, these are hydrophobic liquids containing a compound having aroma.[20] Common volatile oils obtained from the plants which are used in pharmaceutical preparations for specific purposes are summarized in Table 3.[8]

Table 1: Natural gums and their pharmaceutical applications

S. No.	Name of gum	Biological name	Family	Pharmaceutical application
1.	Tamarind gum	*Tamarindus indica*	Leguminosae	Binding agent, emulsifier, suspending agent, sustaining agent, hydrogels, mucoadhesive agent, and nasal drug delivery
2.	Agar	*Gelidium amansii*	Gelidiaceae	Suspending agent, emulsifying agent, gelling agent in suppositories, surgical lubricant, tablet disintegrants, medium for bacterial culture, laxative
3.	Carrageenan	*Chondrus crispus*	Gigarginaceae	Gelling agent, stabilizer
4.	Guar gum	*Cyamopsis tetragonoloba*	Leguminosae	Binder, disintegrating agent, thickening agent, demulcent
5.	Gum ghatti	*Anogeissus latifolia*	Combretaceae	Binder, emulsifier, and suspending agent
6.	Gum tragacanth	*Astragalus gummifer*	Leguminosae	Suspending agent, emulsifying agent, demulcent, emollient in cosmetics and sustained release agent
7.	Karaya gum	*Sterculia urens*	Sterculiaceae	Suspending agent, emulsifying agent, dental adhesive, sustaining agent in tablets, bulk laxative, mucoadhesive
8.	Pectin	*Citrus aurantium*	Rutaceae	Thickening agent, suspending agent, protective agent, floating beads, colon drug delivery, microparticulate drug delivery, transdermal drug delivery, iontophoresis, hydrogels
9.	Sodium alginate	*Macrocystis pyrifera*	Lessoniaceae	Suspending agent, gelation for dental films, stabilizer, sustained release agent, tablet coating, mucoadhesive microspheres
10.	Xanthan gum	*Xanthomonas campestris*	Xanthomonadaceae	Suspending agent, emulsifier, stabilizer in toothpaste and ointments, sustained release agent, buccal drug delivery system
11.	Neem gum	*Azadirachta indica*	Meliaceae	Suspending agent, binder and transdermal film forming agent
12.	Badam gum	*Prunus amygdalus*	Rosaceae	Binding, sustaining and transdermal film forming agent
13.	Myrrh gum	*Commiphora myrrha*	Burseraceae	Mucoadhesive agent.
14.	Okra gum	*Hibiscus esculentus*	Malvaceae	Binder and hydrophilic matrix for controlled release drug delivery

Table 2: Natural mucilages and their pharmaceutical applications

S. No.	Mucilage	Biological name	Family	Pharmaceutical application
1.	Aloe mucilage	*Aloe barbadensis*	Liliaceae	Sustained release tablets, gelling agent
2.	Bavchi mucilage	*Ocimum canum*	Labiatae	Suspending and emulsifying agent
3.	Fenugreek mucilage	*Trigonella foenum graecum*	Leguminosae	Gelling agent, disintegrant, tablet binder, sustaining agent, emollient, and demulcent
4.	Hibiscus mucilage	*Hibiscus rosa sinensis*	Malvaceae	Suspending and sustained release agent.
5.	Isabgol mucilage	*Plantago ovata*	Plantaginaceae	Cathartic, lubricant, demulcent, laxative, sustaining agent, hydrogels, gastroretentive drug delivery system, binder, emulsifying, and suspending agent
6.	Ocimum seed mucilage	*Ocimum gratissimum*	Labiatae	Suspending and binding agent
7.	Shatavari Mucilage	*Asparagus racemosus*	Apocynaceae	Binding and sustained release agent
8.	Cactus mucilage	*Opuntia ficus-indica*	Cactaceae	Gelling agent in sustained release systems
9.	Cashew mucilage	*Anacardium occidentale*	Anacardiaceae	Gelling agent
10.	Gulmohar mucilage	*Delonix regia*	Fabaceae	Binder

Table 3: Volatile oils of natural origin and their pharmaceutical applications

S. No.	Volatile oil	biological source	Pharmaceutical applications
1.	Menthol	*Mentha arvensis*	Cough medicines, topical analgesic, flavoring, and antipruritic agent
2.	Eucalyptus oil	*Eucalyptus globulus*	Flavoring agent, local anti-infective, and anti-inflammatory
3.	Rose oil	*Rosa indica*	Cleansing agent, perfumery
4.	Lavender oil	*Lavandula latifolia*	Perfuming agent, insect repellant
5.	Balsam of peru	*Myroxylon balsamum*	Flavoring agent, healing preparations
6.	Black pepper oil	*Piper nigrum*	Reduces muscle aches, flavoring agent
7.	Camphor oil	*Camphor*	Cold, cough, fever
8.	Caraway oil	*Carum carvi*	Flavoring agents, mouthwashes, toothpastes
9.	Clove oil	*Syzygium aromaticum*	Antiseptic, analgesic and flavoring agent
10.	Coriander oil	*Coriandrum sativum*	Flavoring and carminative agent
11.	Citronella oil	*Cymbopogon nardus*	Insect repellant

Table 4: Additives from animal origin and their pharmaceutical applications

S. No.	Compound	Source	Pharmaceutical application
1.	Bees wax	*Apis mellifera*	Widely used in cosmetics
2.	Cochineal	*Armenian cochineal*	Coloring agent
3.	Gelatin	Animal Collagen	Gelling agent, stabilizer, preparation of capsule shells
4.	Honey	*Apis mellifera*	Cough preparations, wound healing agent, emollient
5.	Lactose	Milk	Diluent for tablets
6.	Spermaceti	Sperm Whale	Excipient in ointments
7.	Lanolin	Sebaceous gland of wool bearing animals	Lubricant, preparation of skin care products
8.	Musk	*Moschus moschiferus*	Strong perfuming agent
9.	Suet	Calf	Preparation of some food products
10.	Chitosan	Exoskeleton of shellfish	Used in direct tablet compression, disintegrating agent

Table 5: Additives from natural mineral sources and their pharmaceutical applications

S. No.	Additive	Source	Pharmaceutical application
1.	Bentonite	Weathering of volcanic ash	Binder, absorbent and purifier.
2.	Kieselguhr	Siliceous sedimentary rocks	Pharmaceutical aid
3.	Kaolin	Chemical weathering of aluminum silicate minerals	Ingredient of ceramics, cosmetics, absorbent, pharmaceutical aid
4.	Paraffins	Petroleum	Lubricant, base for pharmaceutical formulations
5.	Talc	Soapstone	Protective, lubricant, filtering aid
6.	Calamine	Smithsonite	Protective from sun rays
7.	Fuller's earth	Montmorillonite	Decolorizing agent, protective
8.	Asbestos	Weathering of serpentine rocks	Inorganic and organic binders, chemical resistant clothing.

Table 6: Natural polysaccharides and their applications

S. No.	Additive	Source	Pharmaceutical application
1.	Cellulose	Animal cell wall	Preparation of mucoadhesive drug delivery systems, coating process, extended release formulations, binder, disintegrating agent, paper, and board manufacture
2.	Hemicellulose	Cellulose fibril surface	Formulation of controlled drug release systems
3.	Starch	Plant reserve food material	Disintegrating agent, glidant, diluents, binding agent, thickening agent, and stabilizer
4.	Dextrin/dextran	*Leuconostoc mesenteroides*	Reduces blood viscosity, plasma volume expander
5.	Chitin	Cell wall of fungi	Binder, adhesive, fabric, dyes.
6.	Inulin	Chicory plant	Flavoring agent, reduces sugar level

Pharmaceutical additives of animal origin

A large number of compounds are derived from animal sources which are used as additives in pharmaceutical preparations. The most commonly used and important compounds derived from animals are summarized in Table 4.[8,21]

Pharmaceutical additives from natural mineral sources

Minerals are abundant sources of pharmaceutical additives which are widely distributed in the nature in the form of rocks, clays, or ores. These must be firstly extracted, isolated, and purified with the suitable techniques before use. The most important of them are specified in Table 5 with their pharmaceutical application.[22]

Polysaccharides other than gums

There are other polysaccharides which are not basically gums and used at a large scale in pharmaceutical manufacturing. Various polysaccharides obtained from natural resources are represented in Table 6.[23-29]

CONCLUSION

Nature is an abundant source of pharmaceutical additives and these natural additives have found a huge application in pharmaceutical manufacturing in the current time. A wide range of natural additives has been already in use in preparation of pharmaceuticals. These substances are easily available, economic, least toxic, and offer several other advantages over the other synthetic compounds. The natural polymers can be easily modified to newer derivatives which are more effective according to the requirements. Hence, in future researchers should identify the newer sources and should isolate the newer pharmaceutical additives from them.

REFERENCES

1. Bhattacharya L, Schuber S, Sheehan C, William R. Excipients: Background/introduction. In: Excipient Development for Pharmaceutical Biotechnology and Drug Delivery Systems. United States: CRC Press; 2006.
2. Wade A, Weller PJ. Handbook of Pharmaceutical Excipients. Vol. 11. London: Pharmaceutical Press; 1994. p. 426-8.
3. Dinesh MS. Natural gums and mucilage's in NDDS: Applications and recent approaches. Int J Pharm Tech Res 2012;4:799-814.

4. Perepelkin KE. Polymeric materials of the future based on renewable plant resources and biotechnologies: Fibres, films, plastics. Fiber Chem 2005;37:417-30.
5. Bi Y, Sunada H, Yonezawa Y, Danjo K, Otsuka A, Iida K. Preparation and evaluation of a compressed tablet rapidly disintegrating in the oral cavity. Chem Pharm Bull (Tokyo) 1996;44:2121-7.
6. Girish K, Dhiren JP, Shah VD, Prajapati VC. Gums and mucilages: Versatile excipients for pharmaceutical formulations. Asian J Pharm Sci 2009;4:309-32.
7. Qadry JS. Shah CS. Pharmacognosy. Ahmedabad, India: B S Shah Prakashan; 2008.
8. Kokate CK, Purohit AP, Gokhale SB, editors. Pharmacognosy. 22nd ed. India: Nirali Prakashan; 2003. p. 133-66.
9. Prajapati VD, Jani GK, Moradiya NG, Randeria NP. Pharmaceutical applications of various natural gums, mucilages and their modified forms. Carbohydr Polym 2013;92:1685-99.
10. John GL, Declan MD, James EK. The use of agar as a novel filler for monolithic matrices produced using hot melt extrusion. Eur J Pharm Biopharm 2006;64:75-81.
11. Jain NK, Dixit VK. Studies on gums and their derivatives as binding agent. Indian J Pharm Sci 1988;50:113-4.
12. Owen SC, Raymond CR, Paul JS, Paul JW. Handbook of Pharmaceutical Excipients. United Kingdom: Pharmaceutical Press, The American Pharmaceutical Association. 2003. p. 654-6.
13. Odeku OA, Itiola OA. Evaluation of the effects of khaya gum on the mechanical and release properties of paracetamol tablets. Drug Dev Ind Pharm 2003;29:311-20.
14. Kulkarni GT, Gowthamrajan K, Rao GB. Evaluation of binding properties of selected natural mucilages. J Sci Ind Res 2002;61:529-32.
15. Antony PJ, Sanghavi NM. A new disintegrant for pharmaceutical dosage forms. Drug Dev Ind Pharm 1997;23:413-5.
16. Kulkarni GT, Gowthamarajan K, Rao G B, Suresh B. Evaluation of binding properties of *Plantago ovata* and *Trigonella foenum-graecum* mucilages. Indian Drugs 2002;39:422-5.
17. Kulkarni GT, Gowthamarajan K, Satish KM, Suresh B. Gums and Mucilages: Therapeutic and Pharmaceutical Applications. India: NISCAIR-CSIR; 2002. p. 10-7.
18. Jani GK, Shah DP, Jain VC. Evaluating mucilage from *Aloe barbadensis* Miller as a pharmaceutical excipient for sustained-release matrix tablets. Pharm Technol 2007;31:90-8.
19. Patel MM, Chauhan GM, Patel LD. Mucilage of *Lepidium sativum* Linn (Asario) and *Ocimum canum* Sims. (Bavchi) as emulgents. Indian J Hosp Pharm 1987;24:200-2.
20. Canadian Agency for Drugs and Technologies in Health. Essential Oil Products for Disinfection: Clinical Effectiveness, Cost Effectiveness and Guidelines. Ottawa: Canadian Agency for Drugs and Technologies in Health; 2014.
21. Kumar T, Gupta SK, Prajapati MK, Tripathi DK, Sharma V, Jain P. Natural excipients: A review. Asian J Pharm Life Sci 2012;2:97-108.
22. Chatwal GR. Pharmaceutical Inorganic Chemistry. Vol. 1. Bangalore: Himalaya Publishing House; 2010.
23. Kibbe AH. Handbook of Pharmaceutical Excipients. Washington, DC: Pharmaceutical Press; 2000.
24. Hon DN. Cellulose and Its Derivatives: Structures, Reactions and Medical Uses. New York, USA: Marcel Dekker; 1996.
25. Andreopoulos AG, Trantali PA. Study of biopolymers as carriers for controlled release. J Macromol Sci 2002;41:559-78.
26. Conti S, Maggi L, Segale L, Machiste EO, Conte U, Grenier P, *et al*. Matrices containing NaCMC and HPMC 1. Dissolution performance characterization. Int J Pharm 2007;333:136-42.
27. Chen J, Du GC. Environment Friendly Material Production and Application. Beijing: Huaxue Gongye Chubanshe; 2002. p. 46.
28. Tuovinen L, Peltonen S, Jarvinen K. Drug release from starch-acetate films. J Control Release 2003;91:345-54.
29. Banks W, Muir DD. Structure and chemistry of the starch granule. In: Preiss J, editor. The Biochemistry of Plants. Vol. 3. New York: Academic Press; 1980. p. 321-69.