

# PHARMACEUTICAL GUMS

## I. INTRODUCTION TO PHARMACEUTICAL GUMS

Pharmaceutical gums are an important class of excipients used in the formulation of various dosage forms in the pharmaceutical industry. They are versatile additives that provide a wide range of functionalities including thickening, binding, suspending, emulsifying, and stabilizing properties. These properties make pharmaceutical gums essential for the development and manufacture of oral, topical, and parenteral dosage forms. This chapter aims to provide an overview of pharmaceutical gums, their types, properties, and examples of their applications in the pharmaceutical industry.

## II. TYPES OF PHARMACEUTICAL GUMS

**Natural Gums** Natural gums are derived from natural sources such as plants and animals. Examples of commonly used natural gums in the pharmaceutical industry include:

- 1. Acacia Gum:** Acacia gum, also known as gum arabic, is a water-soluble gum derived from the Acacia senegal tree. It is widely used as a binder, emulsifier, and suspending agent in oral dosage forms like tablets, capsules, and syrups.
- 2. Tragacanth Gum:** Tragacanth gum is obtained from the sap of various species of Astragalus plants. It is primarily used as a binder and thickening agent in tablet formulations and as a stabilizer in emulsions.
- 3. Guar Gum:** Guar gum is derived from the seeds of the guar plant (*Cyamopsis tetragonoloba*). It has excellent water-holding capacity and is commonly used as a binder, thickener, and stabilizer in oral dosage forms and topical formulations.
- 4. Xanthan Gum:** Xanthan gum is produced by fermentation of the bacterium *Xanthomonas campestris*. It is a highly efficient thickening and stabilizing agent used in oral suspensions, topical gels, and ophthalmic formulations.
- 5. Synthetic Gums** Synthetic gums are artificially produced polymers that mimic the properties of natural gums. They offer superior consistency, purity, and control over properties compared to natural gums. Examples of synthetic gums used in the pharmaceutical industry include:
  - 6. Hydroxypropyl Methylcellulose (HPMC):** HPMC is a commonly used cellulose derivative that provides excellent film-forming, binding, and mucoadhesive properties. It is widely used in oral solid dosage forms like tablets and capsules, as well as in topical formulations such as creams and gels.
  - 7. Sodium Carboxymethylcellulose (CMC):** CMC is a water-soluble cellulose derivative that is used as a thickening agent, emulsifier, and stabilizer in various pharmaceutical formulations. It is commonly found in oral liquids, ophthalmic solutions, and topical gels.

- 8. Polyvinyl Alcohol (PVA):** PVA is a synthetic polymer that possesses film-forming and thickening properties. It is used in the production of oral films, ophthalmic inserts, and enteric coatings for tablets.

### III. PROPERTIES AND FUNCTIONALITY OF PHARMACEUTICAL GUMS

Pharmaceutical gums offer various properties and functionalities that make them valuable excipients in pharmaceutical formulations. Some of the key properties and functionalities include:

- 1. Thickening and Viscosity-Controlling Properties:** Pharmaceutical gums, such as xanthan gum, HPMC, and CMC, are commonly used as thickening agents to enhance the viscosity and flow properties of liquid formulations. This is important for ensuring proper dispersion and homogeneous distribution of active pharmaceutical ingredients (APIs) in suspensions, emulsions, and gels.
- 2. Binding Properties:** Gums like acacia gum, guar gum, and HPMC are used as binders in tablet formulations to impart cohesiveness and improve tablet hardness. These gums help in maintaining the integrity of tablets and preventing their disintegration or fragmentation.
- 3. Mucoadhesive Properties:** Several pharmaceutical gums, including HPMC and CMC, possess mucoadhesive properties. These gums adhere to the mucosal surfaces, such as the oral cavity or gastrointestinal tract, and prolong the contact time between the dosage form and the mucosa, thereby enhancing drug absorption and bioavailability.
- 4. Emulsifying and Stabilizing Properties:** Gums like tragacanth gum and xanthan gum are used as emulsifiers and stabilizers in emulsion-based formulations. They promote emulsion formation, prevent phase separation, and provide stability to the formulation.  
**Film-Forming Properties:** Gums such as HPMC and PVA possess film-forming properties that can be utilized in the manufacture of drug delivery systems like oral films and topical patches. These films act as a barrier, control drug release, and improve patient compliance.

### IV. APPLICATIONS OF PHARMACEUTICAL GUMS

- 1. Oral Dosage Forms** Pharmaceutical gums find extensive application in oral dosage forms, including tablets, capsules, syrups, and suspensions. They are used as binders, disintegrants, thickeners, taste maskers, and viscosity-modifying agents. For example, HPMC is used as a binder and disintegrant in tablet formulations, while guar gum and xanthan gum are used as suspending agents in oral suspensions.
- 2. Topical Dosage Forms** Gums like HPMC, CMC, and xanthan gum are widely used in topical formulations such as creams, gels, and ointments. They provide viscosity control, stabilization, and emulsification of the formulation. For instance, HPMC is commonly used as a gelling agent in topical gels, while CMC is used as a thickening agent in creams and ointments.
- 3. Ophthalmic Dosage Forms** Pharmaceutical gums are also used in ophthalmic formulations like eye drops and ointments. Gums like xanthan gum and CMC are used as

viscoelastic agents, providing lubrication and improving the retention time of the dosage form on the ocular surface.

4. Parenteral Dosage Forms Gums such as acacia gum and tragacanth gum find application in parenteral formulations as stabilizers and suspending agents. They help maintain the stability and uniform dispersion of particulate APIs within the formulation. For example, acacia gum is used in the preparation of injectable suspensions.

## V. CONCLUSION

Pharmaceutical gums play a crucial role in the formulation and development of various dosage forms in the pharmaceutical industry. They offer a wide range of functionalities, including thickening, binding, emulsification, and stabilization. Natural gums like acacia gum and guar gum, as well as synthetic gums like HPMC and CMC, are extensively used in oral, topical, ophthalmic, and parenteral formulations. The versatility and wide range of applications of pharmaceutical gums make them essential excipients in the pharmaceutical industry, ensuring the safe and effective delivery of medications to patients.