Detailed Study Carbohydrates Containing Drugs

Acacia

Biological Name:

- *Acacia senegal* (L.) Willd.



Synonyms:

- Gum Arabic
- Gum Acacia

Biological Source:

- Acacia is a natural dried gummy exudate obtained from the stems and branches of **Acacia senegal** and other related species of **Acacia** belonging to the family **Fabaceae (Leguminosae)**.

Cultivation, Collection and Method of Preparation:

- **Cultivation:** Acacia is primarily grown in tropical and semi-arid regions including **Sudan, Nigeria, India, and Pakistan**. The tree thrives in sandy soil and arid climates.
- **Collection:** Trees are usually tapped when they are about 5 to 6 years old. Tapping is done by making **deep incisions** in the bark during the dry season.
- **Exudation:** The gum exudes naturally from wounds or from these incisions and hardens upon exposure to air.
- **Harvesting and Preparation:** The gum is collected manually, dried under the sun, sorted, graded, and cleaned to remove impurities such as bark, sand, or insects. It is then broken into tears or granules and packed.

Characteristics:

- **Form:** Occurs in small, rounded or angular tears or fragments
- **Color:** Pale yellow to amber
- **Odor:** Odorless
- **Taste:** Tasteless or slightly sweet and mucilaginous
- **Texture:** Brittle when dry; becomes sticky when chewed
- **Solubility:** Readily soluble in water to form a **viscous colloidal solution**; **insoluble in ethanol**

Chemical Constituents:

- **Complex Polysaccharides**: Primarily composed of **arabin** which yields sugars on hydrolysis such as:
  - **L-arabinose**
  - **D-galactose**
  - **L-rhamnose**
  - **D-glucuronic acid**
- **Mineral elements**: Calcium, potassium, magnesium salts
- **Enzymes**: Oxidases, peroxidases (minor components)
- **Moisture content**: Varies between 10–15%

Identifying Tests:

- **Solubility Test**: Dissolves in water to form a viscous, colloidal solution
- **Lead Subacetate Test**: Produces a white precipitate indicating the presence of gum
- **Molisch's Test**: Positive, indicating carbohydrates
- **Viscosity Test**: 10% solution shows high viscosity
- **Ash Value**: Should not exceed prescribed pharmacopeial limits

Uses:

- **Pharmaceutical Uses**:
  - **Emulsifying agent**: Used in emulsions to stabilize oil and water phases.
  - **Suspending agent**: Used in suspensions to prevent sedimentation.
  - **Binder**: Used in tablets to bind powders.
  - **Demulcent**: Forms a protective layer over mucous membranes, relieving irritation.
- **Other Uses**:
  - In food industry as a stabilizer and thickening agent.
  - In cosmetics and printing industries.
  - Used in microencapsulation techniques.

Tragacanth

Biological Name:

- *Astragalus gummifer* Labill.



Synonyms:

- Gum tragacanth
- Goat's thorn gum
- Shiraz gum

Biological Source:

- Tragacanth is a natural gum obtained by incision from the stem and branches of **Astragalus gummifer** and other species of **Astragalus** (Family: Fabaceae/Leguminosae).

Cultivation, Collection and Method of Preparation:

- **Cultivation**: Native to **Iran, Iraq, and Turkey**, grows in dry, rocky mountainous areas.
- **Collection**: Gum is collected by making **deep incisions** in the bark of the plant, mainly during hot, dry seasons. The exudate comes out as ribbons or flakes.
- **Drying and Preparation**: The gum is air-dried, sorted, and cleaned. It is classified into various grades based on shape and purity (e.g., ribbon form, flake form).

Characteristics:

- **Appearance**: Thin, flattened ribbons, flakes, or vermiform shapes
- **Color**: Whitish or pale yellow
- **Taste**: Tasteless
- **Odor**: Odorless
- **Solubility**: Partially soluble in water
    - Contains two fractions:
        - **Tragacanthin**: Water-soluble part
        - **Bassorin**: Swells in water but is not soluble

Chemical Constituents:

- **Complex acidic polysaccharides**:
    - **Tragacanthin**: Soluble, colloidal component
    - **Bassorin**: Insoluble component that swells in water
- Monosaccharides on hydrolysis: **Galacturonic acid**, **Xylose**, **Arabinose**, **Fucose**

- Contains about **60–70% bassorin** and **30–40% tragacanthin**

Identifying Tests:

- **Swelling Test**: Swells several times its original volume in water
- **Molisch's Test**: Positive
- **Acid Hydrolysis**: Yields galacturonic acid and other sugars
- **No blue coloration with iodine** (distinguishing from starch)

Uses:

- **Pharmaceutical Uses**:
  - **Demulcent**: Soothes mucous membranes
  - **Laxative**: Bulk-forming due to swelling property
  - **Emulsifying agent**: Forms stable emulsions
  - **Suspending agent**: Used in suspensions to maintain uniform distribution of particles
  - **Tablet binder**: Useful in dry granulation techniques
- **Other Uses**:
  - Used in cosmetics, textile and food industry
  - In bacteriological media

Starch

Biological Name:

- **Maize starch**: *Zea mays* L.
- **Potato starch**: *Solanum tuberosum* L.



Synonyms:

- Amylum
- Corn starch (from *Zea mays*)
- Potato starch (from *Solanum tuberosum*)

Biological Source:

- Starch is a polysaccharide reserve food material obtained from the seeds (maize/corn) or tubers (potato) of various plants. It is a **plant storage carbohydrate**, mainly obtained from **maize** and **potato**.

Cultivation, Collection and Method of Preparation:

- **Cultivation**: Maize and potatoes are widely cultivated in countries like the USA, India, China, and Europe.
- **Collection and Preparation**:
  - Maize seeds or potato tubers are harvested, cleaned, and macerated in water.
  - The slurry is sieved to separate starch from fiber.
  - The starch settles, is washed, dried, and powdered.
  - The final product is stored in moisture-proof containers.

Characteristics:

- **Appearance**: White, fine, odorless powder
- **Taste**: Tasteless
- **Solubility**: Insoluble in cold water and ethanol
- **Microscopy**:
  - Granules have characteristic **hilum** (central point) and **concentric striations**
  - Potato starch: Large oval granules
  - Maize starch: Polygonal or angular granules

Chemical Constituents:

- **Polysaccharides**:
  - **Amylose** (20–25%): Linear polymer of α-1,4-glucose
  - **Amylopectin** (75–80%): Branched polymer with α-1,4 and α-1,6-glucose linkages
- Contains moisture and traces of protein and fat

Identifying Tests:

- **Iodine Test**:
  - Blue color with amylose (indicates starch)
- **Microscopic Test**:
  - Identification of granules with specific morphology
- **Solubility Test**:
  - Swells in hot water forming a thick paste
- **Molisch's Test**: Positive for carbohydrates

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