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PHARMACOGNOSY AND PHYTOCHEMISTRY - II

UNIT 2

TOPIC :

- **Resins :** Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony



Resins

- Resins are solid or semi-solid amorphous plant exudates that are insoluble in water but soluble in organic solvents such as alcohol, ether, and chloroform.
They are complex mixtures of various oxidized terpenes or their derivatives, formed by oxidation or polymerization of essential oils.
- “Resins are amorphous, non-crystalline plant products obtained from plant exudations or after oxidation of volatile oils.”

General Characteristics

- Amorphous (non-crystalline) solids or semi-solids.
- Insoluble in water, but soluble in alcohol, ether, chloroform, and oils.
- Brittle and break easily when dry.
- Burn with smoky flame and aromatic odor.
- Softened by heat and become sticky.
- Often occur mixed with essential oils, gums, or balsams.
- Have characteristic odor and taste depending on plant source.

Classification of Resins

Resins are classified in several ways — based on source, composition, formation, and chemical nature.

A. Based on Origin

1. Natural Resins:
Obtained directly from plants.
☞ *Example:* Colophony, Shellac, Benzoin.
2. Artificial (Prepared) Resins:
Obtained by chemical modification or polymerization of natural resins or volatile oils.
☞ *Example:* Resin from oxidation of turpentine oil.

B. Based on Occurrence

1. Exudate Resins:
Obtained as natural exudations from plant bark or wood.
☞ *Example:* Benzoin, Myrrh, Asafoetida.

2. Extracted Resins:

Obtained by extracting plant parts with solvents.

☐ *Example:* Jalap resin, Podophyllum resin.

Benzoin

- Common Name: Benzoin, Gum Benzoin, Benjamin
- Botanical Source: *Styrax benzoin* Dryand. and *Styrax tonkinensis* (also known as Siam benzoin)
- Family: Styracaceae
- Part Used: Balsamic resin (obtained from the bark)
- Description:
 - Benzoin is a balsamic resin obtained from the bark of *Styrax* trees.
 - It occurs as brownish, brittle lumps with a pleasant aromatic odor when burned.
 - It is used in pharmacy, perfumery, and incense preparations.
- Significance:
 - Valued for its fragrance, antiseptic, and expectorant properties.
 - Used in medicinal and aromatic preparations since ancient times.



Composition

- Major Active Constituents:
 - Benzoin or benzoic acid esters
 - Free acids: Benzoic acid and cinnamic acid
 - Esters: Benzyl benzoate, benzyl cinnamate
 - Resin acids: Sumatra resin acids
 - Vanillin and styrene (traces) – responsible for aroma
- Siam Benzoin: Contains benzoic acid mainly.
- Sumatra Benzoin: Contains both benzoic acid and cinnamic acid.

Chemistry & Chemical Classes

- Chemical Class:
 - Balsamic resins (mixture of resin acids, esters, and aromatic compounds).
- Important Chemical Compounds:
 - Benzoic acid (C_6H_5COOH) – antiseptic and preservative.
 - Cinnamic acid ($C_6H_5CH=CHCOOH$) – aromatic and antiseptic.
 - Benzyl benzoate – used as expectorant and antiparasitic.

- **Properties:**
 - Brittle, brownish resin with pleasant balsamic odor.
 - Soluble in alcohol, ether, and fixed oils; partly soluble in water.

Biosources

- **Biological Source:**
 - Dried balsamic resin obtained by incision from *Styrax benzoin* (Sumatra Benzoin) and *Styrax tonkinensis* (Siam Benzoin).
- **Collection:**
 - Incisions are made in the bark of the tree.
 - The exuded resin hardens and is collected after drying.
- **Distribution:**
 - Native to Sumatra, Java, Thailand, and Laos.
 - Cultivated in Southeast Asia and tropical regions.

Therapeutic Uses

- **Antiseptic and Antimicrobial:**
 - Used externally for skin infections and wounds.
- **Expectorant:**
 - Helps in cough and bronchitis by loosening mucus.
- **Anti-inflammatory:**
 - Reduces inflammation in the throat and lungs.
- **Fragrant and Soothing Agent:**
 - Used in inhalations and balms for respiratory relief.
- **Aromatic:**
 - Used in incense and perfumes for its pleasant smell.
- **Mild preservative:**
 - Acts as a natural preservative in ointments and lotions.

Commercial Applications

- **Pharmaceutical Uses:**
 - Ingredient in Benzoin tincture, Compound Benzoin tincture, and Friar's Balsam — used as antiseptic and inhalant.
 - Used in lotions, cough preparations, and skin creams.
- **Perfumery and Cosmetics:**
 - Used in perfumes, incense sticks, and scented candles due to its sweet aroma.

- **Industrial Uses:**
 - Used as flavoring and fragrance fixative in the perfume industry.
- **Traditional Uses:**
 - Burned as incense in temples and used in aromatherapy.

Guggul



- Common Name: Guggul, Indian Bdellium, Gum Guggul
- Botanical Name: *Commiphora mukul* (Burseraceae)
- Family: Burseraceae
- Part Used: Oleo-gum-resin (the exudate from the stem bark)
- Description:
 - Guggul is a small thorny tree or shrub found in arid and semi-arid regions of India.
 - When the bark is incised, a yellowish-brown resin exudes, which hardens on exposure to air.
 - The dried resin has a pleasant aromatic odor and bitter taste.
- Significance:
 - Guggul is an important Ayurvedic drug used for arthritis, obesity, high cholesterol, and inflammation.

Composition

- Major Active Constituents:
 - Guggulsterones (E & Z) – the main bioactive steroidal compounds.
 - Essential oils (myrrh-like aroma) – contain α -pinene, myrcene, limonene, cadinene.
 - Resins (30–40%) – contain commiphoric acids and commiphorolic acids.
 - Gums (20–25%) – composed of arabinoses, galactoses, and glucuronic acid.
 - Sterols and diterpenes – contribute to therapeutic properties.

Chemistry & Chemical Classes

- **Chemical Class:**
 - Oleo-gum-resins (mixture of volatile oils, resins, and gums).
 - Steroidal compounds – Guggulsterones.
- **Important Chemical Compounds:**

- Guggulsterone E & Z (C₂₁H₂₈O₂) – responsible for lipid-lowering and anti-inflammatory effects.
- α-Pinene, Myrcene, Limonene – volatile terpenes giving aroma.
- Commiphoric acids – resin acids.
- **Properties:**
 - Yellowish-brown, aromatic, sticky resin that hardens on drying.
 - Soluble in alcohol and partially in water.
 - Has a balsamic, slightly bitter taste.

Biosources

- **Biological Source:**
 - Oleo-gum-resin obtained from the bark of *Commiphora mukul* Engl.
- **Cultivation and Distribution:**
 - Found in India, Bangladesh, Pakistan, and Arabia.
 - In India, it grows mainly in Rajasthan, Gujarat, and Madhya Pradesh.
- **Collection:**
 - The bark is tapped by making incisions, and the exudate is collected after drying (about 2–3 weeks).
 - The collected resin is purified before medicinal use.

Therapeutic Uses

- **Hypolipidemic (Cholesterol-lowering):**
 - Reduces serum cholesterol and triglyceride levels.
- **Anti-inflammatory:**
 - Used in arthritis, rheumatism, and joint pain.
- **Antioxidant:**
 - Protects body tissues from oxidative damage.
- **Anti-obesity:**
 - Enhances metabolism and helps in weight reduction.
- **Other uses:**
 - Used for skin diseases, wounds, and ulcers.

Commercial Applications

- **Pharmaceutical Uses:**

- Used in Ayurvedic formulations like “Yograj Guggul,” “Triphala Guggul,” “Kaishore Guggul,” etc.
- Incorporated into capsules, tablets, and powders for cholesterol and weight control.

Ginger



- Common Name: Ginger
- Botanical Name: *Zingiber officinale* Roscoe
- Family: Zingiberaceae
- Part Used: Rhizome (underground stem)
- Description:
 - Ginger is a perennial herb cultivated widely for its aromatic rhizome.
 - It is thick, branched, and yellowish-brown in color with a characteristic spicy odor and taste.
 - It is one of the oldest and most commonly used spices and medicinal herbs in the world.
- Significance:
 - Used in food flavoring, traditional medicine, and pharmaceuticals for its digestive, antiemetic, and anti-inflammatory properties.

Composition

- Major Active Constituents:
 - Volatile oils (1–3%) – responsible for aroma and flavor.
 - Oleoresins – responsible for pungent taste and therapeutic activity.
- Important Compounds:
 - Gingerols (especially [6]-gingerol) – main bioactive compound with anti-inflammatory and antioxidant effects.
 - Shogaols – formed from gingerols on drying or heating.
 - Zingerone – formed during cooking; gives sweet aroma.
 - Essential oils: Zingiberene, β -bisabolene, cineole, citral, and borneol.

- Resins, starch, and fibers are also present.

Chemistry & Chemical Classes

- **Chemical Class:**
 - Volatile oil components (terpenes and sesquiterpenes).
 - Phenolic compounds – gingerols, shogaols, zingerone.
- **Important Chemical Compounds:**
 - [6]-Gingerol: $C_{17}H_{26}O_4$ – main pungent principle.
 - [6]-Shogaol: $C_{17}H_{24}O_3$ – more potent antioxidant than gingerol.
 - Zingerone: $C_{11}H_{14}O_3$ – formed by cooking or drying.
- **Properties:**
 - Light brown rhizome with fibrous texture.
 - Aromatic and spicy in odor and taste.
 - Soluble in alcohol and ether.

Biosources

- **Biological Source:**
 - Dried or fresh rhizomes of *Zingiber officinale* Roscoe.
- **Cultivation and Distribution:**
 - Cultivated in India, China, Indonesia, Jamaica, and Nigeria.
 - In India, mainly grown in Kerala, Karnataka, Meghalaya, and Assam.
- **Collection:**
 - Rhizomes are harvested after 8–10 months of planting, washed, and dried in the sun.

Therapeutic Uses

- **Digestive aid:**
 - Stimulates digestive enzymes, relieves indigestion and bloating.
- **Antiemetic:**
 - Prevents nausea and vomiting, especially in motion sickness and pregnancy.
- **Anti-inflammatory:**
 - Reduces inflammation and pain in arthritis and muscle soreness.
- **Antioxidant:**
 - Protects body cells from oxidative damage.

Commercial Applications

- **Pharmaceutical Uses:**

- Used in digestive tonics, syrups, cough preparations, and herbal formulations.
- Incorporated into capsules, teas, and tablets as a natural remedy for nausea and pain.

- **Food Industry:**

- Used as a spice and flavoring agent in cooking, bakery, confectionery, and beverages.

Asafoetida



- Common Names: Asafoetida, Hing, Devil's dung
- Botanical Name: *Ferula asafoetida* Linn.
- Family: Apiaceae (Umbelliferae)
- Part Used: Dried latex (oleo-gum-resin) obtained from the root and rhizome.
- Description:
 - Asafoetida is a gum-resin obtained by cutting the rhizome or taproot of the plant.
 - It has a strong, unpleasant odor (similar to garlic) and a bitter, acrid taste.
- Significance:
 - Used both as a spice and medicine.
 - Known for its carminative, antispasmodic, and expectorant properties.

Composition

- Major Active Constituents:
 - Oleo-gum-resin composed of:
 - Resin (40–60%)
 - Gum (20–25%)
 - Volatile oil (10–17%)
- Important Chemical Compounds:
 - Ferulic acid – antioxidant and antimicrobial.
 - Asaresinotannols (A and B) – main resinous components.
 - Volatile oil components: Mainly disulfides (responsible for strong odor).

- Other compounds: Umbelliferone, vanillin, and other coumarins.

Chemistry & Chemical Classes

- **Chemical Class:**
 - Oleo-gum-resin containing sulfur compounds and coumarins.
- **Major Constituents:**
 - Volatile oil: Rich in organic sulfur compounds like 2-butyl-1-propenyl disulfide.
 - Resin: Contains asoresinotannols (phenolic compounds).
 - Gum: Contains arabinose, galactose, and rhamnose.
- **Properties:**
 - Pale yellow or brown mass with characteristic strong odor.
 - Soluble in alcohol and partially in water.

Biosources

- **Biological Source:**
 - Dried latex obtained by incision from the rhizome and root of *Ferula asafoetida* Linn.
- **Cultivation and Distribution:**
 - Grows in Iran, Afghanistan, and Pakistan.
 - Imported into India mainly through Afghanistan.
 - Belongs to temperate and dry regions.
- **Collection:**
 - The rhizome is cut during spring, and the exuding latex is collected and dried.

Therapeutic Uses

- **Carminative:**
 - Relieves flatulence, bloating, and stomach discomfort.
- **Antispasmodic:**
 - Used in intestinal colic and spasmodic disorders.
- **Expectorant:**
 - Helps in loosening phlegm in respiratory conditions like bronchitis and asthma.
- **Antimicrobial:**
 - Inhibits bacterial and fungal growth.

Commercial Applications

- **Pharmaceutical Uses:**
 - Used in carminative mixtures, digestive tonics, and cough syrups.
 - Also used in Ayurvedic and Unani medicines as a digestive and expectorant.
- **Food Industry:**
 - Used as a flavoring agent and condiment in Indian cooking (especially lentil dishes and pickles).
- **Other Uses:**
 - Used in perfumery in very small amounts

Myrrh



- Common Name: Myrrh
- Botanical Name: *Commiphora molmol* (also known as *Commiphora myrrha*)
- Family: Burseraceae
- Part Used: Oleo-gum-resin obtained from the bark of the tree.
- Description:
 - Myrrh is a natural gum-resin that oozes from cuts made in the bark of small thorny trees.
 - It is yellowish-brown to reddish-brown in color, with a bitter, aromatic taste and a strong balsamic odor.
 - When burned, it gives off a pleasant fragrance.
- Significance:
 - Used since ancient times as a medicine, perfume, and incense.
 - Mentioned in traditional medicine systems for its healing and antiseptic properties.

Composition

- **Main Active Constituents:**
 - Oleo-gum-resin consisting of:
 - Resin (25-40%)
 - Gum (40-60%)
 - Volatile oil (3-8%)

- **Important Chemical Compounds:**

- Resin acids: Commiphoric acid, heerabolene, and α -, β -, and γ -commiphoric acids.
- Volatile oils: Contain sesquiterpenes (curzerene, lindestrene, furanoeudesma-1,3-diene).
- Gum: Contains arabinose, galactose, and uronic acids.
- Other Components: Steroids, lignans, and bitter principles.

Chemistry & Chemical Classes

- **Chemical Class:**

- Oleo-gum-resin containing terpenoids and sesquiterpenes.

- **Main Constituents:**

- Volatile oil: Gives aroma and antiseptic activity.
- Resin acids and esters: Responsible for anti-inflammatory and wound-healing properties.
- Gum: Provides adhesive and demulcent effects.

- **Properties:**

- Amorphous, brittle mass; breaks with a glossy fracture.
- Insoluble in water, but soluble in alcohol and ether.
- Burns with a pleasant aromatic odor.

Biosources

- **Biological Source:**

- Oleo-gum-resin obtained from the stem bark of *Commiphora molmol* and related species.

- **Cultivation and Distribution:**

- Grows in arid regions of Somalia, Ethiopia, Yemen, and Arabia.
- India imports myrrh mainly from Somalia and Yemen.

- **Collection:**

- The bark is cut or tapped, and the exuded resin is collected and dried in the sun.

Therapeutic Uses

- **Antiseptic and Antimicrobial:**
 - Used for mouth infections, ulcers, and wounds.
- **Astringent and Anti-inflammatory:**
 - Reduces inflammation and helps in wound healing.
- **Expectorant:**
 - Used in cough and bronchial congestion.
- **Carminative and Digestive:**
 - Improves digestion and relieves flatulence.
- **Analgesic:**
 - Helps in relieving pain and sore throat.
- **Emmenagogue:**
 - Promotes menstrual flow.
- **Topical Uses:**
 - Used in mouthwashes, gargles, and tooth powders for oral health.

Commercial Applications

- **Pharmaceutical Uses:**
 - Used in toothpastes, mouthwashes, and antiseptic lotions.
 - Incorporated in ointment and tincture preparations for wounds and ulcers.
- **Traditional Medicine:**
 - Used in Ayurvedic, Unani, and Chinese medicine for inflammation, mouth ulcers, and wound healing.
- **Cosmetic and Perfumery Uses:**
 - Used in incense sticks, perfumes, and aromatic oils.
- **Other Uses:**
 - Used as an ingredient in religious and cultural rituals for its fragrance.
- **Formulations:**
 - Found in Tincture of Myrrh and Myrrh Mouthwash preparations

Colophony

- Common Name: Colophony, Rosin
- Botanical Source: Obtained from the resin of *Pinus* species (pine trees).
- Family: Pinaceae
- Part Used: The oleoresin (resin and essential oil) obtained from the trunk of pine trees.
- Description:
 - Colophony is a solid residue left after distilling off the volatile oil (turpentine) from the oleoresin of pine trees.
 - It is brittle, glassy, and translucent with a yellow to brown color and a faint pine-like odor.
- Significance:
 - Used widely in pharmaceuticals, varnishes, soaps, and adhesives.
 - Known for its binding and stiffening properties.

Composition

- **Main Constituents:**
 - Resin acids (about 90%) – mainly abietic acid and related compounds.
 - Neutral compounds (about 10%) – like resenes.
- **Important Chemical Compounds:**
 - Abietic acid – main resin acid responsible for adhesive and stiffening properties.
 - Pimaric acid, Sylvic acid, and Dehydroabietic acid – other minor acids.
- **Other Components:**
 - Traces of volatile oil (turpentine) and resin alcohols.

Chemistry & Chemical Classes

- **Chemical Class:**
 - Oleoresin containing resin acids (mainly diterpenes).
- **Chemical Nature:**



- Resin acids are diterpenoid carboxylic acids.
- Abietic acid ($C_{20}H_{30}O_2$) is the principal compound.
- **Properties:**
 - Solid, brittle, glassy mass, yellow to brown in color.
 - Insoluble in water, but soluble in alcohol, ether, chloroform, and oils.
 - Softens when heated and burns with a smoky flame.

Biosources

- **Biological Source:**
 - Obtained from the oleoresin (turpentine) of *Pinus* species such as:
 - *Pinus palustris* (Longleaf Pine)
 - *Pinus pinaster*
 - *Pinus roxburghii* (Indian Chir Pine)
- **Collection and Preparation:**
 - The bark of pine trees is cut to obtain the oleoresin (crude turpentine).
 - This oleoresin is distilled – volatile oil (turpentine oil) is removed, leaving colophony as the solid residue.
- **Distribution:**
 - Widely produced in India, the USA, France, and Portugal.
 - In India, *Pinus roxburghii* is the main source.

Therapeutic Uses

- **Pharmaceutical Uses:**
 - Plaster base: Used in adhesive plasters and ointments for external application.
 - Emulsifying agent and coating material in pharmaceutical formulations.
 - Used in preparation of pills and tablets as a binding agent.
- **Medicinal Uses:**
 - Used externally as a mild stimulant and rubefacient (increasing blood flow).

- Has antiseptic and sealing properties for wounds.

Commercial Applications

- **Industrial Uses:**

- Used in varnishes, soaps, paints, polishes, adhesives, sealing wax, and paper sizing.
- In music, used to rub on violin and cello bows to provide friction.

- **Pharmaceutical Uses:**

- Used in cerates, plasters, and ointments as a base material.
- Present in “Burgundy pitch plaster” and “Lead plaster” preparations.

- **Other Applications:**

- Used in the manufacture of synthetic resins, inks, and rubber compounds.
- In Ayurveda, sometimes used as a protective or sealing agent on wounds.

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