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PHARMACOGNOSY AND PHYTOCHEMISTRY – I

UNIT 5

TOPIC :

- **Lipids(Waxes, fats, fixed oils) :** Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax

Lipids

Lipids are a heterogeneous group of naturally occurring organic compounds that are insoluble in water but soluble in non-polar organic solvents like ether, chloroform, benzene, and alcohol.

They include fats, oils, waxes, phospholipids, glycolipids, and steroids, and play crucial roles in energy storage, cell structure, and biological regulation.

General Characteristics of Lipids

1. Insoluble in water but soluble in organic solvents.
2. Contain carbon, hydrogen, and oxygen; some also contain phosphorus, nitrogen, and sulfur.
3. Can be hydrolyzed (simple and compound lipids) or non-hydrolyzable (derived lipids like steroids).
4. Serve as an energy source (yield ~9 kcal/g).
5. Important components of cell membranes and hormones.

Castor Oil

Biological Source:

- Fixed oil obtained from the seeds of Ricinus communis
- **Family:** Euphorbiacea

Preparation / Extraction:

1. Seeds are cleaned, dehulled, and dried.
2. Oil is extracted by cold pressing or solvent extraction.
3. The crude oil is filtered and clarified.
4. Sometimes gently heated to remove toxic constituents (like ricin protein).
5. Finally, settled and refined to obtain clear, pale yellow viscous oil.

Evaluation:

1. Physical Tests:

- **Appearance:** Pale yellow, viscous liquid
- **Odor:** Odorless or faint, slightly nauseating smell
- **Taste:** Bland, slightly acrid
- **Solubility:** Soluble in alcohol, ether, chloroform; insoluble in water

2. Chemical Tests:

- **Saponification value:** 176–187
- **Iodine value:** 82–90 (indicates high unsaturation due to ricinoleic acid)
- **Acid value:** ≤ 20
- **Viscosity:** High, due to the presence of hydroxylated fatty acid (ricinoleic acid ~85–90%)

3. Identity Tests:

- Does not dry on exposure to air (non-drying oil)
- Produces a soap with alkali (saponification test)

Storage:

- Store in well-closed containers, protected from light and heat
- Keep in a cool, dry place to prevent rancidity
- Avoid contamination with moisture

Therapeutic and Pharmaceutical Uses:

- **Purgative/Laxative:** Stimulates bowel movements (due to ricinoleic acid)
- **Emollient:** Soothes skin disorders, burns, wounds
- **Vehicle:** Used for eye drops, liniments, and topical medicines
- **Cosmetics & Ointments:** Ingredient in creams, lotions, and hair oils
- **Industrial Uses:** In manufacture of lubricants, soaps, and paints
- **Obstetric Use:** Traditionally used to induce labor (under medical supervision)

Chaulmoogra Oil

Biological Source:

- Fixed oil obtained from the seeds of Hydnocarpus wightiana, *Hydnocarpus anthelmintica*, or related species.
- Family: Flacourtiaceae

Preparation / Extraction:

1. Seeds are collected, dried, and decorticated.
2. Kernels are crushed and pressed to obtain crude oil.
3. Oil is then filtered, clarified, and sometimes refined to remove impurities.
4. Final product is a pale yellow to brown, viscous oil.

Evaluation:

1. Physical Tests:

- **Appearance:** Pale yellow to brown, thick, viscous liquid
- **Odor:** Slight, characteristic unpleasant odor
- **Taste:** Bitter
- **Solubility:** Insoluble in water; miscible with chloroform and ether

2. Chemical Tests:

- **Saponification value:** ~210–220
- **Iodine value:** 85–95
- **Characteristic test:** On heating with alkali, forms a solid soap due to presence of cyclic fatty acids.

3. Composition:

- Contains **cyclopentenyl fatty acids** such as:
  - Hydnocarpic acid
  - Chaulmoogric acid
  - Gynocardic acid

Storage:

- Store in well-closed, light-resistant containers.
- Keep in a cool, dry place away from sunlight.
- Protect from rancidity and thickening.

Therapeutic and Pharmaceutical Uses:

- **Leprosy treatment (historical):** Earlier used in treatment of **Hansen's disease (leprosy)** before sulfone drugs.
- **Skin diseases:** Used in eczema, psoriasis, and scrofula.
- **Anti-microbial:** Shows activity against certain fungal and bacterial infections.
- **Traditional medicine:** Used in Ayurvedic and Unani formulations as a **blood purifier and tonic**.
- **Now mostly of historical importance**, as modern drugs have replaced it

Wool Fat (Lanolin)

Biological Source:

- Wool fat (commonly called Lanolin) is obtained from the sebaceous secretion of the wool of sheep, *Ovis aries*.
- Family: Bovidae

Preparation / Extraction:

1. Raw wool is washed with hot detergent solution to remove the natural grease.
2. The wash water is processed, and the grease is separated by centrifugation.
3. The separated substance is purified and dehydrated to yield anhydrous lanolin (wool fat).
4. Sometimes further bleached and deodorized for pharmaceutical and cosmetic use.

Evaluation:

1. Physical Tests:

- **Appearance:** Yellowish, soft, sticky, ointment-like mass
- **Odor:** Slight, characteristic
- **Taste:** Bland, greasy
- **Solubility:** Insoluble in water; soluble in chloroform, ether, and warm alcohol

2. Chemical Properties:

- Mainly contains esters of high molecular weight alcohols (like cholesterol, isocholesterol, lanosterol) with fatty acids.
- Does not become rancid easily due to presence of antioxidants.
- Water-absorption test: Can absorb up to twice its weight of water, forming a stable emulsion (important identification property).

Storage:

- Store in well-closed containers, protected from heat and light.
- Should be kept in a cool, dry place.
- Must be free from excess moisture to prevent microbial growth.

Therapeutic and Pharmaceutical Uses:

- **Emollient:** Softens and soothes dry, rough skin.
- **Ointment Base:** Used as a vehicle in creams, ointments, and cosmetic products.
- **Protective:** Forms a protective film on skin (useful in eczema, burns, and chapped skin).
- **Absorption Base:** Used in pharmaceutical preparations due to its ability to absorb water.
- **Cosmetics:** Widely used in lip balms, moisturizers, hair conditioners.

Beeswax

Biological Source:

- Beeswax is a purified secretion from the honeycomb of the hive bee, *Apis mellifera*.
- It is secreted by wax glands present on the underside of the bee's abdomen.
- Family: Apidae

Preparation / Extraction:

1. Honeycombs are collected after removing honey.
2. Combs are melted in boiling water; wax floats on the surface.
3. The wax is collected, cooled, and solidified.
4. It is then filtered and purified by bleaching or treatment with chemicals (e.g., potassium dichromate).
5. Two types are obtained:
    - Yellow beeswax: Crude, natural wax.
    - White beeswax: Purified and bleached form used in pharmaceuticals.

Evaluation:

1. Physical Tests:

- **Appearance:** Yellow to white, solid, brittle mass (depending on purity).
- **Odor:** Characteristic honey-like odor.
- **Taste:** Bland, slightly sweet.
- **Solubility:** Insoluble in water; soluble in chloroform, ether, fixed and volatile oils.
- **Melting Point:** 62–65 °C.

2. Chemical Tests:

- **Constituents:**
  - Esters of fatty acids and alcohols (mainly myricyl palmitate).
  - Free fatty acids and hydrocarbons.
- **Saponification value:** 87–104.
- **Acid value:** 17–24.
- **Identification test:** Melts to form a transparent liquid; burns with a bright flame without residue.

Storage:

- Store in well-closed containers, protected from light.
- Keep in a cool, dry place, away from excessive heat.
- Protect from microbial contamination and adulteration.

Therapeutic and Pharmaceutical Uses:

- **Pharmaceutical Base:** Used in ointments, creams, and suppositories.
- **Stiffening Agent:** Added to creams, ointments, lipsticks, and cosmetics to give consistency.
- **Protective:** Provides a barrier effect on skin (used in wound healing, lip balms).
- **Polishing Agent:** Used in dental, furniture, and leather polishes.
- **Food Industry:** Used as a coating agent (E901).