

# PHARMACOGNOSY-I

## UNIT 4 NOTES

### VARIOUS SYSTEM OF MEDICINES

- ALLOPATHY
- UNANI
- SIDDHA
- HOMEOPATHY
- AYURVEDA
- CHINESE

### SECONDARY METABOLITES

- ALKALOIDS
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# PHARMACOGNOSY IN VARIOUS SYSTEM OF MEDICINE

## ALLOPATHIC SYSTEM OF MEDICINE

- The Allopathic system of medicine is the conventional, modern medical system that treats diseases by using drugs or other interventions to produce effects opposite to the symptoms.
- The term "Allopathy" was introduced by Samuel Hahnemann to describe the standard medical practices of his time, where opposite cures opposite.
  - In simple terms: Allopathy aims to combat disease symptoms using medications, surgery, or radiation based on scientific research and clinical trials.

### KEY CHARACTERISTICS

#### ① Scientific and Evidence - Based

- Follows research - based treatments and protocols.
- Treatments are based on clinical trials, pharmacology, pathology, and diagnostics.

## ② Symptom - Oriented Approach

- Treat symptoms or underlying causes using drugs that oppose the disease effect.
- Examples: Antipyretics reduce fever ; antibiotics kill bacteria.

## ③ Use of Synthetic and natural drugs

- Medication can be synthetic or derived from natural sources (like plants , animals, minerals).
- Purified and standardized for dose, safety and efficacy.

## ④ Curative and Emergency - Oriented

- Emphasizes quick relief and cure.
- Most effective in acute conditions (eg., infections, trauma, surgeries).

## ⑤ Involves Specialization

Includes various branches : Cardiology , Neurology , Dermatology , Psychiatry , Pediatrics etc.

## ⑥ Technology - Driven

Uses advanced tools like MRI , CT scans , laproscopic surgery , robotic systems , etc.

## RELEVANCE IN PHARMACOLOGY

In pharmacognosy (the study of medicines from natural sources), allopathic medicine is important because:

- Many modern allopathic drugs are derived from plants.
- Pharmacognosy provides the basis of drug discovery in allopathy.

Example:

- Morphine from *Papaver somniferum*.
- Quinine from *Cinchona* bark.
- Digoxin from *Digitalis purpurea*.

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# INDIAN SYSTEM OF MEDICINES

- Indian systems of medicine refer to the traditional medical practices that originated and evolved in India over thousand of years.
- These systems are deeply rooted in Indian philosophy, culture, and history and are aimed at promoting holistic health — encompassing the body, mind and spirit.
- The major recognized Indian systems of Medicine include:

## ① Ayurveda

Meaning "science of life", Ayurveda is based on balancing the body's three doshas (Vata, Pitta and Kapha) through diet, herbal remedies, lifestyle changes and detoxification.

## ② Siddha

One of the oldest systems, practiced mainly in South India, especially Tamilnadu, it emphasizes the use of herbs, minerals, and yogic practices.

## ③ Unani

Derived from Greek medicine and developed in India under Islamic influence, it focuses on the balance of bodily humors (blood, phlegm, yellow bile, and black bile) for health.

#### ④ Yoga and Naturopathy

Yoga involves physical postures, breathing exercises, and meditation for physical and mental well-being.

Naturopathy relies on natural elements like water, air, diet and lifestyle to maintain health and treat diseases.

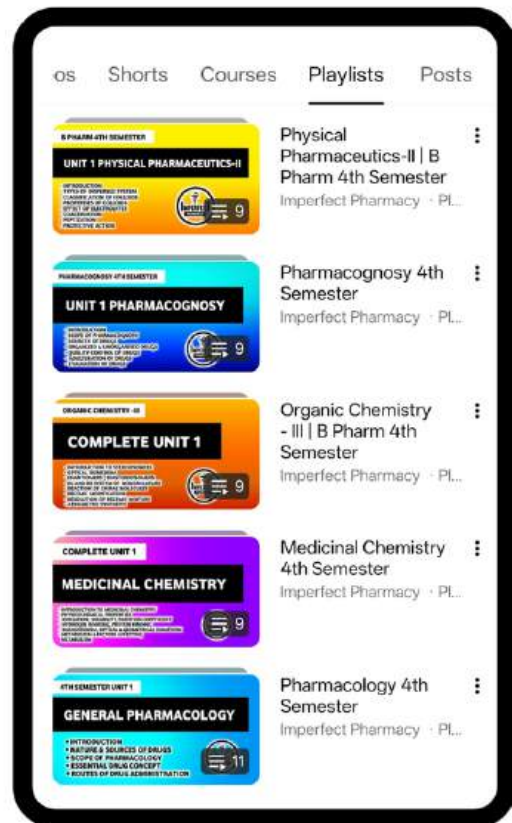
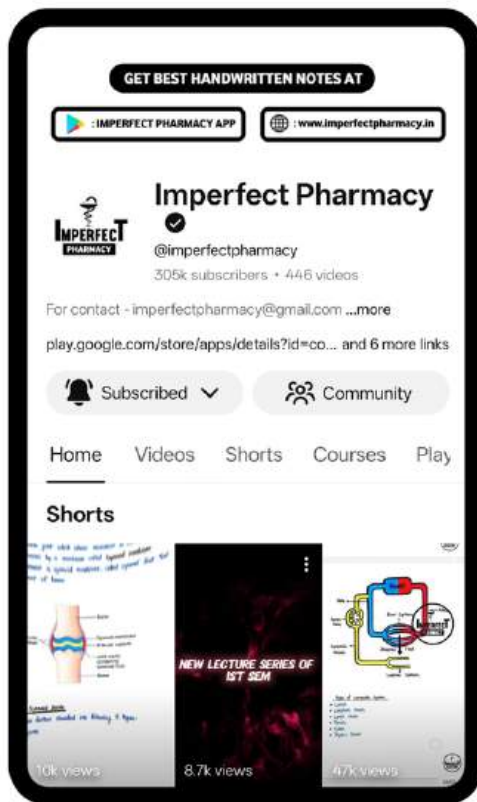
#### ⑤ Homeopathy

Though a European origin, it has been widely practiced in India and is officially recognized, it uses highly diluted substances to trigger the body's natural healing response.

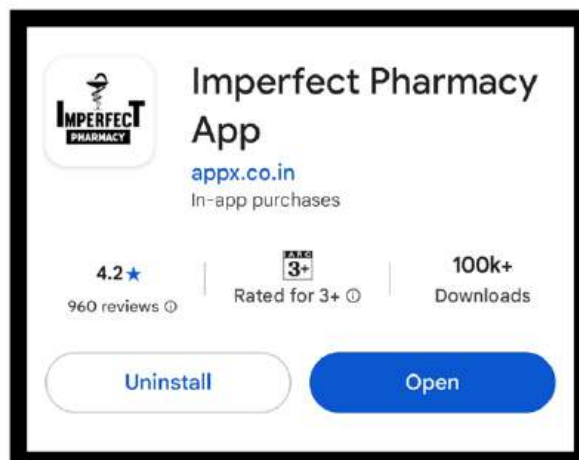
#### ADMINISTRATION

- In India, these systems are regulated and promoted by the Ministry of AYUSH, which stands for:
  - A - Ayurveda
  - Y - Yoga & Naturopathy
  - U - Unani
  - S - Siddha
  - H - Homeopathy
- These systems are increasingly being integrated with modern healthcare approaches for preventive and promotive health care.

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## AYURVEDIC SYSTEM OF MEDICINE

- Ayurveda meaning "Science of Life" (from the Sanskrit words Ayur = Life and Veda = knowledge), is one of the world's oldest holistic healing systems, developed in India over 5,000 years ago.
- It is a traditional system of medicine that focuses on preventing and treating illness through lifestyle practices and natural therapies that aim to balance the body, mind and spirit.

### PRINCIPLE OF AYURVEDA

Ayurveda is based on following principles:

#### ① Panchamahabhuta (five elements)

- Ayurveda believes that all matter (including the human body) is composed of five basic elements:
  - Akasha (Ether / Space)
  - Vayu (Air)
  - Agni (Fire)
  - Jala (Water)
  - Prithvi (Earth)
- These elements combine in various ways to form the Tridoshas.



## ② Tridosha Theory (Three Biological Energies)

The body is governed by three fundamental energies or "doshas".

| DOSHA | ELEMENTS      | FUNCTIONS                                   |
|-------|---------------|---------------------------------------------|
| Vata  | Air + Ether   | Movement, Breathing, circulation, nervous   |
| Pitta | Fire + Ether  | Digestion, Metabolism, Heat regulation      |
| Kapha | Water + Earth | Structure, Lubrication, Stability, Immunity |

## ③ Prakriti (Body Constitution)

- Every individual has a unique combination of the three doshas, which determines:
  - Physical characteristics
  - Mental tendencies
  - Disease susceptibility
  - Suitable diet & lifestyle
- Understanding one's prakriti is a key to personalized treatment in Ayurveda.

#### ④ Dhatu (Body tissues)

- There are seven dhatu (basic tissues) that sustain the body:
  - Rasa (Plasma)
  - Rakta (Blood)
  - Mamsa (Muscle)
  - Meda (Fat)
  - Asthi (Bone)
  - Majja (marrow and nerve tissue)
  - Shukra (Reproductive tissue)
- Health is maintained when these dhatu are balanced.

#### ⑤ Agni (Digestive Fire)

- Agni governs digestion, absorption and metabolism.
- There is different types of agni, but Jatharagni (digestive fire in the stomach) is the most important.
  - Balanced Agni = Good health
  - Weak / Imbalanced Agni = Toxin formation (Ama) and disease

#### ⑥ Malas (Waste Product)

- The body excretes waste through three main malas:
  - Purisha (Feces)
  - Mutra (Urine)
  - Sveda (Sweat)
- Proper elimination is essential for health.

## METHOD OF DIAGNOSIS

- Nadi Pariksha (Pulse Diagnosis)
- Jihva Pariksha (Tongue Examination)
- Mala Mutra Pariksha (Stool & Urine Analysis)
- Sparsha (Touch)
- Darshana (Observation)
- Prashna (Interrogation)

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## UNANI SYSTEM OF MEDICINES

- The unani system of medicine is a traditional system of healing & health maintenance based on the teachings of ancient Greek physicians like Hippocrates and Galen, and later developed by Arab & Persian scholars such as Avicenna (Ibn Sina).
- The term Unani derived from "Yunan", the Arabic name for Greece.
- Unani medicine emphasizes the balance of body humors and focuses on natural healing using diet, herbal remedies and regimental therapies.

### PRINCIPLE

- The Unani system is based on the Humoral Theory (Nazriya Akhlat) which states that the human body consists of four humors (Akhlat-e-Arba).
- Health is properly maintained by the proper balance of these humors and disease is caused by their imbalance.

| HUMOR               | ELEMENT | TEMPERAMENT (MIZAJ) |
|---------------------|---------|---------------------|
| Blood (Dam)         | Air     | Hot & Moist         |
| Phlegm (Balgham)    | Water   | Cold & Moist        |
| Yellow bile (Safra) | Fire    | Hot & Dry           |
| Black bile (Suada)  | Earth   | Cold & Dry          |



# SIDDHA SYSTEM OF MEDICINES

- The siddha system is one of the oldest traditional systems of medicine, originating in South India, particularly Tamil Nadu.
- It is based on ancient Dravidian culture and philosophy and is believed to have been developed by Siddhars, who were enlightened sages.
- The word "Siddha" derived from the Tamil word "Siddhi", meaning perfection or attainment.
- It emphasizes a holistic approach to health and treats not only the diseases but also focuses on spiritual, physical, mental and environmental well-being.

## PRINCIPLE

The fundamental principle of Siddha medicine is based on the concepts of five basic elements (Pancha Bootham) and three humors (Mukkuttram), similar to Ayurveda.

### ① Pancha Bootham (Five Elements) :

Everything in universe, including the human body, is composed of:

- Earth (Prithvi) – solidity & structure
- Water (Appu) – Fluidity
- Fire (Thee) – Metabolism & energy
- Air (Vayu) – Movement
- Ether / space (Akasham) – Accomodation

## ② Mukkuṭṭam (Three Humors or Doshas) :

These are functional principles that maintain physiological balance :

- Vatham (Air & Space) - Responsible for movement and nerve function.
- Pittam (Fire & Water) - Responsible for digestion, metabolism, and body heat.
- Kapham (Water & Earth) - Responsible for stability, lubrication and immunity.
- Health is considered a balanced state of these three humors, and disease occurs due to their imbalance.

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# HOMEOPATHIC SYSTEM OF MEDICINE

- Homeopathy is a holistic system of medicine founded by Dr. Samuel Hahnemann in the late 18th century in Germany.
- The term "homeopathy" is derived from the Greek words:
  - "Homo" meaning similar.
  - "Pathos" meaning suffering.
- It is based on the concept of stimulating the body's natural healing process using highly diluted substances.

## PRINCIPLE

- The fundamental principle of homeopathy is the "Law of Similars" (Similia Similibus Curentur), which means:
  - "Like cures like" - A substance that causes symptoms in a healthy person can be used in a very small dose to treat similar symptoms in a sick person.

## CORE CONCEPTS

### ① Law of similars :

As stated above, a remedy that produces symptoms in a healthy person can cure similar symptoms in the diseased state.



## ② Minimum Dose Principle:

- Homeopathic remedies are prepared through serial dilution and succussion (vigorous shaking), which reduces the toxicity but enhances the healing power (potency).
- The lower the dose, the higher the potency.

## ③ Individualization:

- Treatment is tailored to each individual's physical, mental and emotional symptoms, not just the disease.

## ④ Holistic Approach:

- Focuses on treating the whole person, not just the disease.
- It takes into account lifestyle, emotional health and constitution.

## ⑤ Vital Force Theory:

- Homeopathy believes in a vital force or life energy that maintains
- Disease is the result of imbalance in this force and remedies aim to restore this balance.



# CHINESE SYSTEM OF MEDICINE

- The Chinese system of medicine, also known as Traditional Chinese System (TCM), is an ancient medical system that originated in China over 2500 years ago.
- It is a holistic and natural form of healing that focuses on balancing the body, mind and spirit.

## BASIC PRINCIPLES

### ① Yin and Yang

- Opposing forces in the body that must remain balanced for health.
- Yin = Cold ; Passive ; Yang = hot, active.

### ② Five Elements (Wu Xing)

- Wood, Fire, Earth, Metal and water — believed to govern body organs and their relationships.

### ③ Qi (Vital Energy)

- Qi flows through the body along meridians (energy channels)
- Blockage or imbalance of Qi causes illness.

## KEY THERAPIES IN TCM

### ① Herbal Medicine

- Uses parts of plants, animals and minerals.
- Example: Ginseng, Ginger, Licorice, Ephedra (Ma Huang).

### ② Acupuncture

- Inserting thin needles at specific meridian points to restore energy flow.

### ③ Moxibustion

- Burning herbs near the skin to warm meridian points.

### ④ Cupping therapy

- Glass cups create suction on the skin to improve blood flow.

### ⑤ Tai Chi and Qigong

- Gentle exercises combining movement, breathing and meditation.

## APPLICATIONS

- Used to treat both acute and chronic disease.
- Commonly used in digestive problems, arthritis, stress and respiratory issues.

## ADVANTAGES

- Focuses on prevention and overall well-being.
- Uses natural products and non-invasive therapies.

## LIMITATIONS

- Lack of scientific validation for some treatments.
- Some herbal drugs may interact with allopathic medicines.

# ALKALOIDS

- The term Alkaloids was coined by W. Miessner, German Pharmacist in 1819.
- Alkaloids are naturally occurring organic compounds that mostly contain nitrogen atoms, usually in a heterocyclic ring structure.
- They are mostly derived from plants and possess significant physiological and pharmacological activity on humans and animals.

## GENERAL CHARACTERISTICS OF ALKALOID

- Contain nitrogen, usually a ring (heterocyclic).
- Basic in nature (alkaline reaction).
- Mostly derived from amino acids.
- Found in plants, especially in seeds, bark, leaves or roots.
- Bitter in taste.
- Generally from crystalline solids, some are liquids.
- Many are toxic in large doses but medicinal in small doses.



## CLASSIFICATION OF ALKALOIDS

### (A) BASED ON CHEMICAL STRUCTURE

- i) Pyridine & Piperidin alkaloids - e.g., Nicotine, Coniine.
- ii) Tropane alkaloids - e.g., Atropine, Cocaine
- iii) Quinoline alkaloids - e.g., Quinine
- iv) Isoquinoline alkaloids - e.g., Morphine, Codeine
- v) Indole alkaloids - e.g., Reserpine, Ergotamine
- vi) Imidazole alkaloids - e.g., Pilocarpine.
- vii) Steroidal alkaloids - e.g., solanine
- viii) Purine alkaloids - e.g., caffeine, Theobromine

### (B) BASED ON ORIGIN

- i) True Alkaloids - Derived from amino acids and contain nitrogen in a heterocyclic ring (e.g., Morphine).
- ii) Protoalkaloids - Derived from amino acids but nitrogen is not in a ring (e.g., Ephedrine).
- iii) Pseudoalkaloids - Not derived from amino acids but resemble alkaloids structurally (e.g., Caffeine).

## SOURCES OF ALKALOIDS

- ① Plants: Opium Poppy (morphine), Cinchona bark (Quinine), Tobacco (Nicotine), Belladonna (Atropine).
- ② Fungi: *Claviceps Purpurea* (Ergot alkaloids).
- ③ Animals: Some alkaloids like bufotenin (in toads).

## EXAMPLES OF IMPORTANT ALKALOIDS

| ALKALOID  | SOURCE       | USES                    |
|-----------|--------------|-------------------------|
| Morphine  | Opium poppy  | Pain relief             |
| Quinine   | Cinchon bark | Antimalarial            |
| Caffeine  | Coffee, Tea  | CNS stimulant           |
| Atropine  | Belladonna   | Anticholinergic         |
| Nicotine  | Tobacco      | Stimulant/ Insecticides |
| Reserpine | Rauwolfia    | Antihypertensives       |
| Ephedrine | Ephedra      | Bronchodilators         |

## IDENTIFICATION TEST FOR ALKALOIDS

### ① DRAGENDROFF'S TEST

Reagent: Dragendorff's reagent (Potassium Bismuth iodide).

Procedure: Add Dragendorff's reagent to the drug solution.

Positive result: Formation of orangish-red precipitate.

### ② MAYER'S TEST

Reagent: Mayer's reagent (Potassium Mercuric Iodide)

Procedure: Add a few drops of Mayer's reagent to the drug solution.

Positive result: Formation of creamy-white precipitate.

### ③ HAGER'S TEST

Reagent: Hager's reagent (Saturated aqueous solution of Picric acid)

Procedure: Add Hager's reagent to the drug solution.

Positive Result: Formation of crystalline yellow precipitate.

### ④ WAGNER'S TEST

Reagent: Wagner's reagent (Dilute iodine solution)

Procedure: Add a few drops of Wagner's reagent to the drug solution.

Positive reagent: Formation of reddish-brown precipitate.

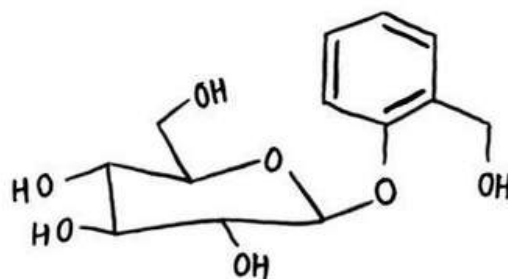
# GLYCOSIDES

- Glycosides are organic compounds made of two parts:
  - ① Sugar Part (Glycone): Usually glucose or another monosaccharide.
  - ② Non-sugar part (Aglycone or Genin): This can be a phenol, alcohol, aldehyde, or other organic compound.
- These two parts are linked by a Glycosidic bond.

## GENERAL STRUCTURE

Glycoside = Glycone (sugar) + Aglycone (non-sugar part)

- The glycone determine solubility and transport in the body.
- The Aglycone determines the biological (pharmacological) activity.



Glycoside



## CLASSIFICATION OF GLYCOSIDES

### (A) BASED ON ATOM LINKING GLYCOSE AND AGLYCOSE

| TYPE        | LINKAGE  | EXAMPLE           |
|-------------|----------|-------------------|
| O-Glycoside | Oxygen   | Salicin           |
| N-Glycoside | Nitrogen | Nucleosides       |
| S-Glycoside | Sulfur   | Sinigrin          |
| C-Glycoside | Carbon   | Alain (From Aloe) |

### (B) ON THE BASIS OF PHARMACOLOGICAL ACTION

Laxative and Purgative  
 Cardiac Glycosides  
 Immunomodulator  
 Expectorant  
 Bitter glycoside and  
 Hepatoprotectives  
 Emetic  
 Antidiabetic  
 Leukoderma

Aloe, Senna, Cascara  
 Digitalis, Stropanthus, Thevetia, Squill  
 Ginseng, Picrorrhiza  
 Liquorice, Wild cherry bark  
 Gentian, Picrorrhiza, Chirata, Quassia  
  
 Black mustard  
 Gymnema  
 Psoralea, Ammi

## PROPERTIES OF GLYCOSIDES

| PROPERTY      | DESCRIPTION                                                                               |
|---------------|-------------------------------------------------------------------------------------------|
| Appearance    | Usually crystalline or amorphous solids                                                   |
| Colour        | Mostly colorless, but some (like anthraquinone glycosides) are colored                    |
| Taste         | Often bitter or slightly sweet                                                            |
| Solubility    | Soluble in water and alcohol (due to glycone); aglycone part may require organic solvents |
| Melting point | Usually have definite melting points (helpful in identification)                          |

## IDENTIFICATION TEST

### ① KILLER - KILLANI TEST

Purpose: Detects deoxy sugars in cardiac glycosides.

Procedure: Add glacial acetic acid, few drops of ferric chloride, and conc.  $H_2SO_4$  to the extract.

Let the mixture stand.

Positive result: Reddish-brown color appears.

### ② ANTIMONY TRICHLORIDE TEST

Purpose: Detects steroidal nucleus in aglycone part.

Procedure: • Add Antimony chloride reagent to the extract.  
• Warm gently if needed.

Positive result: Blue or violet colour appears.

### ③ RAYMOND'S TEST

Purpose: Detects Cardenolides (type of cardiac glycosides).

Procedure: Add Raymond's reagent (mixture of dinitrobenzene in Alcohol + NaOH) to the extract.

Positive result: Red to violet color develops.

#### ④ LEGAL'S TEST

Purpose: Detects keto group in lactone ring of cardiac glycosides.

Procedure: Add sodium nitroprusside and alkali (NaOH or KOH) to the extract.

Positive result: Pink to red color appears.

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# TANNINS

- Tannins are high molecular weight polyphenolic compounds found in plants.
- They can precipitate proteins and are known for their astringent taste.
- Used in leather tanning, medicine and dyeing.

## CLASSIFICATION OF TANINS

### (a) Hydrolysable Tannins

- Yield gallic or ellagic acid on hydrolysis.
- e.g., Gallotannins, Elligatannins.

### (b) Condensed Tannins (Proanthocyanidins)

- Do not hydrolyze easily; form red insoluble compounds.
- e.g., Catechins etc.

### (c) Complex Tannins

- Combination of both hydrolysable and condensed types.

### (d) Pseudo Tannins

- Low molecular weight; do not precipitate proteins.
- e.g., Chlorogenic Acid, Caffeic Acid.

## PROPERTIES OF TANINS

- Water - soluble, but also soluble in alcohol.
- Astringent in nature.
- Form insoluble complex with alkaloids, gelatin and heavy metals.
- Give blue-black or green-black colour with  $\text{FeCl}_3$ .
- Non-crystalline, amorphous powders.

## IDENTIFICATION TESTS FOR TANNINS

### (a) FERRIC CHLORIDE TEST

→ Add  $\text{FeCl}_3$  solution

- Blue-Black colour → Hydrolysable tannins
- Green-Black colour → Condensed tannins

### (b) GOLDBEATER'S SKIN TEST

→ Soak goldbeater's skin in test solution — Then in  $\text{FeSO}_4$

- Brown/Black coloration confirms tannins.

© GELATIN TEST

Add 1% Gelatin solution with NaCl

- White precipitate indicates presence of tannins.

④ MATCHSTICK TEST (FOR CATECHIN TYPE)

Moisten matchstick with sample + HCl → Heat

- Pink / Red color on wood confirms catechin - type tannins.

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# RESINS

- Resins are solid or semi-solid, amorphous substances of plant origin, formed as exudates or secretions.
- They are insoluble in water but soluble in alcohol and organic solvents.
- Resins are used in medicines, varnishes and adhesives.

## CLASSIFICATION OF RESINS

### ① BASED ON CONSTITUENTS

- Oleoresins = Resin + Volatile oil (e.g. Ginger)
- Gum resins = Resin + Gum (e.g. Myrrh)
- Oleo-gum resins = Resin + Gum + volatile oil e.g. (Asafoetida)
- Glycosesins = Resin + Sugar (e.g. Jalap)
- Balsams = Resin + Benzoic or Cinnamic Acid (e.g. Balsam of Tolu)

### ② BASED ON SOURCE

- Natural Resins
- Synthetic Resins



## PROPERTIES

- Solid, Brittle and sticky.
- Insoluble in water; soluble in alcohol, acetone and ether.
- Burns with smoky flames.
- Has a characteristic odor (if volatile oils are present).

## IDENTIFICATION TEST

- ① Solubility test - Insoluble in water, soluble in Alcohol.
- ②  $\text{FeCl}_3$  test - Phenolic resins give colored complex.
- ③  $\text{HCl}$  test - Resins acids precipitate with  $\text{HCl}$ .
- ④  $\text{NaOH}$  test - Phenolic resins gives colored solution.
- ⑤ Turbidity test - Forms emulsion when triturated with water.

# FLAVONOIDS

- Flavonoids are large group of naturally occurring polyphenolic compounds found in fruits, vegetables, tea and wine.
- They are secondary metabolites in plant, known as their anti-oxidant, anti-inflammatory and antimicrobial activities.

## CLASSIFICATIONS

Flavonoids are classified based on their chemical structure into:

- Flavones - e.g., Apigenin
- Flavonols - e.g., Quercetin
- Flavanones - e.g., Naringenin
- Flavonols (catechins) - e.g., Epicatechin
- Anthocyanidins - e.g., Cyanidin
- Isoflavones - e.g., Genistein

## PROPERTIES

### Physical properties

- Yellow to orange colour (especially in Flavones/ Flavonols)
- Crystalline solids
- Soluble in Alcohol, slightly soluble in water.

### Chemical Properties

- Polyphenolic structure
- Undergo oxidation
- Sensitive to pH changes (color changes in acid/base).

### IDENTIFICATION TEST

#### ① SHINODA TEST

- Add magnesium turnings and HCl to the extract.
- Pink or Red colour indicates the presence of Flavonoids.

#### ② LEAD ACETATE TEST

- Add lead acetate solution to the extract.
- Yellow precipitate forms if Flavonoids are present.

#### ③ ALKALINE REAGENT TEST

- Add NaOH solution.
- Intense yellow colour, which turns colourless with acid.

# VOLATILE OILS

- Volatile oils also called essential oils, are aromatic, odorous substances obtained from plants.
- They are called "volatile" because they evaporate easily when exposed to air and are insoluble in water but soluble in alcohol.
- They are used in flavouring, perfumery and medicinal preparations.

## CLASSIFICATIONS

### ① BASED ON CHEMICAL CONSTITUENTS

- Hydrocarbons (e.g., Turpentine oil)
- Alcohols (e.g., Peppermint oil)
- Aldehydes (e.g., Cinnamon oil)
- Ketones (e.g., Spearmint oil)
- Phenols (e.g., Eucalyptus oil)
- Esters (e.g., Lavender oil)

### ② BASED ON VOLATILITY OR USE

- Therapeutic oils
- Flavoring oils
- Perfume oils



## PROPERTIES

- Strong Aromatic odor.
- Volatile at room temperature.
- Insoluble in water, soluble in alcohol.
- Colorless or Pale yellow when fresh.
- Lighter than water (except clove oil, etc.)

## IDENTIFICATION TESTS

- ① Solubility Tests - Soluble in Alcohol, Insoluble in water.
- ② Stain Tests - Does not leave a permanent greasy stain on paper.
- ③ Turbidity Tests- Alcoholic solution becomes turbid on addition of water.
- ④ Chemical Tests- Based on Functional groups (e.g., Phenols with  $\text{FeCl}_3$  give color).

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