



# PHARMACOGNOSY

A COMPETITIVE EXAMINATION BOOK



**COMPETITIVE EXAMINATION BOOK FOR**

**GPAT | NIPER | PHARMACIST | DRUG INSPECTOR**

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**Theory Book**

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## MORPHOLOGICAL CLASSIFICATION

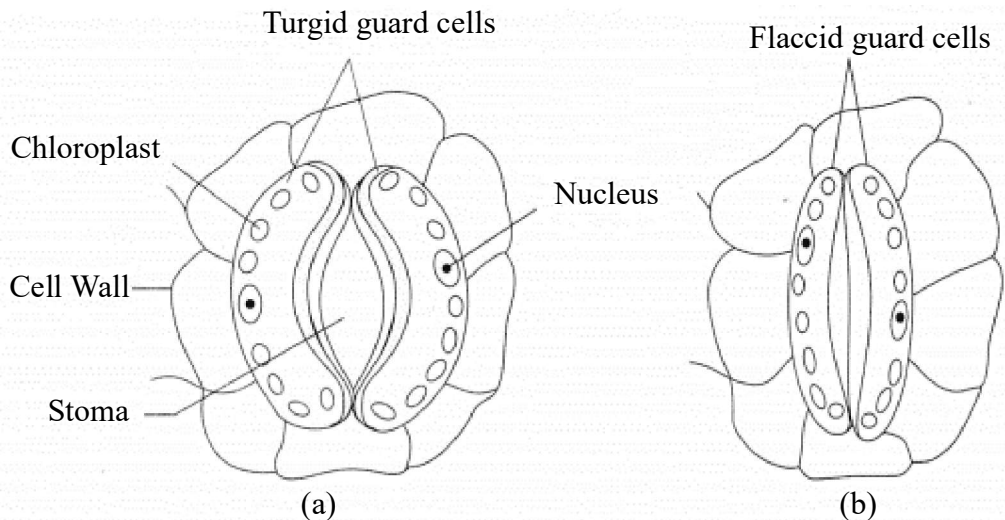
- In this system, the drugs are arranged according to the morphological or external characters of the plant parts or animal parts, i.e. which part of the plant are used as a drug, e.g. leaves, roots, stem, etc.
- The drugs obtained from the direct parts of the plants and containing cellular tissues are called as organized drugs e. g. Rhizomes, barks, leaves, fruits, entire plants, hairs and fibres.
- The drugs which are prepared from plants by some intermediate physical processes such as incision, drying or extraction and not containing any cellular plant tissues are called as unorganized drugs, e. g. Aloe juice, opium latex, tragacanth etc.
- **Examples:**

PARTS OF PLANT	CRUDE DRUGS
Woods	Quassia, Sandalwood.
Leaves	Digitalis, Eucalyptus, Tulsi, Vasaka
Barks	Arjuna, Ashoka, Cinchona, Cinnamon.
Flower parts	Clove, Saffron
Fruits	Amla, Anise, Bael, Coriander, Tamarind.
Seeds	Bitter almond, Black Mustard, Cardamom
Roots & Rhizomes	Garlic, Ginger, Shatavari, Turmeric
Plants and Herbs	Ephedra, Brahmi, Kalmegh, Vinca
Hair and Fibres	Cotton, Hemp, Jute

## PHARMACOLOGICAL CLASSIFICATION

- Grouping of drug according to their pharmacological action or of most important constituent or their therapeutic use is termed as pharmacological or therapeutic classification of drug.
- This classification is more relevant and is mostly followed method.
- Drugs like digitalis, squill and strophanthus having cardiotoxic action are grouped together irrespective of their parts used or phylogenetic relationship or the nature of phytoconstituents they contain.
- **Examples:**

S.NO.	PHARMACOLOGICAL CATEGORY	EXAMPLE
1.	<b>Drug acting on G.I.T.</b> Bitter Carminative Emetic Antiamoebic Laxative Purgative Cathartic	Cinchona, Quassia, Gentian Fennel, Cardamom, Mentha Ipecac Kurchi, Ipecac Agar, Isabgol, Banana Senna, Castor oil Senna
2.	<b>Drug acting on Respiratory system</b> Expectorant Antitussive Bronchodilators	Vasaka, Liquorice, Ipecac Opium (codeine) Ephedra, Tea
3.	<b>Drug acting on Cardiovascular system</b> Cardio tonic Cardiac depressant Vasoconstrictor Antihypertensive	Digitalis, Strophanthus, Squill Cinchona, Veratrum Ergot Rauwolfia

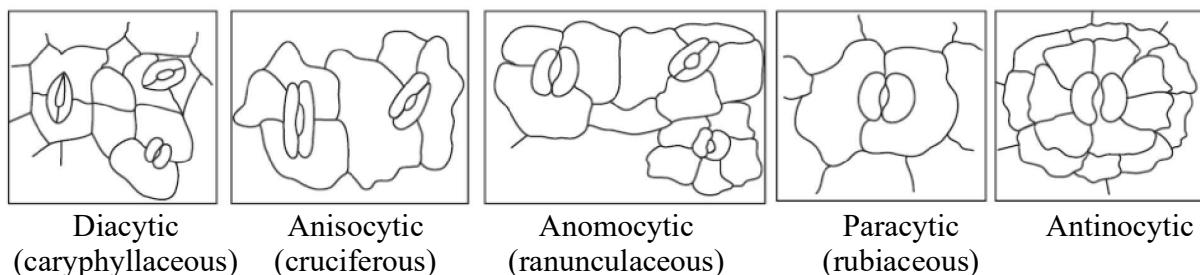


**Fig. 1** (a) Stoma (open)  
(b) Stoma (closed)

### TYPES OF STOMATAL ARRANGEMENT

According to the arrangement of the epidermal cells surrounding the stomata, they have been grouped as follows:

S.NO	STOMATAL ARRANGEMENTS	OTHER NAME	EXAMPLES
1.	Diacytic or Caryophyllaceous (cross celled) The stoma is accompanied by two subsidiary cells, the long axis of which is at right angles to that of the stoma.	Labiatae type	Vasaka, tulsi, Spearmint and Peppermint.
2.	Anisocytic or Cruciferous (unequal celled) The stoma is surrounded by usually three subsidiary cells of which one is markedly smaller than the others.	Solanaceous type	Belladonna, Datura, Hyoscyamus, Stramonium, Tobacco
3.	Anomocytic or Ranunculaceous (irregular celled) The stoma is surrounded by a varying number of cells in no way differing from those of the epidermal cells.	-	Digitalis, Eucalyptus, Henna, Lobelia, Neem
4.	Paracytic or Rubiaceous (parallel celled) The stoma is surrounded usually by two subsidiary cells, the long axis of which is parallel to that of stoma.	-	Senna and Many Rubiaceous plants
5.	Actinocytic (radiate celled) The stoma is surrounded by circle of radiating cells.	-	Uva ursi



**Fig.** Different types of stomata

## INTERNATIONAL CLASSIFICATION OF ENZYMES

S.NO.	CLASS	TYPE OF REACTION CATALYZED	EXAMPLES
1.	Oxidoreductases	Transfer of electrons (hydride ions or H atoms)	Dehydrogenases, Oxidases
2.	Transferases	Group transfer reactions	Transaminase, Kinases
3.	Hydrolases	Hydrolysis reactions (transfer of functional groups to water)	Estrases, Digestive Enzymes
4.	Lyases	Addition of groups to double bonds or formation of double bonds by removal of groups	Phospho hexo Isomerase, Fumarase
5.	Isomerases	Transfer of groups within molecules to yield isomeric forms	Decarboxylases, Aldolases
6.	Ligases	Formation of CC, CS, CO, and CN bonds by condensation reactions coupled to ATP cleavage	Citric acid synthetase

## FIBRES, SUTURES AND SURGICAL DRESSINGS

## FIBRES

- Fibres may be defined as any hair-like raw material directly obtainable from an animal, vegetable, or mineral source and convertible into nonwoven fabrics such as felt or paper or, after spinning into yarns, into woven cloth.
- **Examples of fibres** – Cotton, Jute, Flax, Hemp, Silk, Wool, Viscose, Alginate fibres, Terylene, Orlon, Nylon.

## SURGICAL DRESSINGS

- A material used to protect a wound and to heal is called a surgical dressing. They serve various functions for the injured site.
- They remove wound exudates from the site, prevent infection, and give physical protection to the healing wound and mechanical support to the supporting tissues.
- **Examples**- Adsorbents, Bandages, Adhesive tapes, Protectives.

## SUTURES AND LIGATURES

- A surgical suture is a thread or sting used for sewing or stitching together tissues, muscles, and tendons with the help of a needle.
- **Examples of sutures** are catgut, Kangaroo tendon, and synthetic polyesters.

## MINERALS

- The substances of mineral origin have been used for various pharmaceutical purposes ranging from therapeutic agents to nutritional supplements to pharmaceutical excipient.
- These inorganic substances are found as mineral deposits of different types such as terrestrial deposits or fossil deposition of geological origin in ocean and seabeds.

## ❖ ALKALOIDS

S.NO.	TEST NAME	COMPOSITION	POSITIVE COLOUR CHANGE
1.	Dragendorff's Test	Drug solution + Dragendorff's reagent (Potassium Bismuth Iodide)	Orangish red colour
2.	Mayer's Test	Drug solution + few drops of Mayer's reagent (potassium mercuric iodide)	Creamy-white precipitant
3.	Hager's Test	Drug solution + few drops of Hager's reagent (Saturated aq. Solution of Picric acid)	Crystalline yellow precipitate
4.	Wagner's Test	Drug solution + few drops of Wagner's reagent (dilute potassium Iodide solution)	Reddish-brown precipitate
5.	Tannic Acid Test	Drug solution + few drops of tannic acid solution	Buff coloured precipitate
6.	Ammonia Reineckate Test	Drug solution + slightly acidified (HCl) saturated solution of ammonia reineckate	Pink flocculent precipitate

**VITALI-MORIN TEST (TROPANE ALKALOID)**

Tropane alkaloid + fuming nitric acid



Followed by evaporation to dryness



Addition of methanolic KOH solution to an acetone solution of nitrated residue



Violet colouration takes place due to tropane derivative.

**TEST FOR NUX VOMICA****1. Strychnine Test:**

To a section of endosperm + ammonium vanadate + sulphuric acid



Strychnine in the middle portion of endosperm is stained purple

**2. Potassium dichromate test:**

Strychnine + potassium dichromate + conc. Sulphuric acid



## TANNINS

### 1. Goldbeater's skin test:

A piece of goldbeater's skin previously soaked in 2% hydrochloric acid

**Note:-** Hydrolysable and condensed tannins both give the positive goldbeater's test, whereas pseudotannins show very little colour or negative test.

↓  
Washed with distilled water is placed in a solution of tannin for 5 minutes

↓  
It is then washed with distilled water

↓  
Transferred to 1% ferrous sulphate solution

↓  
A change of the colour of the goldbeater's skin to brown/ black indicates the presence of tannin

**Note:-** Hydrolysable and condensed tannins both give the positive goldbeater's test, whereas pseudotannins show very little colour or negative

### 2. Phenazone Test:

5ml aqueous solution of drug + 0.5g sodium acid phosphate

↓  
Warm the solution, cool, and filter

↓  
Add 2% phenazone solution to the filtrate.

↓  
All tannins are precipitated as bulky, coloured precipitate

### 3. Gelatin Test:

1% gelatine solution + few amount of 10% sodium chloride

↓  
If a 1% solution of tannin is added to the gelatine solution

↓  
Tannins cause precipitation of gelatine from solution

### 4. Test for Catechin (Matchstick Test):

Dip a matchstick in the dilute extract of the drug

↓  
Dry; moisten it with concentrated hydrochloric acid

↓  
Warm it near a flame

↓  
Catechin in the presence of acid produces phloroglucinol which stains the lignified wood pink or red

### 5. Test for chlorogenic acid:

A dilute solution of chlorogenic acid containing extract

↓  
If treated with aqueous ammonia and exposed to air

↓  
Slowly turns green indicating the presence of chlorogenic acid



## MORPHOLOGICAL EVALUATION

- Wavy shape of rauwolfia
- Pungent taste of capsicum and ginger
- Brown colour of cinnamon

## MICROSCOPICAL EVALUATION

- The characteristic of cell walls, cell content, types and size of starch grain, type of calcium oxalate crystals, types of trichome, types of stomata (stomatal no., stomatal index, palisade ratio) vein islet no, vein termination no. length of fibres, and vessels.
- **Lignified trichomes** are found in **nuxvomica**.
- **Warty trichomes** in **senna**.
- **Wavy medullary rays** in **casacara bark**.
- **Glandular trichomes** of **mint**.
- **Powdered cloves** do not contain **scelereids** or **calcium oxalate crystals**, but both of them are **present in cloves stalks**.
- Presence of **nonlignified vessels** in **powder of rhubarb** and ginger indicates adulterations.
- Diameter of starch grain is **10 micron** and hence useful for detection of adulterants.
- Lignin + drop of phloroglucinol + conc. HCl → Gives red stain
- Mucilage + rheuthenium red → Gives pink stain
- Cellulose + dissolve in cuoxam → Swells
- Hemicellulose and starch + N/50 iodine solution → Stained blue

## LEAF CONSTANTS

- **Palisade ratio:** average number of palisade cells beneath each epidermal cell.
- **Vein islet number:** number of vein islet per sq mm of the leaf surface midway between the midrib and margin.
- **Vein termination number:** number of veinlet termination per sq mm of the leaf surface midway between the midrib and margin.
- **Stomatal number:** average number of stomata per sq area of the epidermis of the leaf.
- **Stomatal index:** The percentage which the no. of stomata formed to the total no. of epidermal cells.

S.I = Stomatal index

S = No. of stomata per unit area.

E = No of epidermal cell in the same unit area

$$S. I = \frac{S}{E+S} \times 100$$

2.	<b>Salkowaski test</b>	Alcoholic extract of drug was evaporated to dryness→Extracted with $\text{CHCl}_3$ →Then add conc. $\text{H}_2\text{SO}_4$ from sidewall of test tube to the $\text{CHCl}_3$ extract	Formation of yellow coloured ring at the junction of two liquid, which turns red after 2 min, indicate the presence of steroid moiety
3.	<b>Antimony trichloride test</b>	Alcoholic extract of drug was evaporated to dryness→Extracted with $\text{CHCl}_3$ →Then add saturated solution of $\text{SbCl}_3$ in $\text{CHCl}_3$ containing 20% acetic anhydride	Formation of pink colour on heating indicates presence of steroids and triterpenoids
4.	<b>Trichloro acetic acid test</b>	Triterpenes on addition of saturated solution of trichloro acetic acid	Forms coloured precipitate
5.	<b>Tetranitro methane test</b>	unsaturated steroids and triterpenes + Tetranitro methane	Forms yellow colour
6.	<b>Zimmermann test</b>	Meta dinitrobenzene solution + alcoholic solution of drug containing alkali→On heating	It forms violet colour in presence of keto steroid

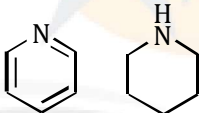
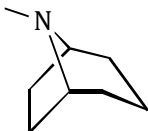
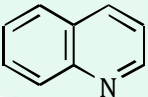
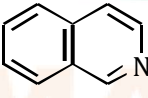
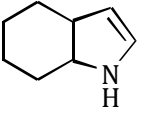
#### D. Chemical Tests for Cardiac Glycosides

1.	<b>Keller-kiliani test</b>	Alcoholic extract of drug→Add equal volume of water and 0.5 ml of strong lead acetate solution→Then shaken and filtered→Filtrate was extracted with equal volume of chloroform→Chloroform extract was evaporated to dryness→Residue was dissolved in 3 ml of glacial acetic acid followed by addition of few drops of $\text{FeCl}_3$ solution→The resultant solution was transferred to a test tube containing 2 ml of conc. $\text{H}_2\text{SO}_4$ .	Reddish brown layer is formed, which turns bluish green after standing due to presence of digitoxose
2.	<b>Legal test</b>	Alcoholic extract of drug→Then equal volume of water and 0.5 ml of strong lead acetate solution was added→Shaked and filtered→Filtrate was extracted with equal volume of chloroform→The chloroform extract was evaporated to dryness→The residue was dissolved in 2 ml of pyridine→Then sodium nitropruside 2 ml was added followed by addition of $\text{NaOH}$ solution to make alkaline	Formation of pink colour in presence of glycosides or aglycon moiety

## CHEMICAL TESTS

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6.	Ammonia Reineckate Test	Drug solution + slightly acidified (HCl) saturated solution of ammonia reineckate	Pink flocculent precipitate

## DRUG CONTAINING ALKALOIDS

S.NO.	CLASS	STRUCTURE	EXAMPLE	SYNONYM
1.	Pyridine Piperidine alkaloids	 Pyridine Piperidine	Tobacco, Areca, Lobelia	Betel nut, supari Asthma weed, tobacco
2.	Tropane alkaloids		Belladonna,  Datura, Hyoscyamus, Stramonium, Dubosia, Coca leaves Ashwagnadha	Deadly night shade leaf  Henbane Thornapple, jamstownweed
3.	Quinoline alkaloids		Cinchona, Camptotheca	Peruvian bark Cancer tree
4.	Isoquinoline alkaloids		Opium, Ipecac, Curare, Berberis Sanguniria	Americanarrowroot poison  Blood root
5.	Indole alkaloids		Ergot, Nux vomica, Rauwolfia, Catharanthus, Physostigma	Claviceps Crowfig seed Sarpagandha , Indian snake root Callabus

SOLUBILITY	ACTIVE FORM	INACTIVE FORM	SALT FORM
Water soluble	Ergometrine	Ergometrinine	Ergotamine maleate
Water insoluble	Ergotamine	Ergotaminine	Ergotamine tartarate
	Ergocristine Ergocryptine Ergocornine		

**Solubility Active form Inactive form Salt form**

**Water soluble** Ergometrine, Ergometrinine, Ergotamine maleate

**Water insoluble** Ergotamine, Ergotaminine, Ergotamine tartarate

Ergocristine, Ergocryptine, **Ergotoxine**, Ergocornine

- Ergot also contain pigment → Ergosterol, Fungisterol

**Chemical Tests: -**

1. Ergot → under UV light → shows a red-coloured fluorescence

**2. Van Urk's test:**

Ergot powder + p-dimethyl aminobenzaldehyde (Van urk's reagent) (0.1g) + H<sub>2</sub>SO<sub>4</sub> (35%, v/v, 100 ml) + 5% ferric chloride (1.5ml) → deep blue colour is produced

3. Ergometrine + water → blue fluorescence

**Uses: -**

- Ergot is oxytocic, vasoconstrictor and abortifacient
- Used to assist delivery and to reduce post-partum haemorrhage
- Lysergic acid diethylamide (LSD-25) is a potent specific psychotomimetic
- Ergometrine is oxytocic and used in delivery
- Ergotamine and the semisynthetic dihydroergotamine salts are used as specific analgesics for the treatment of migraine
- Ergotoxine methane sulphate is used by geriatric patients for the treatment of dementia

**Substitutes**

- Ergot of wheat
- Ergot of oats
- Ergot of diss

**RAUWOLFIA**

**Synonyms: -** Sarpagandha, Chandrika; Chootachand; Indian snake root.

**Biological Source: -** Dried roots of *Rauwolfia serpentina*

**Family: -** Apocynaceae

**Microscopy**

- Transverse section of the root shows a **stratified cork**
- Cells of secondary cortex are **parenchymatous** and contain **starch grains**
- Phloem is narrow and consists of parenchyma with **scattered sieve tissue**
- Xylem is wide, **entirely lignified**
- Roots and rhizomes are identified by **central pith**

## INTRODUCTION

- Volatile oils are **odorous volatile principles** of plant and animal source
- **Evaporate** when exposed to air at ordinary temperature, and hence known as **volatile** or **etheral oils**.
- These represent **essence of active constituents** of the plant and hence also known as **essential oils**.
- Volatile oils are → **freely soluble in ether** and in **chloroform**  
→ **Fairly soluble in alcohol**  
→ **Insoluble in water**
- **High refraction index** and **most** of them are **optically active**.
- Volatile oils are **colourless liquids**, but when exposed to air and direct sunlight these become **darker due to oxidation**.
- Terpenoids are regarded as derivative of polymers of isoprene ( $C_5H_8$ )
- Terpenoid  $\xrightarrow{\text{heat}}$   $CH_2=C(CH_3)CH=CH_2$  (**Isoprene or 2-methyl-1,3 butadiene**)

## CLASSIFICATION OF VOLATILE OILS

Volatile oils are classified on the basis of functional groups present

GROUPS	DRUGS
Hydrocarbons	Turpentine oil
Alcohol	Peppermint oil, Pudina, Sandalwood oil, etc.
Aldehydes	Cymbopogon sp., Lemongrass oil, Cinnamon, Cassia, and Saffron
Ketones	Camphor, Caraway and Dill, Jatamansi, Fennel, etc.
Phenols	Clove, Ajowan, Tulsi, etc.
Phenolic ethers	Nutmeg, Calamus, etc.
Oxides	Eucalyptus, Cardamom, and Chenopodium oil
Esters	Valerian, Rosemary oil, Garlic, Gaultheria oil, etc.

## EXTRACTION OF VOLATILE OILS

Volatile oils are prepared by means of several techniques and those techniques are discussed below:

- **Extraction by Hydrodistillation:** - Herbal drugs
- **Steam distillation**
- **Extraction by Scarification**

Preparation of oil of lemon, oil of orange, and oil of bergamot.

The two principal methods of **scarification** are the **sponge** and the **ecuelle method**.

## Pharmacognosy

- Rheumatic ailments

### Adulteration: -

- Spanish eucalyptus oil, camphor
- Oil, and turpentine fractions is common

## GAULTHERIA OIL

**Synonyms:** - Canada tea, Checker berry, Wintergreen oil

**Biological Source:** - Obtained by the distillation of dried leaves of *Gaultheria procumbens*

**Family:** - Ericaceae

**Chemical Constituents:** -

- 99% **methyl salicylate**
- **Water gaultherase**  
Other components → like Gaultherilene and an aldehyde or ketone, a secondary alcohol and an ester
- Gaultherin  $\xrightarrow[\text{gaultherase}]{\text{Water}}$  Methyl salicylate (counter irritant)

**Uses:** -

- Used as tonic, stimulant, antiseptic, astringent, diuretic, emmenagogue, aromatic
- Useful as a diuretic, it stimulate stomach, heart, and respiration
- In chronic inflammatory rheumatism, rheumatic fever, skin diseases, sciatica
- For dropsy, gonorrhea, stomach trouble, bladder troubles, and obstruction in the bowels

## VALERIAN

**Synonyms:** - Valeriana rhizome

**Biological Source:** - Dried roots and rhizomes of *Valeriana wallichii*

**Family:** - Valerianaceae

**Chemical Constituents:** -

- **Valerianic**, formic, and acetic acids
- Alcohol → **Borneol** and **pinene**

**Uses:** -

- Treatment of insomnia, hysteria, blood pressure
- As an anticonvulsant in the treatment of epilepsy
- Antitumor activity
- As aromatic, stimulant, nervine, emmenagogue, anodyne, and antispasmodic
- Promote menstruation when taken hot
- Useful in colic, low fevers, to break up colds and relieves palpitation of the heart

## MISCELLANEOUS

### Monoterpenoid

## PALMAROSA OIL

**Synonym:** - Rosha oil, Geranium oil

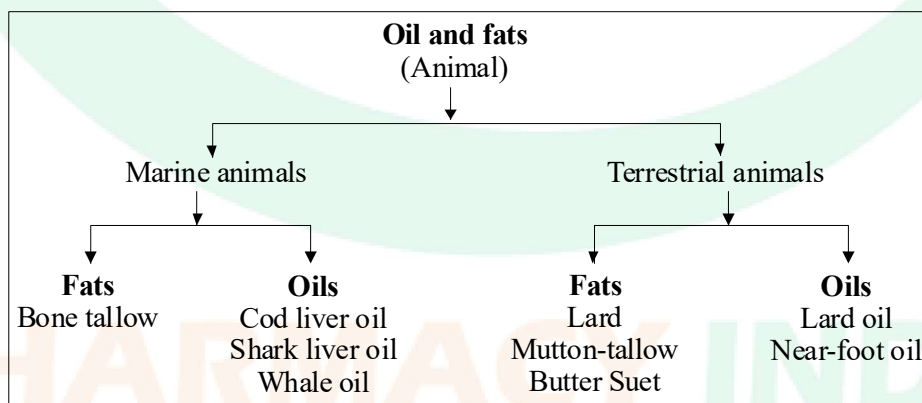
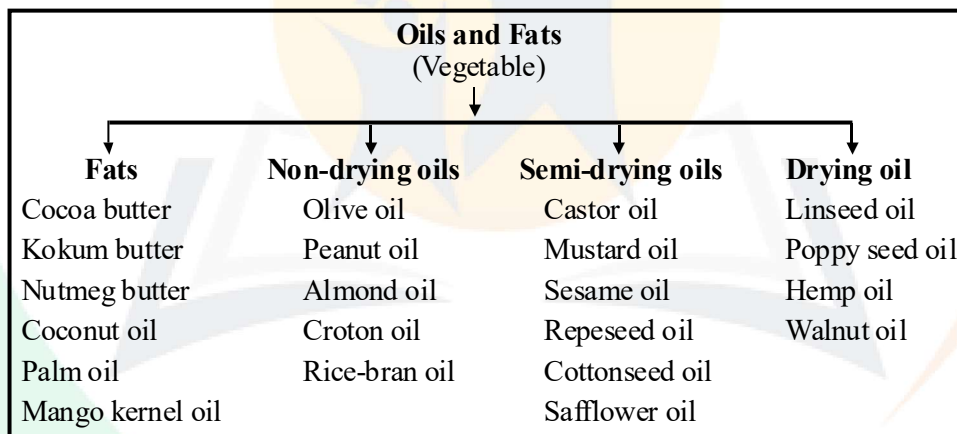
**Biological source:** - Obtained from leaves and tops of *Cymbopogan martini*

## INTRODUCTION

- These are the reserve food materials of plants and animals.
- Those, which are lipid at 15.5c to 16.5c are called as fixed oils
- They possess following properties: Fixed oils are thick, viscous, yellow coloured liquids with characteristic odour.
- They are non-volatile and cannot be distilled.
- They turn rancid on storage due to free acidity.

## CLASSIFICATION OF FIXED OILS

- Depending upon sources and physical characteristics, fixed oils fats can be classified as



A lipid is a macro biomolecule that is soluble in nonpolar solvents. Non-polar solvents are typically hydrocarbons used to dissolve other naturally occurring hydrocarbon lipid molecules that do not (or do not easily) dissolve in water, including fatty acids, waxes, sterols, fat-soluble vitamins (such as vitamins A, D, E, and K), monoglycerides, diglycerides, triglycerides, and phospholipids.

Ginger	Adrak,	dried rhizomes of the <i>Zingiber officinale</i> ( <b>Zingiberaceae</b> )	Zingiberene, gingerol, shagoal, gingediols	antiemetic, positive inotropic, spasmolytic, aromatic stimulant, carminative, condiment, flavouring agent
Guggul	Scented Bdellium, Gumgugul, Salai gogil.	obtained by incision of the bark of <i>Commiphora mukul</i> ( <b>Burseraceae</b> )	guggulsterols I to VI, $\beta$ -sitosterol, cholesterol, Z- and E-guggulsterone	inhibits platelet aggregation, increase thermogenesis, hypolipidemic, astringent, aritirheumatic, antiseptic, expectorant, aphrodisiac, demulcent, emmenagogue
Ipomoea	Radix ipomoeae	dried tuberous roots of <i>Ipomoea orizabensis</i> ( <b>Convolvulaceae</b> )	Jalapin, jalapinolic acid, ipurolic acid, convolvullinic acid	strong cathartic
Jalap	Radix jalapae, Jalap root, Vera cruz	dried tuberous roots or tubercles of <i>Ipomoea purga</i> ( <b>Convolvulaceae</b> )	Jalapin-ether sol. (scammonin), Convolvulin (ether insoluble)	hydragogue cathartic, laxative, purgative
Kaladana	Mirchi, Krishnabija	dried ripe seeds of <i>Ipomoea hederacea</i> ( <b>Convolvulaceae</b> )	Lysergol, hederaceterpenol, hederaceteriol, hederaterpenoside, $\beta$ -sitosterol glucopyranoside, chanoclavine	purgative
Male fern	Filix Mass, Rhizoma Filicis Maris	dried rhizomes and its surrounding frond bases of <i>Dryopteris filix-mas</i> ( <b>Polypodiaceae</b> )	Filicin, butyryl phloroglucinol, aspidinol, acylfilicinic acids	Antihelminthic
Myrrh	Gum-resin Myrrh, Gum Myrrh, Arabian or Somali Myrrh	obtained from the stem of <i>Commiphora molmol</i> or <i>C. abyssinica</i> ( <b>Burseraceae</b> )	$\alpha$ , $\beta$ , & $\gamma$ , Commiphoric acids and $\alpha$ , $\beta$ , Heerabomyrrholic acid, Eugenol	Antiseptic, stimulant, Carminative, astringent



**Note:** - Hydrolysable and condensed tannins both give the positive goldbeater's test, whereas pseudotannins show very little colour or negative test.

### 2. Phenazone Test:

5ml of aqueous solution of tannin containing drug + 0.5g sodium acid phosphate → Warm the solution → cool filter → Add 2% phenazone solution to the filtrate → Tannins are precipitated as bulky, coloured precipitate.

### 3. Gelatin Test:

1% gelatine solution + little 10% sodium chloride + 1% solution of tannin → tannins cause precipitation of gelatine from solution.

### 4. Test for Catechin (Matchstick Test):

Dip a matchstick in the dilute extract of the drug → Dry; moisten it with concentrated HCl → Warm it near a flame → Catechin in the presence of acid produces phloroglucinol which stains the lignified wood pink or red.

### 5. Test for chlorogenic acid:

Dilute solution of chlorogenic acid containing extract + aqueous ammonia → Exposed to air → Slowly turns green indicating the presence of chlorogenic acid.

### 6. Vanillin-hydrochloric acid test:

Drug shows pink or red colour → In mixture of vanillin: alcohol : dilute HCl in the ratio 1:10:10.

**Note:** - The reaction produces phloroglucinol which along with vanillin gives pink or red colour.

## HYDROLYSABLE TANNINS

DRUG NAME	SYNONYM	BIOLOGICAL SOURCE	ACTIVE CONSTITUENTS	USES
<b>Myrobalan</b>	Chebulic myrobalan, harde, haritaki	dried fruits of <i>Terminalia chebula</i> (Combretaceae)	chebulinic acid, chebulagic acid, gallic acid	Chronic ulcers, Wounds, piles, stomachic, purgative, ingredient of Triphala
<b>Bahera</b>	baheda, bibhitak	dried ripe fruits of the plant <i>Terminalia belerica</i> (Combretaceae)	gallic acid, ellagic acid, phyllembin	Astringent, Dyspepsia, diarrhoea, constituent of triphala, demulcent, purgative
<b>Arjuna</b>	Arjun bark, arjun	dried stem bark of the plant known as <i>Terminalia arjuna</i> (Combretaceae)	(+) catechol, (+) gallo catechol, epicatechol, epigallocatechol, ellgic acid	Diuretic, astringent, hypotensive

## TESTS FOR CARBOHYDRATES

S. NO.	TEST NAME	PROCEDURE	OBSERVATION
1.	Reduction of Fehling's Solution	Solution of carbohydrate + equal quantity of Fehling's solutions A and B → after heating	Brick red precipitate is obtained
2.	Molisch Test	Solution of carbohydrate + $\alpha$ -naphthol + concentrated sulphuric acid	Gives purple colour
3.	Resorcinol Test for Ketones (Selivanoff's Test)	A crystal of resorcinol + carbohydrate solution → warmed on a water bath with an equal volume of concentrated hydrochloric acid	Rose colour is produced if a ketone is present (e.g. fructose, honey or hydrolysed inulin).
4.	Test for Pentoses	Heat a solution of the substance in a test tube + equal volume of hydrochloric acid containing a little phloroglucinol	Formation of a red colour indicates pentoses
5.	Keller-Kiliani Test for Deoxysugars	A Deoxysugar (found in cardiac glycosides) + acetic acid + trace of ferric chloride → transferred to the surface of concentrated sulphuric acid	At the junction of the liquids a reddish-brown colour is produced which gradually becomes blue.
6.	Furfural Test	A carbohydrate sample is heated in a test tube + a drop of syrupy phosphoric acid to convert it into furfural → disk of filter paper moistened with a drop of 10% solution of aniline in 10% acetic acid → placed over the mouth of the test → tube bottom of the test tube is heated for 3060s	Pink or red stain appears on the reagent paper

## ACACIA GUM

**Synonyms:** - Egyptian thorn, Gum Senegal, Kher, Sudan gum arabic, Somali gum, Yellow thorn, Indian Gum and Gum Arabic.

**Biological Source:** - Dried gummy exudation obtained from the stems and branches of

- Acacia Senegal (African species of Acacia)
- Acacia arabica (Indian)

**Family:** - Leguminosae

**Chemical constituents:** -

- **hydrolysis**

Acacia consists principally of **arabin**, (complex mixture of calcium, magnesium and potassium salts of Arabic acid)

- Arabic acid  $\xrightarrow{\text{hydrolysis}}$  L-arabinose, D-galactose, D-glucuronic acid and L-rhamnose 1

**Chemical Tests:** -

**1. Lead acetate test:**

Aqueous solution of acacia + lead acetate solution → Yields a heavy white precipitate.

## CARBON SOURCE

- It is essential to supplement the tissue culture media with an utilizable source of carbon to the culture media.
- The most commonly used carbon source is sucrose at a concentration of 2–5%. Glucose and fructose are also known to be used for good growth of some tissues.

## PLANT GROWTH REGULATORS

- Plant growth regulators are the critical media components in determining the developmental pathway of the plant cells.
- The plant growth regulators used most commonly are plant hormones or their synthetic analogues.
- **Classes of plant growth regulators:** There are five main classes of plant growth regulator used in plant cell culture, namely:
  - (1) Auxins
  - (2) Cytokinins
  - (3) Gibberellins
  - (4) Abscisic acid
  - (5) Ethylene
- **Auxins:** Auxins promote both cell division and cell growth.

ABBREVIATION/NAME	CHEMICAL NAME
2,4-D	2,4-dichlorophenoxyacetic acid
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
Dicamba	2-methoxy-3,6-dichlorobenzoic acid
IAA	Indole-3-acetic acid
IBA	Indole-3-butyric acid
MCPA	2-methyl-4-chlorophenoxyacetic acid
NAA	1-naphthylacetic acid
NOA	2-naphthylacetic acid
Picloram	4-amino-2,5,6-trichloropicolinic acid

- **Cytokinins:** Cytokinins promote cell division.

ABBREVIATION/NAME	CHEMICAL NAME
BAPa	6-benzylaminopurine
2iP (IPA)b	[N6-(2-isopentyl)adenine]
Kinetina	6-furfurylaminopurine
Thidiazuronc	1-phenyl-3-(1,2,3-thiadiazol-5-yl)urea
Zeatinb	4-hydroxy-3-methyl-trans-2 butenylaminopurine

- **Gibberellins:** They are involved in **regulating cell elongation**, and are agronomically important in determining plant height and fruit set. Only a few of the gibberellins are used in plant tissue culture media, **GA3** being the most common.
- **Abscisic acid:** Abscisic acid (ABA) **inhibits cell division**. It is most commonly used in plant tissue culture to promote distinct developmental pathways such as somatic embryogenesis.
- **Ethylene:** Ethylene is a gaseous, naturally occurring, plant growth regulator most commonly associated with **controlling fruit ripening** in climacteric fruits.

## INTRODUCTION

Fibres may be defined as any hair-like raw material directly obtainable from an animal, vegetable, or mineral source and convertible into nonwoven fabrics such as felt or paper or, after spinning into yarns, into woven cloth. A natural fibre may be further defined as an agglomeration of cells in which the diameter is negligible in comparison with the length.

## CLASSIFICATION AND PROPERTIES

Natural fibres can be classified according to their origin.

1. Vegetable, or cellulose-base - Cotton, Fax, and Jute.
2. Animal, or protein-base, fibres - Wool, Mohair, and Silk.
3. Regenerated and synthetic fibres - Nylon, Terylene, Orlon, Viscose, Alginate fibres, etc.

## VEGETABLE FIBRES

### COTTON

**Synonyms:** - Raw cotton, Purified cotton, Absorbent cotton.

**Biological Source:** - Epidermal trichomes of the seeds of cultivated species of the *Gossypium herbaceum* and other species of *Gossypium* (*G. hirsutum*, *G. barbadense*)

**Family:** - Malvaceae

**Description:** -

- Colour - White
- Odour - Odourless
- Taste - Tasteless
- Shape - These are fine filaments like that of hair, which are soft and unicellular.
- Size - 2.2–4.6 cm in length and 20–35 micron in diameter

**Chemical Constituents:** -

- 90% of cellulose
- Purified cotton has almost cellulose and 6–7% of moisture

**Chemical Tests:** -

1. On ignition, cotton burns with a flame, gives very little odour or fumes, does not produce a bead, and leaves a small white ash; distinction from acetate rayon, alginate yarn, wool, silk, and nylon.
2. Dried cotton is moistened with N/50 iodine and 80% w/w sulphuric acid is added. A blue colour is produced; distinction from acetate rayon, alginate yarn, jute, hemp, wool, silk, and nylon.

## INTRODUCTION

- The substances of mineral origin have been used for various pharmaceutical purposes ranging from therapeutic agents to nutritional supplements to pharmaceutical excipient.
- These inorganic substances are found as mineral deposits of different types such as terrestrial deposits or fossil deposition of geological origin in ocean and seabeds.
- The natural ores or minerals are collected by mining in open quarries, and the product is further purified for various pharmaceutical uses.

MINERAL	OTHER NAME	SOURCE	USES
Kaolin	Hydrated aluminium silicate	Feldspar deposits	In gastric affection
Asbestos	Silicates of calcium-magnesium	Hornblende	For bacterial filter
Talc	Hydrated magnesium silicate	Sleatite/soap stone	Filtration
Bentonite	Hydrated aluminium silicate	Mineral deposits	Emulsion, cosmetics
Fueller's Earth	Aluminium magnesium silicate	Siliceous earth	Dusting powder
Prepared chalk	Calcium carbonate	Calcareous remains of algae	Antacid
Kieselguhr	Aluminium silicate	Fossil diatoms	Filtration aid
Calamine	Zinc oxide	Hemimorphites	Cosmetics
Shilajit	Herbo-mineral	Iron rich rocks	Aphrodisiac
Mica	Alumino-silicate	Metamorphic rocks	Manufacturing of furnaces, transformers, transmitters etc.

## KAOLIN

**Synonyms:** - China clay.

**Identification:** - Heat kaolin on charcoal black with cobalt nitrate, it forms blue mass due to alumina.

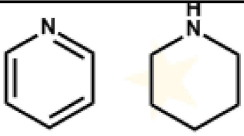
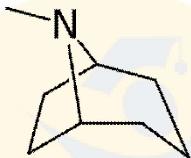
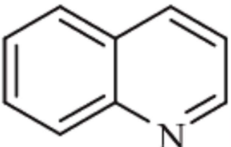
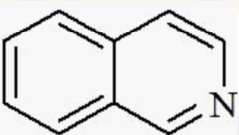
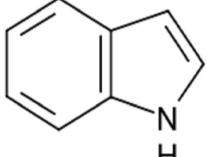
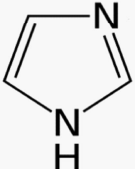
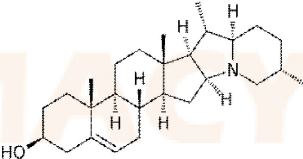
## BENTONITE

**Synonyms:** - Whilkinite.

**Identification Test:** -

1. Bentonite is mounted in cresol → Observed on dark field polarized light, it shines brightly.
2. Bentonite acquires permanent red stain → When treated with 1% solution of safranin in 70% alcohol.

## ALKALOIDS

S. NO.	CLASS	STRUCTURE	EXAMPLE
1.	Pyridine – Piperidine alkaloids		Tobacco, Areca, Lobelia
2.	Tropane alkaloids		Belladonna, Datura, Hyoscyamus, Stramonium, Dubosia, Coca leaves, Ashwagandha
3.	Quinoline alkaloids		Cinchona, Camptotheca
4.	Isoquinoline alkaloids		Opium, Ipecac, Curare, Berberis
5.	Indole alkaloids		Ergot, Nux vomica, Rauwolfia, Catharanthus, Physostigma
6.	Imidazole alkaloids		Pilocarpus
7.	Steroidal alkaloids		Veratrum, Kurchi
8.	Alkaloidal amine	$\text{CH}-\text{CH}_2-\text{CH}_2-\text{NH}_2$	Ephedra, Colchicum
9.	Glycoalkaloids	-	Solanum

## STARCH GRAINS

S.NO	CHARACTERISTICS	MAIZE	RICE	WHEAT	POTATO
1.	Colour	White	White	Faint grey	Yellowish tint
2.	Shape	Simple grains, angular, hilum central, rarely compound grains	Simple or compound grains (2–150 components), polyhedral with sharp angles	Mostly simple (large and small) grains, faint striations, Hilum appears as line	Flattened ovoid or subspherical, well-marked striations, hilum eccentric.
3.	Size in $\mu\text{m}$	5–30	2–10	Small 2–9 Large 10–45	10–100
4.	pH	Neutral	Alkaline	Acidic	Acidic
5.	Moisture content(%v/w)	13	13	13	20
6.	Ash content(%w/w)	0.3	0.6	0.3	0.3

## CALCIUM OXALATE CRYSTALS

S.NO.	TYPES OF CA-OXALATE CRYSTALS	EXAMPLES
1.	Microsphenoidal or sandy crystals	Cinchona (Small prism), Belladonna (Monoclinic microsphenoids), Hyoscyamus (Tetragonal)
2.	Single acicular crystals	Cinnamon, gentian
3.	Prismatic crystals	Quassia, hyoscyamus, senna, rauwolfia, cascara
4.	Rosettes crystals	Stramonium, senna, cascara, rhubarb
5.	Bundles of acicular crystals	Squill, ipecacuanha
6.	Needle shaped crystals	Allium cepa, Hyoscyamus species, Henbane, Tradescantia discolor (Spider wort), Begonia species.

PHARMACY INDIA