CHAPTER 1

Definition, History, Present Status & Scope of Pharmacognosy

Pharmacognosy:-

Pharmacognosy is defined as the scientific and systematic study of structural, physical, chemical and biological characters of crude drugs along with their history, method of cultivation, collection and preparation for the market.

- The word Pharmacognosy is derived from Greek word viz.
- Pharmakon: A Drug
- Gignosco : To acquire the knowledge

The Pharmacognosy is the subject of crude drugs obtained from the plant, Animalsand Minerals origins.

Source of crude drugs:-

- Plant Source:- Neem, Babul, Tulsi, Saffron, Clove.
- Animal source:- Honey bee, bee wax, Silk, Insulin, Shark, Liver oil, Thyroid.
- Mineral source:- Chalk, bentonite, asbestos, talc, kaolin, Fuller's earth.
- Micro- Organism: - Antibiotics,
- Marine :- Salt, Protozoa, etc.

History of Pharmacognosy

Egyptians wear aware of medicinal uses of several plants and animals and alsoabout human anatomy.

The Greek physician **Hippocrates (460- 360 B.C*)*** known as **'Father of medicine'**

Aristotle the renowned philosopher (384 - 322 B.C.) is well known for his studieson animal Kingdom and **Theophrastus (370 - 287 B.C.)** for the plants Kingdom.

Pedanius Dioscorides, (040- 080 A.D.) A Greek physician in 78 A.D. describedseveral plants of medicinal importance in "De Materia Medica".

Pliny the Elder (23-70 A.D.) who compiled 37 volumes of natural history.

Greekpharmacist Galen (131 - 200 A.D.) described various methods of preparation containing active constituents of crude drugs. The branch of dealing with the extraction of plant and animal drugs is known as Galenical Pharmacy.

Indian history of medicinal plants is dated back to 3500 B.C. The curative properties of plants have been mentioned in the Suktas Of Rigveda and Atharvaveda.

Ayurveda has also described good number of plants with their therapeutic properties. The ancient well known known treaties in Ayurveda the Charak Samhita and Susruta Samhita are written by **Charka And Susruta** Respectively.

Scope of Pharmacognosy

The crude drugs are obtained from plants and only a small number comes fromanimals and mineral origins.

Pharmacognosy has wide and broad scope in the field of Pharmacy and itsbranches of them are given following:-

- Cultivation and domestication of the medicinal plants.
- Analysis and Phytochemical
- Preparation of general tonic and stimulation.
- The steroid industry
- Herbal Preparation herbal medicine
- Flavoring agent and perfumes.
- Tissue Culture
- Phytomedicine

1) Natural Products.

- **Analysis and Phytochemical:-** Many Bioactive biomolecular are extracted andisolated from the crude drugs. They are analysed by modern technique such as Thin Layer Chromatography(TLC), High performance Liquid Chromatography (HPL), Gas Chromatography.
- **Herbal Preparation herbal medicine:-** Herbal medicine have become morepopular in recent years because it is believe that these do not have and toxin orside-effects as compare to the modern medicine.
- **Flavoring agent and perfumes:-** Large number of aromatic plants which are extensively used as Flavoring agent, perfume, spicy and medicine Ajowan, Lemongrass, etc.
- **Tissue Culture:-** Plant tissue Culture broadly referral to the in-vitro cultivationof plant seed and various parts of the plants organ embryo, tissue, single cell protoplast.
- **Phytomedicine: -** Herbal based traditional medicine practice that uses various plant material in modalities considered both prevention and therapeutics.

Classification of Drugs

Introduction:

Drugs are chemical constituents which are obtained by the natural/herbal sourcesor synthetic source.

Technically and legally the term drug as defined in India under Drugs andCosmetics Act of 1940 reads as follows.

1. All medicines for internal or external use of human beings or animal and allsubstances intended to be used for or in diagnosis, treatment, mitigation or prevention of disease in human beings or animals.
2. Such substances, other than food, intended to affect the structure or any function of the human body or intended to be used for the destruction or vermin or insects, which cause disease in human beings or animals as may be specified from time to time by the Central government by notification inOfficial Gazette

- Classification is required for each drug because they are not similar in manyexpect like chemical, mode of action, morphological etc. If we are not classified them then we face many problem that is drug identification, drug adverse effect, and drug action.
- For the identification and separation of drug with each other classification isrequired in many ways.

CLASSIFICATION OF DRUGS:

- Alphabetical classification.
- Taxonomical classification.
- Morphological classification.
- Pharmacological classification.

- Chemical classification.
- Chemo-taxonomical classification.
- Serotaxonomical classification.

Alphabetical classification—

Alphabetical classification is the simplest way of classification of any disconnectedor alphabetically similar crude drug. That means drug which are belong to similar alphabet then it place the similar group. Crude drugs are arranged in alphabetical order of their Latin and English names (common names) or sometimes local language names (vernacular names). Some of the pharmacopoeias, dictionaries and reference books which classify crude drugs according to this system are as follows.

- Indian Pharmacopoeia (English)
- British Pharmacopoeia (English)
- British Herbal Pharmacopoeia (English)
- United States Pharmacopoeia (English)
- British Pharmaceutical Codex. (English)
- European Pharmacopoeia (Latin)
- Pharmacopoeia Internationalis (Latin)

Taxonomical classification—

In that classification drugs are classified on the basis of their division, class, sub- class, order, family, genus and species. It is type of biological classification and restricted mainly to crude drugs from plant source. It is criticized for its failure to recognise the organised or unorganised nature of crude drugs in their morphological studies. The taxonomical system of classification can be elaboratedfurther as follows.

Class	Order	Family	Drugs
1. Gymnospermae 2. Angiosper mae Subclass: Monocotyledonae	Ephedrales Poles Asparagales Zingiberales	Ephedraceae Graminae Liliaceae Zingiberac eae	Ephedra Maize,whea t,rice Aloe Turmeric

Morphological classification.

In this types of classification, the crude drugs are divided into the parts of plantslike leaves, fruits, flowers, woods, barks, extract, gums etc.

Part of Plant	
Woods	Quassia, Guaiacum, Sandalwood.
Flowers	Clove, Rose, Saffron etc.
Barks	Cinnamon, Arjuna, Cinchona, etc.
Seeds	Linseed, Nutmeg, Nux-vomica, etc.
Gums	Guar, Ghatti, Acacia etc.
Dried Juices	Aloe, Red gum, Kino.
Fruits	Bael, colocynth, lemon, orange, Coriander.
Extracts	Catechu, Agar, Gelatin.
Subterranean-Parts	Ginger, Rhubarb. Turmeric, Aconite, Rauwolfia.

This type of classification is more convenient for practical purposes, even if thechemical nature is not known, a drug can be studied on the basis of their morphological and pharmacological characteristics.

This type of classification is very useful in identifying the adulterants used.

In the natural state crude drugs from plant source can be readily distinguished butoperations like collection, drying, preparation for the market produce distortion ofthe natural form making their recognition very difficult.

Animal drugs and mineral drugs are difficult to classify by this method.

On the basis of morphology drugs are divided into two parts.

1. Organized drugs
2. Unorganized drugs.

Organised Drug	**Unorganized Drug**
These are obtaining by the Plant and animal sources.	These are also obtaining by plant and animals sources but also found by minerals sources.
These are obtain direct part of plantsor animals (Dried or Fresh)	These are the products of Plants &animals.
They contain well defined cellular structure & solid in nature	They do not have well defined cellularstructure & they are solid, semisolid or liquid in nature.

They defined the morphological character of the Plants or animals.Ex: Digitalis leaf, Ephedra stem, clove bud, Tulsi leaf etc.	The defined the organoleptic character like(Teste, Odour, etc.) Ex: Agar, Gelatin, Honey, Essential oil.

Pharmacological classification.

In this classification drugs are placed together, which show the similarpharmacological function or therapeutic effects.

Drug action is a specific function for each drug due to its chief chemical constituents. Chemicals are bind to the specific receptors of our body and play agreat role in the therapeutics. Some crude drug are classified below.

Pharmacological action	Examples.
1. Drug action on Nervous system 2. Carminatives 3. Laxatives 4. Astringents 5. Diuretics 6. Cardiotonics 7. Antihypertensive 8. Antirheumatics 9. Antitumor 10. Antimalarial 11. Antidiabetics 12. Antitussives 13. Bitters	1. Opium, cannabis, nux-vomica,Belladona, ephedra . 2. Coriander, caraway, cinnamon,clove. 3. Castor oil, Ispaghula, senna. 4. Catechu. 5. Gokhru, punarnava. 6. Digitalis, arjuna. 7. Rauwolfia. 8. Guggal, colchicum. 9. Vinca. 10. Cinchona 11. Pterocarpus, gymnemasylvestro. 12. Vasaka, tolu balsam, Tulsi. 13. Nux- vomica, cinchona,gentian.

- The special advantages which the method enjoys is that even if the contentof the crude drugs are not known, they can be classified properly on the basis of therapeutics or pharmacological property.
- Pharmaceutical Aids are also a crude drugs, which are not place in this classification because pharmaceutical Aids shows many pharmacologicaleffects.

- However, the drugs which are dissimilar in their action of mechanism even though their therapeutic effects is same (Example- bulk purgative and irritant purgatives etc.) are put together.
- It is also possible that the same drugs with two different actions in the body,may be classified seperatly at both the places. for example cinchona is grouped as antimalarials and bitters and stimulants.

Chemical classification

In this classification crude drug are put together, which are contains the similar chemical constituents. It is very important expect in the classification system because chemicals are responsible for the pharmacological action.

It is very important for the phytochemical study of crude drugs.

Chemical classification is given below.

Type of chemicals	Examples
Alkaloids	Cinchona, nux-vomica, belladonna, ipecac,vinca, opium, tea, aconite.
Glycosides	Digitalis, liquorice, senna, squill, aloe,dirscorea.
Volatile oils	Peppermint , clove, eucalyptus.
Tannins	Kino, catechu.
Resins	Benzoin, tolu balsam, asafoetida, Myrrh, guggal.

Vitamins	Yeast, cod liver oil, shark liver oil.
Carbohydrate	Agar, honey,starch, tragacanth,acasia.

However, this type of classification fails in proper placement of drugs containing two different types of chemicals. For examples, certain drugs are found to contains alkaloids and glycosides (cinchona), Fixed oil and volatile oil (nutmeg), fixed oil and enzymes (bitter almond) together and hence makes it difficult to categorize them systematically.

Chemo-taxonomical classification.

In this classification combine the two classifications for defining the crude drugs. In which we investigate the drug category and chemical composition. Many crude drugs which contain the chemical constituents which are belong to the similar classes or closely related to similar species or family or division.

- In this system, equal importance is given for taxonomical status and chemical constituents. There are certain types of chemical which are characteristics the specific classes of plants.
- The character most often studied in chemotaxonomy are secondary metabolites of pharmaceutical significance such as alkaloids, glycosides, flavonoids etc.

Serotaxonomical classification.

This technique is based on the highly specific relationship between antigens and the antibodies produced in response to the animal during the any infection or harm.

- Serology is the scientific study of the blood for the diagnosis of our immunity power or define our immunity efficiency by the production of antibodies against the pathogens or introduce substances.
- It is mainly based on the protein content, which are present in the plants or crude drugs. Different protein contents are divided the crudedrugs in different categories.

Quality control ofcrude drugs

Adulteration

Adulterations are defined as admixture of genuine articles with spurious or harmful substances.

The action of making something poorer in quality by the addition of another substance is alsoknown as adulteration.
Example:-

- Mixture of Papaya seed with black pepper.
- Mixture of power of brick into red chili powder.

Methods of adulterating the drugs.

- The extent of adulteration depends upon whether the drug is obtained from othercountries.

- An adulteration of a drug may be accidental.
- Adulteration is very common with drugs which are sold illegally.

Following are the various methods used for drugs adulteration.

A. **Substitution with manufactured materials**
B. Substitution with Inferior material
C. **Substitution with Exhausted material.**
D. Substitution with cheap natural substance.
E. **Adulteration with non- plant material.**
F. Excessive adventitious matter.

A. Substitution with manufactured materials:-

This is done with artificially manufactured material which resembles various drugs in form andappearance.

Example: - Paraffin wax has been colored yellow to substitute bee wax.

B. Substitution with Inferior material:-

Drug are sometimes adulterated and substituted with standard commercial material. The common example of substitution is adulteration of cloves by mother cloves.

Saffron is adulterated with dried flowers of Carthamus tinctorius (Safflower).

C. Substitution with Exhausted material.

Exhausted material the vegetable residues which remain after the original material has been usefor drug preparation.

Example

- The substitution of Alexandrian Senna with Arabian Senna.
- Used of exhausted Clove and ginger for adulteration.

D. Substitution with cheap natural substance.

Sometimes drugs are adulterated with cheaper natural substance which has no relation to thegenuine article.

Example: - Japan wax for bees wax and sterculia gum for Tragacanth.

E. Adulteration with non- plant material.

Plant materials are sometime adulteration with worthless non-plant materials.

Evaluation of crude drugs:-

Evaluation of drugs means identify of its quality and purity.

It is also includes the detection of the nature of adulteration in the crude drugs.

The morphological character may suffice the need of detection but in case of powdered drugs the microscopic characters, while in case of liquid drug chemical tests and one of the physical standards such as specific gravity, optical rotation solubility etc. May be helpful in detection of adulteration.

The methods are employed in detecting adulteration is genuine drugs.

The crude drugs can be identified on the basic of their morphological, histological and chemicalstudies.

The different techniques involved in standardization of crude drugs are as follow.

1. Physical Evaluation:- Physical standards are to be determined for drugs

wherever possible.They may help in evaluation, specifically with reference to specific gravity, density, optical rotation refractive index, melting point, viscosity and solubility in different solvents.

2. **Chemical Evaluation:-** Chemical comprises of different chemical tests and chemical assays. The isolation, purification and identification of active constituents are chemical methods of evaluation Quantitative chemical tests such as Acid value, Saponification value etc.

It also help in proper identification of various of the crude drugs.

3. **Biological Evaluation:-** The estimation of potency of crude drugs is done by means of the itseffect on the living organism like bacterial, fungal growth or animal tissue or entities animal, it iscalled as bioassay

Bioassay is the measure of sample being tested capable of producing the biological effects as thatof the standard preparation.

4. **Morphological Evaluation (Organoleptic):-** It is refers to evaluation of drugs by colour, odor, teste, size, shape and special features like touch, texture and sound etc.

The study of form of crude drugs is morphology while description of the form is morphography.

The adulteration of seeds of strychnos nux-vomica with the seed of strychnos nux-blanda or Strychnos potatorum, caraway with Indian dill, Alexandrian Senna with dog Senna is identifiedby morphological techniques.

5. **Microscopic Evaluation:-** The microscopic evaluation also covers study of constituents byapplication of chemical tests to small quantities of drugs in powdered form or to histological sections of the drug (micro-chemistry)

This method allows more detailed examination of a drug and its can be used to identify organized drugs by their known histological characters.

Histological studies are made from very thin sections of the drugs.

Microscope by virtue of its property to magnify permits the minute structure under study to beenlarged and can be used to confirm the structural details of the drugs from plants origin.

Alkaloids

Introduction—The term alkaloid (Alkali-like) is extremely useful in commonly applied to basic nitrogenous compounds (ergotamine contain 5 nitrogen) and it may be exist in primary amine, secondary amine, tertiary amine ofplant origin, that are physiologically active about 21000 alkaloids have been identified.

- Alkaloids never occur alone, these are usually present as a mixture of a major or several minor alkaloids of a particular biosynthetic unit, which differ in functional groups. It contains at least one nitrogen atoms. Alkaloidsare generally insoluble in water, but the salt formed on reaction with acids isusually freely soluble. Alkaloids are freely soluble in ether, chloroform or other organic solvents.

- The first complete synthesis of an alkaloid (coniine) was achieved in 1886by German chemist Albert Ladenburg. The term alkaloid was coined by Meissner in 1819.
- Chemist Derosne in 1803 isolated the alkaloid norcotine. In the same year,morphine from opium was isolated by Serturner. Pettetier and Caventon isolated emetine in 1817 and colchicines in 1819.

On the basis of chemical nature of alkaloids it is divided in three parts—

A. **True alkaloids—** True alkaloids derive from amino acid and they share a heterocyclic ring with nitrogen. These alkaloids are highly reactive substances with biological activity even in low doses. The primary precursors of true alkaloids are such amino acids as L-ornithine, L-lysine, L-tryptophan and L-histidine. Examples of true alkaloids include such biologically active alkaloids as cocaine, quinine, dopamine and morphine.

B. **Proto/Amino alkaloids—** Protoalkaloids are compounds, in which theN atom derived from an amino acid is not a part of the heterocyclic. Such kinds of alkaloid include compounds derived from L-tyrosine and L- tryptophan. Example- Hordenine, mescaline and yohimbine.

C. **Pseudo alkaloids—** Pseudoalkaloids are compounds, the basic carbon skeletons of which are not derived from amino acids. These alkaloids can also be derived from nonaminoacid precursors. Example- coniine, capsaicin, ephedrine, solanidine, caffeine and theobromine.

Occurrence and distribution of alkaloids— Plant have been a rich source of alkaloids but some are found in animals (muscopyridine in muskdeer), fungi (Ergot alkaloids in *Claviceps purpurea)*, insect (scopolamine in *Apis mellifera*), bacteria (pyocyamine in *Pseudomonas aeruginosa*), practically alkaloids are also obtained in the laboratory by chemical synthesis. In the plant kingdom, the alkaloids appear to have a restricted distribution in certain families and genera. Among the angiosperms the Leguminosae, Pavaraceae, Ranuculaceae, Rubiaceae, Solanaceae, and Barberidaceae are outstanding alkaloids yielding plants. The gymnosperm rarely contains the alkaloids.

Isolation of alkaloids— Isolation of alkaloids is perform by different-different process-

Stas-otto process.

- Initially powdered materials are defatted with non-polar solvents andmoist with water and treated with NH_3 (free alkaloids).
- Then extract is obtain by the mixing of organic solvent (chloroform,ether) and concentrate it.
- Then dissolved the alkaloid salt and basified with ammonia or sodiumbicarbonate.
- Finally obtained the organic phase free alkaloids and dry them.

Manske's process.

- Initially powdered materials are defatted with non-polar solvents and convert the methanol extract by adding methanol and concentrate it.
- Then dissolve in water and acidified up to PH-2 and stand for severaldays in refrigerator or boiled water paraffin and filter it.
- Filtrate is shake with organic solvent and basified with ammonia.
- Finally obtained the organic phase free alkaloids and dry them.

Identification Test for alkaloids—

1. **Mayer's reagent (Potassiomercuric iodide solution)—**Take the alkaloid materials → Mix with the Mayer's reagent → then obtained cream color ppt.

2. **Wagner's reagent (Solution of iodine in potassium iodide)—**Take the alkaloid materials → Mix with the Wagner's reagent → then obtained brownor reddish brown ppt.

3. **Hager's reagent (Saturated solution of picric acid)—**Take the alkaloidmaterials → Mix with the Hager's reagent → then obtained yellow color ppt.

4. **Dragendroff's reagent (Potassium bismuth Iodide)—**Take the alkaloid materials → Mix with the Dragendroff's reagent → then obtained reddishbrown ppt.

5. **Murexide reagent (Ammonium purpurate)—** Take the alkaloid materials
   → Mix with the murexide reagent → then obtained purple color ppt.

Therapeutic/Pharmaceutical applications— In therapeutic efficiency alkaloids are used as broad level.

- **Acts on CNS—** Depressants (Morphine), stimulants (caffine),
- **Acts on ANS—** Sympathomimetic (ephedrine), Para sympathomimetic (pilocarpine), Anticholinergic (atropine, hyoscyamine).

- Local anaesthetic or analgesics (cocaine and morphine).
- Antitumor (Vinblastine).
- Antimalarial (Quinine).
- Antibacterial (Berberine).
- Antiseptic (Scopolamine).

Glycosides.

Introduction— A glycoside is any molecule in which a sugar group/moiety is

bonded through its anomeric carbon to another group via glycosidic linkage, chemically, the glycosides are acetal in which the hydroxyl of the sugar is condensed with a hydroxyl group of non sugar component.

The non sugar component is known as aglycone and sugar component is known asglycone. Both the portion can be chemically separated by hydrolysis in the presence of acid. There are also numerous enzymes that can form and break glycosides bond.

Genin or aglycones may be hydroxylic compounds like alcohols or phenols or evenit may be an amine. Pharmacologically aglycone part of glycosides is the active constituents and helps in the growth, regulation, protection etc.

Classification of glycosides—

1. **On the basis of glycoside linkage.**
    a. **O-glycoside—** Sugar molecule is bond with phenol or OH group ofaglycone. Example- Amygdaline, Salicin, Arbutin.
    b. **N-glycoside—** Sugar molecule is bond with N of the amine group(-NH-) of aglycone. Example-Nucleosides.
    c. **S-glycoside—** Sugar molecule is bond with S or SH (Thiol group) ofaglycone. Example- Sinigrin.
    d. **C-glycoside—** Sugar molecule is bond with C atom of aglycone. Example- Aloin, barbaloin.
2. On the basis of aglycone nature.
    a. Cardiac or sterol glycoside— Example- Digitalis, squill.
    b. Anthraquinone glycoside— Example- Senna, aloe, rubarb.
    c. Thiocynate or isothiocynate glycoside—Example- Black mustard.
    d. Saponinglycoside glycoside— Example- Liquorice, ginseng.
    e. Flavone glycoside— Example- Ginkgo.
    f. Aldehyde glycoside— Example- Vanilla.

g. Phenol glycoside— Example- Cascara, bearberry.
h. Steroidal glycoside— Example- Solanum.

Occurrence and distribution of glycosides— Pharmaceutically important glycosides are obtained from the vegetable source. They occur in variousparts of plant like fruits, seeds, leaves, and barks. Most commonly occurring sugarsas a product of hydrolysis of glycosides are glucose, mannose, and galactose.

Glycosides are colorless, crystalline, non-reducing, optically active compounds usually levo-rotatory molecule. These are class of compounds abundant in nature, some plants families containing important glycosides are- Liliacea, Leguminoceae, Scrophulareaceae, Rosaceae, cruciferae, gentianaceae, Umblliferae, Rutaceae, and mytaceae etc.

Isolation of glycoside—

Stas-otto method.

- Take the finely divided glycoside containg powder drugs.
- Obtain the extract by continuous hot percolation (thermolabile substancebelow 45^0C using soxhlet apparatus with alcoholic solvent (enzyme partdeactivated by heat).
- Then extract treated with lead acetate for removing the tannins and non-glycosidal impurities.
- Excess lead acetate is precipitated as lead sulphide by passing the hydrogensulphide gas.
- Finally obtain the crude glycoside and purify them by fractional solubility,fractional crystallization and chromatographic technique.

Identification Test for glycosides—

1. **Borntrager's test (Anthraquinone glycoside).**
    - Take 1gm of crude drugs

- Then add 5-10ml of HCl and boil on water bath for 10 minutes andfilter.
- Filtrate was extracted with CCl_4/Benzene and add equal amount ofammonia solution and shake well.
- Formation of pink or red color in ammonia layer due to presence ofanthraquinone glycoside.

2. Saponin glycoside.

- Take the crude drug on slide.
- Then add some drops of blood and mixed well.
- RBC's becomes ruptured due presence of saponin glycosides.

3. Steroid glycoside.

- Take alcoholic crude drugs and mixed with $CHCl_3$.
- Slowly add concentrate H_2SO_4 from side walls of test tube.
- Yellow color ring appear at the junction of two liquid. Which turnsred after 2 minutes, indicates the presence of steroids.

4. Vanillin HCl test for flavonoid glycoside.

- Take alcoholic crude drugs and mixed with vanillin HCl.
- Formation of pink color due to presence of flavonoids.

5. Killer-Killani test for cardiac glycoside.

- Take alcoholic drug + equal amount of water and add 0.5ml ofstrong lead acetate solution, shake well and filtered.
- Equal amount of chloroform add in filtrate and evaporate to dryness.
- Then residue is dissolve in 3ml of glacial acetic acid followed byaddition of few drops of FeCl3 salt.
- Finally solution transferred into 2ml of concentrate H2SO4 test tube.

- Reddish brown layer is formed, which turns bluish green afterstanding due to presence of digitoxose.

Therapeutic/Pharmaceutical applications of glycosides—

- **Senna leaves—** Senna leaves are used as laxative. It causes irritation of large intestine and have some griping effect. Senna is stimulant cathartic andexerts its action by increasing the tone of the smooth muscles in large intestine.
- **Aloe—** The drug Aloes is one of the safest and stimulating purgatives, inhigher doses may act as abortifacient. Its action is exerted mainly on the large intestine; also it is useful as a vermifuge.
- **Digitalis leaves—** It is also used in allopathic medicine in the treatment ofheart complaints. It has a profound tonic effect upon a diseased heart, enabling the heart to beat more slowly, powerfully and regularly without requiring more oxygen
- **Bitter almond—** it is used as sedative.

Volatile oils and Terpenoids.

Introduction— Volatile oils are the odorous chemical substances which are easily evaporate when exposed to air at ordinary temperature. These represent essence of active constituents of the plants and hence also known as essential oil.They differ entirely in both chemical and physical properties from fixed oils.

Volatile oils are freely soluble in ether and in chloroform and fairly soluble in alcohol and insoluble in water. Their density is lower than water with the exception (clove and cinnamon) heavier than water. They possess characteristics odor, have high refractive index and most of them are optically

active. Volatile oils are colorless liquid, but when exposed to air and direct sunlight these become darker due to oxidation.

Classification of the volatile oils— On the basis of chemical nature it is divided into many parts-

i. Hydrocarbons— Example- Turpentine oil.
ii. Alcohols— Example- Sandal wood oil, Peppermint oil.
iii. Ketone— Example- Caraway, dill, fennel, camphor.
ii. Aldehyde— Example- Lemon grass oil, Cinnamon oil, Saffron.
iii. Phenols— Example- Clove, Ajowan, Tulsi.
iv. Phenolic ethers— Example- Nutmeg, calamus.
v. Oxides— Example- Cardamom, Eucalyptus, Chenopodium oil.
vi. Esters— Example- Rosemary oil, Garlic, Gaultheria oil.

Volatile are chemically derived from terpenes (mainly mono and sesqui terpenes)and their oxygenated derivatives.

Terpenoids—

Terpenoids are the hydrocarbons of plant origin of the general formula $(C_5H_8)_n$ as well as their oxygenated, hydrogenated, and dehydrogenated derivatives. It is a group of naturally occurring chemical compound, majority of which occur in plants (widely in the leaves and fruits of higher plants, conifers, citrus, and eucalyptus etc.), a few of them have also been obtained from other sources.

The term ‘terpene’ was given to the compound isolated from turpentine, a volatile liquid isolated from pine trees. The simpler mono and sesqui terpenes is the chief constituents of the essential oils obtained from sap and tissues of certain plants andtrees. The di and tri Terpenoids are not steam volatile.

Terpenes are easily dividedinto their isoprene unit or (Isoprene unit is the monomer of any terpenes). On the basis of hydrocarbon (carbon number) it is

divided into many parts.

i. **C_{10}-monoterpene—** Example- Essential oil, oleoresins, pyrethrins.
ii. **C_{15}-Seqsuiterpene—** Example- Essential oil, sesquiterpenoid lactones.
iii. **C_{20}-Diterpene—** Example- Retinol.
iv. **C_{30}-triterpene and steroids—** Example- Saponins, Cardiac glycosides.
v. **C_{40}-tetraterpene—** Example- β-carotene.

Occurrence and distribution of volatile oils/terpenoids— Majority of volatile are preexist in the plants and is usually contained in some special secretory tissues, for example- the oil ducts of umbelliferous fruits, the oilcells or oil glands occurring in the sub- epidermal tissue of the lemon and orange, Mesophyll of Eucalyptus leaves, trichomes of several plants etc. In few cases it does not preexist but is formed by the decomposition of glycosides (example- Bitter almond oil and mustard oil).

Volatile oils are generally mixtures of hydrocarbons and oxygenated compoundderived from these hydrocarbons. In some oils (example-oil of turpentine) the hydrocarbons predominate and only limited amounts of oxygenated constituentsare present, in other (example-Clove oil) the bulk of oil consists of oxygenated compounds.

Volatile oils are extracted by the many plants—

- Leaves— (Eucalyptus oil, lemon grass oil).
- Flowering tops— (Peppermint oil, rosemary oil, Cintronella oil).
- Stem barks or woods— (Chinnamon, Taxus, camphor oil, sandal oil).
- Fruiting body— (Chenopodium oil, coriander, caraway, fennel).
- Rhizome— (Calamus).
- Seeds— (Annatto).

Now days India and China produce large quantities of oil for export.

Isolation methods for volatile oils—

i. **Isolation by distillation—** The distillation is carried out by water or steam. On the basis of melting properties of the volatile oil, hydro distillation, and steam distillation is widely used.

ii. **Isolation by scarification—** This method is used for the preparation of oilof lemon, oil of orange, and oil of bergamot etc. These oils are found in large oil glands just below the surface in the peel of the fruit. Scarificationworks on the two principle-

   a. Sponge process—
      - Removed the fruit content by cutting and emerged in water fora short period of time.
      - Then fruit contents are pressed on the sponge operator. Oil glands are burst open and the sponge absorbs the exuded oil.
      - Sponge liquid contain both water and oil so it allowed to standfor a short time, where upon the oil separates from water and is collected.

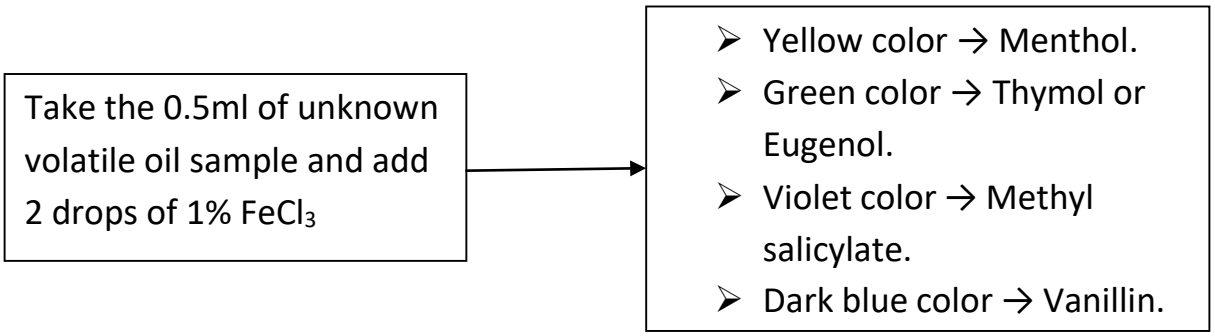
   b. Ecuelle process— In this process, the rinds are ruptured mechanically using numerous pointed projections with a rotarymovement and the oil is collected.

Identification Test for volatile oils—

1. Take the naturally containing volatile oils and treat with alcoholic solutionof Sudan-III develops red color in the presence of volatile oil.
2. Take the naturally containing volatile oils and treated with tincture of alkane, which produced red color that indicates the presence of volatileoils.

3. Take 0.5ml of eugenol containing drug and add 2 drops of 1% $FeCl_3$ solution. Then green color produced to indicate the Eugenol chemical.

Some common identification criteria—



Therapeutic/Pharmaceutical applications of volatile oil/Terpenoids—

- In the pharmaceutical formulation it is used as an flavoring agent andperfuming agent for masking the unpleasant odor of the drugs.
- It is also used in the foods, beverages, and in cosmetic industries.
- It shows more therapeutic values— Carminative (Umbelliferous fruits), Irritant (Turpentine and oil of wintergreen), Local anaesthetics (Clove), Sedative (Jatamansi), Anthelmintics (Chenopodium oil).

Tannins.

Introduction— The name 'tannin' is derived from the French and is used for a range of natural polyphenols. Tannins are secondary metabolites complex organic, non-nitrogenous, phenolic, plant products, which generally have astringent properties.

The term tannin was first used by Seguin in 1796 to denote substance which

hasthe ability to combine with animal hides to convert them into leather which is known as tanning of the hide.

According to this, tannins are substance which is detected by a tanning test due toits absorption on standard hide power. The test is known as Goldbeater's skin test.

Classification of tannin compounds— On the basis of Goldbeater's skin test it isdivided into two major groups.

I. **Pseudo tannins—** Those tannins which are partly retained by the hidepower and fails to give the test, are called as pseudo tannins.

II. **True tannins—** Those tannins which shows the maximum hide power andgive the positive test are called as true tannins. On the basis of hydrolytic reaction it is further divided into two groups: -

   a. **Hydrolysable/Pyrogallol tannins—** These tannins are easily hydrolysable by mineral acid or enzymes. Their structure involvesseveral molecule of polyphenolic acids are bounded through ester linkage to a central glucose molecule. On the basis of hydrolysis product it is divided into two part.

      - Gallotannins composed of gallic acid.
      - Ellagitannins composed of hexahydrodiphenic acid.

   b. **Non hydrolysable or condensed/Proanthocyanidins tannins—** These tannins are not readily hydrolysable to simpler molecule with mineral acids and enzyme. These compounds contain condensed tannin only phenolic nuclei which are bio-synthetically related to flavonoids.

Occurrence and distribution of tannins— Tannin compounds comprisea large group of compounds thet are widely distributed in the plant kingdom. The

families of the plants rich in both (Hydrolysable and Non- hydrolysable) groups of tannins, include: - Rosaceae, Leguminosae, Combretaceae, Polygonaceae, Rubiaceae, Geraniaceae etc.

The members of families Cruciferae and Papeveraceae on the other hand are totallydevoid of tannin. In the plants in which tannins are present, they exert an inhibitory effect on many enzymes due to their nature of protein precipitation and therefore contribute a protective function in bark and heart wood.

Isolation of tannins— Tannin compounds can be easily extracted by water r alcohol because both tannins (hydrolysable and non-hydrolysable) are highly soluble in water and alcohol but insoluble in organic solvents (chloroform, ether, and benzene).

The general method for the extraction of tannic acid from various gall is either with water-saturated ether, or with mixture of water, alcohol and ether. After extraction, the aqueous and ethereal layers are separately concentrated, dried, and subjected to further isolation and purification using various separation techniquesof chromatography.

Identification Test for tannins—

1. Gold beater's skin test.
2. **Phenazone test.**
3. Gelatin test.
4. **Test of catechin (Match stick test).**
5. Test for chlorogenic acid.
6. **Vanillin hydrochloric acid test.**

1. Gold beater's skin test—

- Take gold beaters skin piece and initially soaked in 2% hydrochloric acidand washed with distilled water.

- Then placed in a solution of tannin for 5 minutes then washed with distilledwater and transferred to 1% ferrous sulphate solution.
- Finally brown or black color membrane is appearing which are indicatingthe presence of tannin.

2. Phenazone test—

- Take 5ml of aqueous solution of tannin and add 0.5 g of sodium acidphosphate.
- Then warm the solution and cool and filter, and add 2% phenazone solutionto filtrate.
- Finally all tannins are precipitated as bulky, colored perceptible.

3. Gelatin test—

- Prepare the gelatinous solution by adding 1% of gelatin solution and littleamount of 10% sodium chloride.
- Then add 1% solution of tannin.
- Finally tannin causes precipitation of gelatin solution.

Therapeutic/Pharmaceutical applications of tannins—

- Medically tannins show astringents properties and promote rapid healing andthe formation of new tissue.
- Tannins are also used for treating wounds and inflamed mucosa.
- Tannins are used in the treatment of various ulcers, hemorrhoids, minorburns frostbite etc.
- Recently tannins should antiviral activities and used for treatment of viraldiseases including AIDS.

Resins.

Introduction—Resin can be defined as the complex amorphous chemical of more or less solid characteristics. Which on heating, initially they soften and finally melt.

They are insoluble in water and petroleum spirit but dissolve in more or less completely in alcohol, chloroform, and ether.

Classification of Resin:- It is divided into two parts.

On the basis of their chemical natural (Functional group)

1. **Resin acids :** Resinous substances which contains the carboxylic acid groups. Being acidic compounds they are soluble in aqueous solution of alkalies producing frothy solution. Resin acids can be derivatized to their metallic salts known as resonates. Which finds their use in soaps, paints, varnish industries.
2. **Resin Esters :** Resin Esters are the esters of the resin acids or the other aromaticacids like benzoic, cinnamic acid, salicylic acids etc.
3. **Resin alcohols:** Resin alcohols or resinols are the complex alcoholic compound of high molecular weight like resin acids they are found as free alcohols or as esters of benzoic, salicylic and cinnamic acid.
4. **Resin phenols :** Resin phenols or resinotannols are also high molecular weightcompounds which occurs in free state or as esters.

On the basis of their association with other chemicals--

1. **Glucoresins :-** Glucoresins are the combined chemical of sugar and Resin byglycosylation.
2. **Oleoresins :-** these resins are the homogeneous mixture of resin with volatileoils.
3. **Gem resins :-** Gum Resin are the naturally occurring mixture of resins

withgum.

4. **Oleogum Resin :-** Oleogum Resin are the naturally occurring mixture of resin,volatile oil and gum.

5. **Balsams :-** balsams are the naturally occurring resinous mixture which contain ahigh proportion of aromatic balsamic acids such as benzoic acid, cinnamic acids and their esters.

Occurrence and distribution of resins—Resins are produced and storedin the schizogenous or schizolysigenous glands or cavities of the plants. Glands arepresent at the different-different location. Example—In the resin cell of blood root,in the elements of the heart wood of guaiacum, in the external glands of Indian hamp, in the internal glands male fern or in the gland on the surface of the lac insect.

They are often performed in the plant but the yield is usually increased by injury (pinus), and may products (benzoin and balsam) are not formed by the plant until ithas been injured.

Isolated resin products which come as unorganized crude drug in the market aremore or less solid, hard, transparent, or translucent materials.

Isolation of resins— Isolation of resinous chemical is the difficult tasks dueto presence of various combinations.

- General mechanism of isolation technique can be the extraction of the drug with alcoholic solvents and then subsequent precipitation of resin by addingconcentrated alcoholic extract to a large proportion of water.
- The method of distillation or hydro-distillation can be used for the separation of volatile oils from resin. This process is used largely for theseparation of resin from turpentine.

Identification Test for resins—

1. Dissolve about 0.1gm of powdered resin in 10ml of acetic anhydride.

- Then add one drop of cold and concentrated sulphuric acid on glassrod.
- After adding the acid a purple color, rapidly changing to violet isproduced.

2. Take the resinous drug (0.5g) is boiled with hydrochloric acid (5ml) andfiltered.
    - Then add ammonia with filtrate.
    - Finally a blue fluorescence is obtained.
3. Take the crude resinous drug and add 50% of nitric acid. Finally green coloris produced.
4. Take the crude resinous drug and add 1drop of sulphuric acid. Finally redcolor is obtained which changes to violet on washing with water.
5. Alcoholic solution of balsam reacts with potassium permanganate to yieldbenzaldehyde.
6. Alcoholic solution of balsam is acidic to litmus paper.

Therapeutic/Pharmaceutical applications of resins— The pharmaceutical applications of resins are local irritant, local cathartic (e.g. Jalap, Ipomoea), as anticancer (podophyllum), in bronchial asthma (Cannabis), used externally as mild antiseptic in the form of tinctures (Benzoin), ointment and plasters (Turpentine and Colophony) and used in the preparation of emulsion andsustained release formulations.

Laxatives

The drugs are loose the bowels (Intestine) or the drugs producing increasing andhosting intestinal evacuation.

Laxatives are indicated in constipation and in evacuation of the bowel, prior to diagnostic procedure or surgery.

Aloe

Synonyms:-

Aloe, Aloevera

Family :-Liliaceae

Biological

source:-

It is the dried juice of the leaves of *Aloe barbadensis* Miller. (Curacao aloes)

Physical Characteristics

Colour	Bright yellowish or rich reddishbrown to black.
Odour	Penetrating
Taste	Nauseous and bitter
Size	Various Size

Chemical Constituents:-

- Aloes contain a yellow coloured crystalline substance known as barbaloin(C-glycoside) resin and aloe-emodin.
- Aloe emodin
- Barbaloin

Therapeutic efficacy :-

- Improves digestive health.
- Promotes oral health.
- Clears acne.
- Relieves anal fissures
- It used as irritant purgative
- It use for cosmetic and protective
- It also used for treatment of radiation burns.

Castor oil

Synonyms:-

Oleum Ricini

Family:-Euphorbiaceae

Biological Source:-

It is the fixed oil obtained by the cold expression of the kernels of seeds of *Ricinus communis*.

Physical Characteristics

Colour	Pale yellow or almost colourlessliquid

Odour	Nauseating
Taste	Slightly acrid

Chemical Constituents:-

Triglyceride of ricinoleic acid, fatty acids.

Isoricinoleic, linoleic, stearic and isostearic

acids.**Therapeuticefficacy :-**

- Costor oil is used as a cathartic.
- It also used for lubrication commercially.
- Castor oil can be used as an irritant/simulative laxative.
- Castor oil is a natural emollient and a few drops may also be used to remedy dry skin, as a massage oil, and may benefit hair as a treatment. Castor oil contains ricinoleic acid, a fatty acid that comprises about 90% ofthe oil.

Ispaghula

Synonyms:- Isapgol,

Isabgol**Family:-**

Plantaginaceae

Biological source:-

It consists of dried seeds of the plant known as *Plantago ovata* Forskal.

Chemical Constituent :-

- Isapgol seed contain mucilage
- It consists of **pentosan** and **aldobionic acid.**

Physical Characteristics

Colour	Pinkish-grey or brown
Odour	None
Taste	Mucilaginous, bland
Size	**Length :** 10 to 35 mm **Width:** 1 to 1.75 mm

Therapeutic efficacy :-

- It is also useful in dysentery, chronic diarrhoea, in cases of duodenal ulcersand piles.
- It works effectively as a soothing agent.
- The husk are used as demulcent, laxatives and emollient.
- It used as the treatment of chronic construction amoebic and bacillarydysentery.
- Ispaghula is used in the treatment of constipation.

Senna Leaves

Synonyms:-Tinnevelly Senna, Indian Senna

Family:-Leguminosae

Biological source:-

- It consist of dried leaflets of *Cassia angustifolia.*

Physical Characteristics

Colour	Light Green

Odour	Faint
Taste	Bitter mucilagenous.
Size	3–5 cm long, 2 cm wide andabout 0.5 mm thick

Chemical Constituents:-

- It consists not less than 2.0% of hydroxyanthracene derivatives calculated assennoside B.
- It contains anthraquinone derivatives.
- The active constituents of the drug. They are sennosideA, sennoside B,sennoside C, and Sennoside D.
- Senna Leaves also contains rhein, kaempferol, Aloe-emodin andisorhamnetin etc.

Therapeutic efficacy :-

- Senna Leaves are used as laxatives.
- It is an irritant purgative due to presence of anthraquinone derivatives.
- It causes irritation of large intestine and have some griping effect.
- They are prescribed along with carminatives.
- Senna is stimulant cathartic and exerts its action by increasing the tone of thesmooth muscles in large intestine.

Cardiotonic

- The drugs which gives Strength or energy to the activity of the heart.
- Cardiotonic drugs increase the force of the contraction of the muscle(myocardium) of the heart.

Example:- Digitalis, Strophanthussquill, Arjuna barketc.

Classification of Cardiotonic

Digoxin:

- Digoxin is used to treat heart failure, usually along with other medications. Itis also used to treat a certain type of irregular heartbeat (chronic atrial fibrillation).
- Digoxin is one of the oldest medications used in the field of cardiology.
- Treating heart failure may help maintain your ability to walk and exercise and may improve the strength of your heart. Treating an irregular heartbeatcan decrease the risk for blood clots, an effect that may reduce your risk fora heart attack.

Milrinone:

- This medication is used for the short-term treatment of heart failure. It worksby making your heart beat stronger and by relaxing certain blood vessels so that the amount of blood that is pumped from the heart is increased.

Dexazoxane:

- The heart from damage of continued treatment with chemotherapy agentsknown as anthracyclines in women with breast cancer.
- Dexrazoxane is an agent that protects patients treated with anthracyclinesagainst cardiac side effects

Phenyephrine:

- Phenylephrine is a decongestant that is used to treat stuffy nose and sinuscongestion caused by the common cold, hay fever, or other allergies.

Lisinopril :

- Lisinopril is used to treat high blood pressure (hypertension) in adults andchildren who are at least 6 years old.

Dopamine:

- Dopamine is a medication form of a substance that occurs naturally in the body. It works by improving the pumping strength of the heart and improvesblood flow to the kidneys.

Dobutamine:

- Dobutamine is used short-term to treat cardiac decompensation due toweakened heart muscle.
- Dobutamine is usually given after other heart medicines have been triedwithout success.

Digitalis

Synonyms:-

Digitalis leaves, Foxglove leaves

Family:-Scrophulariaceae.

Biological Source:- It consists of dried leaves of ***Digitalis purpurea*** at 60°cbelow temperature after collecting the leaves.

Chemical Constituents:-

- Cardiacglycosides (Cardenolideas) 0.2 to 0.45 % Purpurea glycosides.
- They also contains few other glycosides like oderoside H, glucogitaloxin,gitaloxin, verodocin and glucoverodoxin.

Therapeutic efficacy (Uses)

- It is effective in congestive cordiac failure to increase cardiac output andrelieve venous congestion.
- The drug is also used to slow the rate of ventricular contraction in patientswith atrial fibrillation or flutter.
- Digitalis directly increases the contractile power of the heart muscle, enabling a disease-weakened heart to keep up with the body's demand forheart action
- It increases excitability to cardiac muscles.

Arjuna

Synonyms:
-

Arjun bark, Arjun, Terminalia Arjuna rab

Family:- Combretaceae

Biological source:- Arjuna consists of dried stem bark of the plant known as *Terminalia arjuna* Rob.

Chemical Constituents:-

- It contains triterpenoid saponins, arjunolic acid, arjunic acid arjungenin.
- It also contains β-sintoerol, ellagic acid and arjunic acid.

Uses:-

- The bark of Arjun is astringent, sweet, acrid, cooling, aphrodisiac,

urinary astringent, and expectorant, but, chiefly used as cardio tonic as it improvesblood supply to heart.

- It is also useful in ulcer treatment, fractures, cirrhosis of liver, ischaemicheart disease, and hypertension.
- Arjuna bark is used as a diuretic and astringent.