Pharmacognosy And Phytochemistry

Unit - I

Introduction to Pharmacognosy :

Pharmacognosy

- Pharmakon → Drug (Crude Drug)
- Gnosis → Study / Knowledge

Definition : Pharmacognosy is a branch of science that deals with the study of crude drugs which are obtained from natural sources or origin like Plants, Animals, Minerals and Marine Sources.

Phytochemistry

- Phyto related to Plants
- Chemistry related to chemical compound

The chemicals which are obtained from Plants.

Plants Metabolites

Primary Metabolites	Secondary Metabolites
1. Primary metabolites are directly Synthesised from plants.	1. They are biolynthesized by Primary metabolites.
2. They help in growth & development of plant.	2. They help to protect the plant from any disease.
3. They are present in all parts of plant.	3. Present specific part of plants.
4. Eg: Protein, Enzymes, oils & carbohydrates.	4. Eg: Alkaloids, oils, Resins, volatiles, Glycosides.

Scope of Pharmacognosy =>

1. Herbal medicines
2. Cosmetics
3. Industry
4. Academics
5. Food & drug inspector
6. Traditional system medicine

=> Drug: A drug is any substance that can be inhaled, inject, smoked, absorbed via

patch on the skin or dissolved under the tongue that causes a physiochemical change in the body.

⇒ Sources of Drug:

1. Plant Sources
2. Animal Sources
3. Mineral Sources
4. Marine Sources
5. Plant tissue culture

① Plant Sources:

1) Plant Sources is the oldest and longest source of drug.
2) They has been used in the treatment of various diseases from ancient time.
3) The traditional system of medicine like Ayurveda, Siddha, Homeopathic and Unani systems are based on the use of plants.
4) Many of the plant products are having important therapeutic agents like alkaloids, glycosites, flavonoids, enzymes, volatile oils, etc.
5) Examples:

S. No.	Plants	Name	Constituents
1.	Leaves	Digitalis Eucalyptus Tobacco	Digitoxim, Digoxim Eucalyptus oil Nicotine
2.	Fruit / Flower	Opium Vinca	Morphin, Codeine, Heroine, Amorphine Vincristine, Vinblastine
3.	Roots	Ipecac Rauwalfia	Ematine Reserpine
4.	Bark	Cinchona	Quinine (Anti-malaria) Quinidine, (Anti-erythmia)

② Animal Sources :

→ It is a second largest source of drug.
→ Certain animal part and animal products are used of drug.
→ The major groups of Animal products used in medicine are harmone, enzymes, organs, bile acids.

(i) Harmones :

→ Thyroidism modify preparation of thyroid gland of sheep and

pigs. It is given orally to treat patients suffering from thyroid insufficiency.

→ Pancreas is a source of insulin used in the treatment of diabetes.

→ Epinephrin is a hormone produced by adrenal medulla and used a vasoconstrictor drug.

→ Oxytocin is a polypeptide hormone obtained from pituitary gland by cattles and pigs.

(ii) Enzymes :

→ Pepsin is a protiolytic enzymes of gastric juice produced from fresh pig stomach.

→ Trypsin is a protiolytic enzymes prepared from extract of pancreas or pancreas. It is used for the topical application of the treatment of wounds, ulcer, etc.

→ Pancreatin is a preparation which contain enzymes of pancreas

which is used to treat digestion problems it is prepared from pig pancreas.

(iii) Animal ectractives organs:

→ Liver & Stomach preparations and bile are the escample of this group.
→ Honey from Honey bee.
→ Beewax from bees.
→ Cod liver from shark.
→ Wool fat from sheep.
→ Carminic Acid from Cachineal.
→ Venumes from Snake.

③ Marine Sources: Major part of earth is covered with water bodies. Hence the bioactive compounds. (Chemical constituents) are also obtained from marine Flora (Plant) and Fauna (Animal) used for the treatment of many diseases.

⇒ Classification of Drug of Marine Source:

(i) Antimicrobial Agents / Antibiotics:
- → Cephalosporin
- → Testamycin
- →
- →

(ii) Antiviral Compounds:
- → Ara · A
- → Oppositol
- → Avarona & Avarol

(iii) Antiparasitic Compounds:
- → Domoic Acid
- → α - Kainic Acid
- → Laminine
- → Bengemide F.

(iv) Anticancer Agent:
- → Sinularin
- → Halitoxin
- → Asparicdal
- → Aplidin

(v) Cardiovascular Agents:
- → Octopamine
- → Tetramine
- → Saxitonin
- → Laminine

(vi) Anti-inflamation / Antiplasmodic Agent:
Tetradoxin Menoalide

④ Plant tissue Culture:

Plant tissue culture is a technique that is used to grow plant cells, tissues or organs under sterile condition on a nutrient culture medium.

→ It is widely used to produce of plants.
→ It is technique of control production of usefull secondary metabolites.

⇒ Advantage of plant tissue culture:

- Production of extract copy of plants.
- To quickly produce mature plants.
- Production of genetically modified plants.
- Production of disease free plant.

Plant tissue culture as a source of drug -

S.No.	Secondary Metaballites	Plant Source	Type of Culture
1.	Reserpine	Rauwalfier	Suspension Culture
2.	Vinblastin	Vinca	Cell Culture
3.	Nicotine	Tobacco	Suspension Culture

S.No.	Organized drugs	Unorganized drugs
1.	These are "Organs of Plants and Animals" and are made up of cells and are having definite structure.	These are obtained from parts of plants by some process of extraction and purification.
2.	These drugs are named as flowers, seeds, fruits, bark, stem, etc.	These drugs are named as extract, latex juice, resin, etc.
3.	They are solid in nature.	They are solid, semi solid and liquid in nature.
4.	Microscopical study are useful in quality control.	Chemical test are perform for quality control or evaluation.
5.	Examples: Parts of Plant — Example i) Leaves → Eucalyptus, Tobacco, Digitalis ii) Wood → Sandal wood iii) Bark → Cinchona, Cinnamon iv) Flower → Vinca, Clove, Saffron.	Examples: Classification — Example i) Resin → Asafoetida ii) Gums & Mucilages → Acacia, Transacanth, Guar gum iii) Latex → Opium (afeem) iv) Waxes → Bees wax.

Dried Latex :

→ A latex is a product that contains special secretary tissue (the tissues that are concerned with the secretion of gum resin volatile oils and other substances).
→ A latex is a milky fluid which is usually exuded after tissue injury / incission.
→ It is usually a white aqueous suspension in which small particle of oil globules are suspended. These natural suspension of milky consistancy may contains proteins, alkaloids, starch, resin, gums, oils, tanins, sugar, etc. that coqulate on exposure to air. eg:- opium, papain, etc.
→ These pharmaceutical latex were collected dried and therapeutic-ally used.

Dried Juices :

→ These juices are obtained from extraction or pressing of vegetables and fruits.
→ The incissions are made up to respective parts of plants,

collected and dried.
examples - leaves → Aloe
stem → Kino

Dried extracts:

→ An extract is a concentrated preparation of a drug which is obtained by removing active constituents of the drug with suitable solvent and evaporating the solvent to obtain a residual mass or powder.
→ The extracts were prepared by using water, alcoholic, hydro-alcoholic solutions. ex. sample:- tea, kebatin, catechu, etc.
↳ (extract from acacia used as food adition)

Gums and Mucilage:

→ Gum are the abnormal product of plant metabolism formed by injury of the plants and by a break down of the cell walls.
→ They are produced by process known as Gummosis.
→ They are translucent amorphous substance of plant hydrocolloides produced by plants.
→ They are soluble in water and

gives a viscous sticky solution.
→ They are insoluble in alcohol and other organic solvents.
→ eg: teragacanth, gum, acacia, Guar gum, etc.

Mucilage:

→ Mucilage are also plants products which are similar to gum. but are generally the namely products of plant metabolism formed within the cell.
→ With water it forms a slimy mass but don't dissolve.
→ eg:- Isabgal, Agar, Fenugreek, Squill.
→ In pharmacy gums and mucilage are used as a binding and thickening agent.

Oleo - Resin:

→ These are semisolid extracts which are composed of resin with volatile oil.
→ Oleo - resin are prepared from:
* Ginger
* Clove
* Capsicum
* Turmeric
* Cordemum (ilachi)
* Cinnomen

→ They are used as a flavouring agent in perfumery some are used as medicinally.

Oleo - gum resin :

→ It is a mixture of volatile oil, gum & resin i.e, released from some plants and trees.
example :- Asafoatida, Myrrh.

Classification of Crude drug :

→ Crude drug :- The crude drug are the unprocessed form of drug which are directly obtained from natural source like plants, animals, etc.
→ For the proper & adequate study of crude drug it is necessary to arrange them in scientific and systemic manner.
Classified in seven types :

1) Alphabatic Classification
2) Morphological "
3) Pharmacological "
4) Chemical "
5) Taxo chemical "
6) Chemo - taxo chemical "
7) Sero - taxochemical "

(1) Alphobatical Classification of Crude drug :

→ In this classification the crude drug are arranged according to the alphabates.
→ Most of the Reference book and

Pharmacopia are arranged according to the latin or english name they are:

i) British Pharmacopia
ii) British Pharmaceutical Codex.
iii) V.S.P
iv) I.P.
v) British Herbal P'copoeia.

→ Example:

A ⇒ Amla, Agar
B ⇒ Balsam, Bentonite
C ⇒ Cinnamon, Cinchona
D ⇒ Dhatura, Digitalis
E ⇒ Eucalyptus
F ⇒ Fennel
G ⇒ Ginger
H ⇒ Honey.
I ⇒ Ipecac
J ⇒ Jatamansi
K ⇒ Kalmegh
L ⇒ Lemon
M ⇒ Myrrh
N ⇒ Nutmeg, Neem
O ⇒ Opium
P ⇒ Pepper, Papaya
Q ⇒ Quassia
R ⇒ Rauwolfia
S ⇒ Senna
T ⇒ Tulsi, Turmeric
V ⇒ Vinca
W ⇒ Withania (Asavgandha)
Y ⇒ Yeast.

② Morphological Classification System of Crude drug

The crude drug are classified in organized and unorganized manner.

① Organized drug :→ In this drug are classified as:

Parts		Drugs
a) Bark	⇒	Cinchona, Cinnomon
b) Root	⇒	Rouwolfia, Liquorice
c) Leaves	⇒	Eucalyptus, Senna
d) Flower	⇒	Sapon, Clove, Vinca
e) Fruits	⇒	Opium, Bael, fennel
f) Seed	⇒	Almond, coffee, beans
g) Entire plants	⇒	Vinca (Vinusting, Vinplastin) Anticancerous drug

② Unorganized drug :→

Classification / Category		Drugs
Extracts	→	Tea, Gelatin
Latex	→	Papaya, Opium
Fixed oil	→	Castor oil
Volatile oil	→	Eucalyptus, Sandle wood oil
Juice	→	Amla, Aloevra
Gum	→	Tragacanth, Acacia, Guar

③ Pharmacological Classification : According to this classification the crude drug are classified in P'cological in Therapeutic activity they are as follow :-

P'cological Activity	Drug
① Carminatives → agent that expel out gas from the body	fennel, Clove, corriander, cinnamen.
② Antimalaria	→ Cinchona, Artemisia
③ Anticancer	→ Vinca, Taxus
④ Anti inflammatory	→ Turmeric, Colichicum
⑤ Anti Spasmodic	→ Dhatura, thyoscyomus
⑥ Bitter	→ Gentian, Cherata
⑦ Expectorant	→ Opium, liquorous

④ Chemical classification: In this classification the drug is arranged according to the chemical or active constituents present on crude drug, they are as follow:-

eg: Chemical or active Constituent — Drugs

① Alkaloids ⇒ opium, Vinca, Cinchona, datura, Nux-Vomica

② Glycosides ⇒ Senno, Aloe, Bitter, Almonds.
glycon + aglycon
(sugar) (Non sugar) → shows therapeutic activity

③ Volatile oils ⇒ Eucalyptus, Clove, Fennel, Cardemum

④ Vitamins ⇒ Shark liver oil, cod liver oil

⑤ Enzymes ⇒ Papain, Trypsin

⑥ Carbohydrates ⇒ Tragacanth, honey, agar, Isobgol

⑦ Lipids ⇒ parrafin oil (wax), Bees wax
⑧ Resin ⇒ Asofoetida, myrh, ginger

⑤ Taxonomical Classification:

In this classification the drug are arranged according to phylum / class, sub/ class, order, family genues and species.

Sr. No.	Drug	Division	Class	Order	Family	Genus	Species
i)	Senna	Angio sperm	Dicotyleden	~~Rutales~~ Rosales	Leguminosa	Cassia	Angusti-folia
ii)	Fennel	"	"	Umbilli-ferae	Umbelli-feral	Foenic-ulum	Vulgare
iii)	Nux-Vomica	"	"	Gentian-ales	Logania-ceae	Stryc-hnos	Nux-vomica

⑥ Chemotaxonomical Classification:

→ Applying chemistry to the taxonomy as chemotaxonomical.
→ This classification is based on the chemical similarities of a taxon based on the exciatance of the relationship b/w the plant & its constituents.
→ In this plant secondary metabolite are taken into consideration. Researches have proved already regarding the similarities of constituents from different plant species of a Gene.

(a) Tropane alkaloid: Solanaceae family
eg: Datura,
Belladonna,
Hyoscyamus.

(b) Rutin: Rutaceae family
↳ by Hawinaids → sent in cetrus fruits
eg: Amla, lemmon etc, greentea

(7) Serotaxonomical Classification:

→ The sero-taxonomy can be explained as the study about the application 'or' the utility of serology in solving the taxonomical problem.

→ Serology can be defined as the study of Antigens, Antibody reaction.

→ Antigens are those substance which can stimulate the formation of antibody.

→ Antibody is the highly specific protien molecule produced by plasma cell in the immune system.

→ This classification expresses the similar-ities and dissimilarities among different texa.

→ It determines the degree of similarities

between species 'Genera' or 'Genus', family etc. by comparing the reaction with antigens from various plant texa with antibodies present against a given taxen.

Drug Adulteration

Definition:- The term adulteration is a practice of mixing or subtituting the original drug partially or wholy with other similar looking substance.

→ The Adulterated drug have loss its actual or original therapatic properties & some time form a toxic product.

Condition of Adulteration:

1) Admixture: Adding of substances due to accidently or carelessness.
eg: Collection of two different species of plant or drug in a field there may be a change of mixing above species due to carlessness or ignorance.

2) Sophistication: It means intentionally mixing up of original crude drug with adulterant.
eg: brick powder use in Red Chilly powder.

(3) Deterioration: Due to microbial attack high temperature, incorporation of impurities causes decrease in quality of drug.

4) Substitution: It means use of similar looking substance inplace of original drug.
eg: Cotton seed oil in place of olive oil.

5) Spoilage: Due to improper storage & attacking of microbes, causes therapeutic loss of product & may be also form toxic product.

6) Inferiority: (low quality product) In this mixing of original drug with infertive quality product.

Types of Adulteration:

Direct adulteration (intentionally / knowingly)

Indirect adulteration (unknowingly / unintentionally)

① Intentional Adulteration:

Reasons: • Price of drug is normally high.
• Product is not sufficient.
• Just for profit.

i) Adulteration with Similar looking Substance:
eg: papaya seed in black pepper.
Bees wax with Japan wax.
Indian Senna with Arabian Senna.

ii) Adulteration with Exhausted material:
eg: exhausted clove with a volatile oil.

iii) Adulteration with Artificially manufactured substances:
eg: Bees wax with Parrafin wax.

iv) Adulteration with Synthetic chemical:
eg: Citral in Citraus oil. (lemmon)

v) Addition of useless part of same plant:
eg: Stem part in Senna leaf.

vi) Adulteration of Powder:
eg: In this the powder drug is Adulterates with waste products.
eg: bricks powder is mixed with red chilli powder.

(2) Indirect Adulteration:

Reason: Due to carelessness, ignorance, accidently and unknowingly.

i) Faulty or Cardless Collection: Here adulteration is caused by mishandeling of drugs by collections & supplies.

ii) Improper processing: In this case the extranious matter is not removed after collection, improper, drying, etc.

iii) Improper storage: In this proper storage of drug is not done, the drug stored in unsealed bottle or the drug box. Stored in open area, may lead to degredation of drug, cause adulteration.

iv) Similarities in morphology:
eg: Mucuna pruinies is marpholoni-cally similar to Mucuna utilis.

v) Name Conclusion: The adulteration also happen when the pronountion of drug is almost same.
eg: Parpatuka (is used in awrvedic system of medicine).
Parpadalgam (used in Siddha system of medicine).

Quality Control of Crude drug:

Quality control is a system of maintaining standard in product by ensuring it identify, purify & its quality.

Evaluation Method of Crude Drug:

1) Organoleptic / Morphological evaluation
2) Microscopic evaluation
3) Chemical evaluation
4) Physical evaluation
5) Biological evaluation

1) Organoleptic / Morphological evaluation:

It is a technique of qualitative evaluation based on the morphological and sensory profiles.

- Morphological evaluation: In this the drugs are identified on the basis of size, shape & other specific features.
- Organoleptic evaluation: In this the drugs are identify by the help of sensory organ.
  - Colour, order, touch, texture, taste.

2) Microscopic evaluation method:

- In this method the organised drugs are use to identify by its histological & morphological character. (cell arrangement)
- The characteristics like tricnomes (hairy

like structure present in Dhatura), fibers, Vascular bundles, Xylem, phloem, cholenchyma & other cell contents can be studied under this.

3) Chemical evaluation method:

It wolves the determination of crude drug by chemical test.

i) Qualitative test: Quality determine
ii) Quantitative test: Quantity determine
iii) Chemical assay: drug की quantity ज्ञात करना है।
iv) Instrumental analysis: functional group determine by chermatography & Spectroscopy.

i) Qualitative test:

S.No.	Metabolites / Constituents	Test
① & ⑧	Alkaloids	Dragendruff test Mayer's test Wagner's test Hagen's test
②	Glycosides	Legal test Beljet test Berntrager test
③	Carbohydrates	Saponin test Mollish test Bendict test Felling'n test
④	Proteins	Millien's test

Biuret test
Ninhydrin test
Shinoda test

⑤ Flavouride.

ii) Quantitative test:

eg: Ash. value, Iodine value
Ester value, Acid value
Saphonification value

iii) Chemical Assay:

By this method the approximate value of total phytoconstituents in a crude drug is determined.

iv) Instrumental Analysis:

It is used to Analysis the chemical group of phyto constituents using chromatographic & spectroscopic method.

The chromatographic method include.

a) TLC - Thin layer chromatography
b) Gass Chromatography
c) Paper Chromatography
d) HPLC - High Pressure Liquid Chromatography / High Performance Liquid chromatography.

Spectroscopy method include.

a) UV visible spectroscopy
b) NMR - Nuclear Magnetic Resonance spectroscopy
c) Infrared spectroscopy

4) Physical evaluation method:

The physical evaluation method for crude drug are as follow:

i) Moisture Content: The percentage of active constituent of crude drug is expressed in air dry basic.

→ It should be minimized to prevent the de-composition of crude drug or due to chemical change due to microbial contamination.

→ The moisture content is determined by the heating the drug at 105°C in oven to a constant weight.

eg: Drug — Moisture Content in percentage

1) Alloe — Not more than 10%.
2) Digitalis — " — 5%.

ii) Viscosity: the Viscosity of liquid drug is constant at a given temperature.

iii) Melting point: To check the purity of drug this parameter is used.

→ for pure chemicals, phytochemical M.P. is very sharp & constant.

eg:

Drug	M.P in °C
a) Wool fat	34° - 44° C
b) Bees wax	62° to 65° C
c) Cocoa butter	30° - 33° C

iv) Solubility: An adulterant can be defected in a crude drug by solubility studies. eg: Alkaloidal bases are soluble in organic solvent.

v) Optical Rotation activity: It is determined by using Na lamp as a light source at 25° C.

- Certain substance are found to have the property of rotating the plane polarised light in the pure state.

eg:

S.No.	Drugs	Angle of optical rotation
a)	Honey	13° to -15°
b)	Castor oil	0° to -1.5°

vi) Ash value: The residue remaining after insigration in that ash contain drug.

- It reconstant the inorganic salts like carbonates, phasphates, silicates etc

5) Biological evaluation: This methods are perform

on living animals or experimental animals like Rat, mice, rabbit, cat etc, isolated organ and tissues and according as bio assay or biological assay.

- The plant extracts are used here to determine the Pharmacological activity, Potency & toxicity.

=> In this method following activities are checked:

1) Anti diaratic Activity
2) Analgesic Activity
3) Anti ulcer Activity
4) Anti inflammatory Activity
5) Anti Pyratic Activity

Quantitative Microscopy of Crude Drug :->

Lycapodium Spore Method:

- It is an analytical technique used for powdered drug it determins the no. of spore present in a mg. of sample.
- Here Lycapodium is taken as a refrence or standard drug about 94,000 spores are found in 1 mg. of powder lycopodium.

- A powdered drug is evaluated by lycopodium spore method -

eg: The percentage purity of ginger powder is calculated by:

$$\% \text{ purity of drug} = \frac{N \times W \times 94000 \times 100}{S \times m \times P}$$

where, N = no. of characteristic structure in 26 sets.

W = weight of lycopodium in (mg.)

S = no. of lycopodium spores

m = weight of sample (in mg.)

P = 2 lack 86 thousand

In case ginger starch grain powder.

Leaf Constant: The determination of leaf constant can be done by:

a) Palisade ratio
b) Vein islet no.
c) Vein termination no.
d) Stomatal index

a) Palisade ratio: It is the average no. of Palisade cell present below each epidermal cell.

b) Vein islet no: It is defined as the no. of vein islet per sq. mm of the leaf surface midway between the midrib and the margin.

c) Vein termination no. – It is defined as the no. of vein clid termination per sq. mm. at the leaf surface mid way between midrib & margin is per sq. mm.

d) Stomatal index – It is the pericentage which the no. of stomates forms to the total no. of epidermal cells.

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

where, S = no. of stomata per unit Area

E = no. of epidermal cell in the same unit Area.