

TIRUPATI COLLEGE OF POLYTECHNIC AND PHARMACY, RATIA

D. PHARMACY FIRST YEAR

PHARMACOGNOSY

Section – A

Fill in the blanks with answers. Each question carry one mark.

1×10 = 10

1. **Cod liver oil** is a fixed oil from animal source.
2. In a cardiac glycoside the basic nucleus consist of a **steroidal structure**.
3. Alkaloids are soluble in **alcohols, ether and chloroform**.
4. Clove oil is **heavier** than water.
5. **Fennel** and **Coriander** are used as carminatives.
6. **Clove** is an example of flower bud used as drug.
7. **Cinchona** bark is used as an anti-malarial.
8. **Silk and wool** are the fibers obtained from animal source.
9. The linkage between alcohol and sugar is called **glycosidic linkage**.
10. Alkaloidal salts are soluble in **water**.
11. **Cinchona** is an example of bark used as drug.
12. **Chaulmoogra** oil is used as an antileprotic.
13. Cardiac glycosides are used in the treatment of **cardiac heart failure**.
14. Alkaloids are defined as **the basic nitrogenous organic products of plant origin**.
15. **Quinine** is example of antimalarial drug from plant source.
16. Datura contains **hyoscine** as major constituents.
17. **Fennel** is an example of umbelliferous drug.
18. **Van-urk reagent** test is used to identify the Ergot alkaloids.
19. Balsams contain **benzoic acid** and **cinnamic acid**.
20. Indian tobacco is obtained from **dried leaves of *Nicotiana tabacum***.
21. **Aloe juice** is an example of stimulant laxative.
22. Botanical name of Garlic is ***Allium sativum***.
23. The word pharmacognosy was coined by **Seydler in 1815**.
24. **Vinca** is used as anticancer drug.
25. The special tubes containing volatile oil in umbelliferous fruit are called **vittae**.
26. Gold beaters skin test is used to identify **tannins**.
27. **Acacia** belongs to the family **Leguminosae** and is used as **suspending agent**.
28. **Senna** is dried leaflets and used as laxative.

29. **Peppermint oil** is a source of menthol.
30. **Quinidine** is an isomer of **quinine** and is employed as a cardiac depressant.
31. Biological source of Fennel is *Foeniculum vulgare*.
32. **Ephedrine** is the major alkaloid of Ephedra.
33. Borntrager's test is used for identification of **anthraquinone** glycosides.
34. Digitalis belongs to the family **Scrophulariaceae**.
35. Biological name of dill is *Anethum graveolens*.
36. Male fern is used as **vermifuge**.
37. Insect repellent oil is **neem oil**.
38. **Ipecacuanha** bark is used in the treatment of amoebic dysentery.
39. **Guggul** and **Colchicum** are used as antirheumatic drugs.
40. Aristotle is known for studies on **animal kingdom**.
41. **Digitalis** is organized and **aloe** is unorganized drugs.
42. Dragendorff's reagent test is used for the identification of **alkaloids**.
43. **Cod liver oil** is a fixed oil and rich in Vitamin A & D.
44. **Terpenoids** occurs naturally and comprise of isoprene units.
45. **Ipecac** is used as expectorant, emetic and antidysentric agent.
46. The other name for hyoscine is **Scopolamine**.
47. Curcuma Longa belongs to the family **Zingiberaceae**.
48. Nylon suture is a type of **non-absorbable suture**.
49. **Opium** is an example of narcotic analgesic.
50. The major constituent present in ajowan is **volatile oil**
51. **Isapgol** is an example of a bulk laxative.
52. Balasms is defined as **aromatic resionus substance of plant origin containing balsamic acid**.
53. Rauwolfia belongs to family **Apocyanaceae**.
54. Amla is a rich source of **vitamin C**.
55. **Mulethi** is the common vernacular name of liquorice.
56. **Ergot** is an oxytocic drug obtained from fungus.
57. Quinidine is an isomer of **quinine** and used as **antiarrythmic**.
58. Honey is obtained from **Apis mellifica**.
59. Oils are **liquids** and fats are **solids** at room temperature.
60. Cinnamon is commonly known as **Dalchini**.
61. **Dried unripe fruit** is the plant part used as drug in black pepper.

62. The botanical name of Ispaghula is *Plantago ovata*.
63. Garlic is used as **carminative** and **aphordiasic**.
64. Gokhru is used as **diuretic**.
65. The important chemical constituent of lemon grass oil is **citral**.
66. The use of absorbent cotton is in **surgical dressing**.
67. Tulsi is also known as **holy basil**.
68. Honey is obtained from honeycomb **sugary secretion by bees**.
69. Ephedra belongs to the family **Gnetaceae**.
70. Opium is obtained from unripe capsules of *Papaver somniferum*.
71. Fennel is commonly adulterated with **exhausted fennel**.
72. Castor oil is obtained from **seeds of Ricinus communis**.
73. Turmeric is used as **antiseptic and expectorant**.
74. Beeswax is a **purified wax**.
75. Datura contains **hyoscine** as major constituent.
76. **Vinca** is used as anticancer drug.
77. Cannabis contains **1, 3, 4 Trans tetrahydrocannabinol** as the main constituent.
78. Biological source of belladonna is **Atropa belladonna**.
79. Vasaka is used to treat **cough or bronchial asthma**.
80. Senna belongs to family **Leguminosae**.
81. **Clove** is dried flower used as dental analgesic.
82. Botanical name of Gokhru is **Tribulus Terrestris** and is used for treatment of **calculous infection and painful micturition**.
83. An example of umbelliferous drug is **Fennel**.
84. Botanical name of Tulsi is **Ocimum sanctum** and it belongs to family **Labiatae**.
85. Botanical name of Digitalis is **Digitalis purpurea** and it belongs to family **Scrophulariaceae**.
86. Botanical name of Ashwagandha is **Withania somnifera** and it belongs to the family **Solanaceae**.
87. **Methyl cellulose** is an example of bulk laxative.

Give one specific use of following drugs:

1. Black Pepper - **Carminative**
2. Rauwolfia – **Antihypertensive**
3. Colchicum – **Antirheumatic**
4. Aloe - **Laxative**

5. Curcuma - **Antiseptic**
6. Aconite – **In treatment of Neuralgia**
7. Digitalis - **Cardiotonic**
8. Nux-vomica – **Bitter Stomachic**
9. Clove – **Dental analgesic**
10. Catechu - **Astringent**
11. Vasaka – **Anti-tussive**
12. Vinca - **Anticancer**
13. Ipecac - **Antidysentery**
14. Ephedra – **Asthma, hay fever, whooping cough**
15. Rhubarb – **Purgatives**
16. Tulsi– **Anti-tussive**
17. Castor oil– **Laxative**
18. Hyoscyamus– **To relieve spasm of urinary tract**
19. Shark liver oil– **Source of vitamin A**
20. Tolu balsam– **Expectorant & flavouring agent**
21. Ispagula– **Bulk laxative**
22. Cinchona– **Antimalarial**
23. Belladonna – **Parasympathetic depressant**
24. Liquorice – **Demulcent/ antitussive and mild expectorant**
25. Senna - **Laxative**
26. Opium – **Narcotic Analgesic**
27. Nutmeg – **Carminative & stimulant**
28. Gokhru - **Diuretic**
29. Ergot– **Reduce post-partum haemorrhage**
30. Amla– **Diuretic & laxative**
31. Lemon grass oil– **Flavouring & perfuming agent**
32. Guggal– **Antirheumatic**
33. Arjuna– **Cardiotonic**
34. Ashwagandha –**C.N.S Depressant**
35. Dill – **Carminative**
36. Cinnamon and Black Pepper - **Carminative**
37. Orange oil – **Flavouring agent**

Define the following terms and give at least one example with each.

- | | | | |
|-----------------|-----------------|------------------------|-----------|
| 1) Antiemetic | 2) Diuretic | 3) Antiseptic | 4) Miotic |
| 5) Antidiabetic | 6) Antimalarial | 7) Flavouring agent | |
| 8) Emetics | 9) Analgesic | 10) Pharmaceutical Aid | |

Answer:

- 1) **Antiemetic:** These are drugs effective against vomiting and nausea e.g. Cannabis.
- 2) **Diuretic:** These are the drugs which increase the flow of urine e.g. Gokhru, Digitalis.
- 3) **Antiseptic:** These are the chemical substances which are used to kill pathogenic microbes or for Prevention of their growth e.g. Turmeric, Benzoin.
- 4) **Miotic:** Drug used in the treatment of glaucoma to reduce pressure in the eye e.g. Pilocarpine.
- 5) **Antidiabetic:** The substances used in the treatment of diabetes are known as antidiabetic e.g. Pterocarpus, Gymnema.
- 6) **Antimalarial:** These are the drugs used in the treatment and prophylaxis of malaria e.g. Cinchona.
- 7) **Flavouring agent:** Flavoring agents used in the medicines have no therapeutic advantage, but they certainly have a psychological importance e.g. Orange, Lavender, Rose, Lemon.
- 8) **Emetics:** These are the drugs that induce vomiting e.g. Mustard, Senega.
- 9) **Analgesic:** Drugs acting to relieve pain e. g. Opium.
- 10) **Pharmaceutical aid:** Substances which are of little or no therapeutic value, but are necessary in the manufacturing, compounding, storage etc. of pharmaceutical preparations or dosage forms.
Examples: antioxidants, preservatives, pharmaceutical coloring agents, flavouring agents, vehicles, excipients, ointment bases.

Give the biological source of the following drugs.

- | | | | |
|---------------------|---------------|---------------|----------------|
| 1) Turmeric | 2) Coriander | 3) Aconite | 4) Ephedra |
| 5) Mentha | 6) Opium | 7) Cinchona | 8) Agar |
| 9) Honey | 10) Digitalis | 11) Rauwolfia | 12) Nux-vomica |
| 13) Sodium alginate | 14) lanolin | | |

Answer:

- 1) **Turmeric:** Turmeric consists of dried fresh rhizomes of plant known as *Curcuma longa*, Family - Zingiberaceae.
- 2) **Coriander:** These are fully dried ripe fruits of plant *Coriandrum sativum*, Family – Umbelliferae.
- 3) **Aconite:** It consists of dried tuberous roots of *Aconitum napellus*, Family - Ranunculaceae.
- 4) **Ephedra:** Ephedra consist of dried young stem of *Ephedra gerardiana*, Family - Ephederaceae.

5) **Mentha:** It is the volatile oil obtained by steam distillation of fresh flowering tops of the plant known as *Mentha piperita*, Family-Labiatae.

6) **Opium:** Opium is dried latex obtained from unripe capsules of the plant *Papaver somniferum*, Family-Papaveraceae.

7) **Cinchona:** Cinchona is the dried bark of cultivated tree of *Cinchona calisaya*, Family- Rubiaceae.

8) **Agar:** It is a dried gelatinous substance obtained from *Gelidium amansii* and several other species of red algae, Family- Rhodophyceae.

9) **Honey:** Honey is a sugar secretion deposited in honey comb by the bees *Apis mellifera*, Family Apidae.

10) **Digitalis:** it consists of dried leaves of *Digitalis purpurea*, Family- Scrophulariaceae.

11) **Rauwolfia:** It consists of the dried root of plant of *Rauwolfia serpentine*, Family - Apocynaceae.

12) **Nux-Vomica:** It consists of dried ripe seeds of *Strychnos nux-vomica*, Family- Loganiaceae.

13) **Sodium alginate:** It is sodium salt of alginic acid. Alginic acid is a polyuronic acid composed of reduced mannuronic and glucuronic acids, which are obtained from the algal growth of the species of family- Phaeophyceae.

14) **Lanolin:** Hydrous wool fat is the purified fat like substance obtained from the wool of the sheeps *Ovis aries*, Family- Bovidae.

Section – B

Attempt any five Questions. Each question carries three marks.

3×5 =15

Question No. 1. Differentiate between volatile oils and fixed oils.

Question No. 2. Write down the tests for identification of Tannins.

Question No. 3. What is biological source and preparation of Cotton fibre?

Question No. 4. What are biological source and uses of Acacia?

Question No. 5. What is the biological source of Tragacanth?

Question No. 6. Give the biological source, chemical constituents of Guggal.

Question No. 7. Give the biological source, chemical constituents of Amla.

Question No. 8. Give classification of glycosides.

Question No. 9. Write the identification tests of Volatile Oil.

ANSWER

Question No. 1. Differentiate between volatile oils and fixed oils.

Answer: Volatile oil: These are volatile, odorous principle which evaporates at room temperature. They are also known as essential oils. Chemically they are derived from terpenes and their oxygenated derivatives. They are usually lighter than water. They are used as carminative, diuretic, antiseptic, sedative and local anesthetics. Examples: Clove oil, Cinnamon oil. Volatile oils are isolated by ecuelle method, hydro-distillation method, enfleurage.

Fixed oil: - These are reserves of food material of plants. These are liquid at room temperature. They are viscous liquid with characteristic odor and non-volatile. They turned rancid on storage due to free acidity. They are emollient and demulcent. Examples of fixed oils are cod liver oil, shark liver oil. Fixed oils are liquid at 15.5-16.5 °C. They are used as laxative, in soaps, paints, varnishes and also as lubricants.

Question No. 2. Write down the tests for identification of Tannins.

Answer: 1) With ferric chloride solution, hydrolysable tannins give blue black color and condensed tannins give brownish green tint.

2) A piece of gold beater skin when treated with dilute HCl and ferrous sulphate, test solution gives brown or black color.

3) With the gelatin solution (1%) containing sodium chloride (10%), tannins are precipitated out from the solution.

4) Trituration of Asafoetida with water produces yellow orange emulsion.

Question No. 3. What are biological source and preparation of Cotton fibre?

Answer: Biological Source: Cotton consists of the epidermal trichomes or hairs of the seeds of cultivated species of the *Gossypium herbaceum*, belongs to the family Malvaceae.

Chemical Constituents: 90% cellulose, 7-8 % moisture, wax and fat and remains of protoplasm.

Preparation: The plant after flowering bears fruits known as capsules. The fruits are 3-5 celled. Each capsule contains numerous seeds. The seed covered with hairs are known as bolls. The bolls are collected, dried and taken to the ginning press, wherein the trichomes are separated from the seeds. Various devices are used to separate short and long hairs.

Uses: It is used as filtering medium and in surgical dressings. It is also used as an insulating material.

Question No. 4. What are biological source and uses of Acacia?

Answer: Synonym: Gum acacia, Gum Arabic

Biological Source: It is a dried gummy exudation obtained from stem and branches of *Acacia arabica* belongs to the family leguminosae.

Chemical Constituent: Principally it consists of arabin, which is a complex mixture of calcium, magnesium, and potassium salts of arabic acid.

Uses: Used as demulcent, suspending agent, emulsifying agent. Intravenous administration of acacia is used in haemolysis. It is a good binding agent and used in the preparation of lozenges.

Question No. 5. What is the biological source of Tragacanth?

Answer: Synonym: Gum tragacanth, Tragacantha

Biological Source: It is dried gummy exudation obtained by making incision on stem and branches of *Astragalus gummifer*, belongs to the family Leguminosae.

Chemical Constituents: It contains a water soluble portion known as tragacanthin, water insoluble portion known as bassorin. It contains about 15% moisture, traces of starch and tragacanthic acid.

Uses: It is used as demulcent, emollient in cosmetics, and also in confectionary. Tragacanth is used as a thickening, suspending and an emulsifying agent. It is used along with acacia as a suspending agent. Mucilage of tragacanth is used as binding agent in the tablets.

Question No.6. Give the biological source, chemical constituents and uses of Guggal.

Answer: Synonyms: Guggul, Gum guggul.

Biological Source: It is obtained by the incision of the bark of the plant *Commiphora weightii*.

Family: Burseraceae.

Chemical Constituent: Myrcene, caryophyllene and volatile oils.

Uses: It is used as anti inflammatory and anti-rheumatic.

Question No. 7. Give the biological source, chemical constituents of Amla.

Answer: Synonyms: Emblica

Biological Source: It consist of dried fruit of plant *Emblica officinalis*.

Family: Euphorbiaceae.

Chemical Constituent: Vitamin C and Phyllemblin.

Uses: Amla is used as source of Vitamin C.

Question No. 8. Give classification of glycosides.

Answer: The most acceptable classification of glycosides is based on the chemical nature of the aglycone moieties present in them, namely:

- (i) Anthracene glycosides
- (ii) Phenol glycosides
- (iii) Steroid glycosides
- (iv) Flavonoid glycosides
- (v) Coumarin and Furanocoumarin glycosides
- (vi) Cyanogenetic glycosides
- (vii) Cardiac glycosides
- (viii) Saponin glycosides
- (ix) Aldehyde glycosides.

Question No.9. Write the identification tests of Volatile Oil.

Answer. Volatile oils: These are the polymer of isoprene unit.

Identification test:

- 1) Put a drop of drug on filter paper. It will leave no spot.
- 2) On hydrolysis with water drug will give 2-methyl-1-3-butadiene.
- 3) Drug with alcoholic solution of Sudan III will give red color.
- 4) In small sample of drug put a drop of Tincture alkana it will give red color.

Section C

Each question carries five marks.

3×5 =15

Question No.1. Discuss the biological source and preparation of Silk fibre.

Question No.2. Give the tests for identification of alkaloid.

Question No.3. What are biological source and uses and chemical constituents of Opium?

Question No.4. What are chemical constituents of Ergot?

Question No.5. Give the biological source, chemical constituents, uses and identification test of Starch.

Question No.6. Give the biological source, chemical constituents and uses of Ginger and draw neat well labelled diagram of Transverse Section (T.S.) of Ginger.

Question No.7. Discuss the various methods of extraction of volatile oil.

Question No.8. Give the biological source, chemical constituent, uses of Cinnamon and also draw a neat well labelled diagram of Transverse Section (T.S.) of Cinnamon.

Question No.9. What are glycosides? Give the identification tests and major therapeutic uses of glycosides.

Question No.10. Write short note on Animal fibres.

Question No.11. Give the biological source, chemical constituents of Ergot and Cinchona.

Question No.12. Define the following terms and give at least one example with each.

1) Mydriatic 2) Hypnotic

Question No.13. Write a short note on anthraquinone glycoside.

Question No.14. Differentiate between Organized and unorganized drugs.

ANSWER

Question No. 01. Discuss the biological source and preparation of Silk fibre.

Answer: These are the fibres obtained from the cocoons of *Bomboyx mori*, belongs to the family Bombycidae.

Chemical constituents: Silk contains a protein known as fibroin. Fibroin on hydrolysis yields amino-acids glycine and alanine.

Preparation: The larvae of the silkworm produce silk fibroin fibres from the glands in their mouth. This fibroin gets united with a gum like secretion known as sericin and forms cocoon. These cocoons are not allowed to grow further into an insect, but are heated to 60-80⁰C by exposing them to steam. The exposed cocoons are put into hot water to dissolve the gum and to separate the fibres.

Uses: Used to prepare special type of sutures, sieves and ligatures.

Question No. 02. Give the tests for identification of alkaloid.

Answer: Identification test of alkaloids:

1) **Mayer's reagent test** (Potassium mercuric iodide solution):

Drug + Potassium mercuric iodide \longrightarrow Creamy solution or pale yellow precipitate

2) **Wagner's reagent test** (Aqueous iodine solution):

Drug + Aqueous iodine solution \longrightarrow Brown or reddish brown precipitate

3) **Nitric acid test**

Drug + Nitric acid \longrightarrow Crimson red

4) **Dragendorff's reagent test** (Potassium bismuth iodide solution):

Drug + Potassium bismuth iodide solution \longrightarrow Brown or reddish brown precipitate

5) **Hager's Reagent** (Saturated picric acid solution):

Drug + Saturated picric acid \longrightarrow Yellow precipitate

Question No. 03. What is biological source and uses and chemical constituents of Opium?

Answer: *Biological Source:* Opium is obtained from dried latex obtained from unripe capsule of the plant *Papaver somniferum*, belongs to the family Papaveraceae. It contains not less than 9.5% of morphine, and not less than 2.0% of codeine both calculated as anhydrous morphine.

Chemical Constituents: It contains 25 alkaloids combined with meconic acid. Important active constituents are morphine and codeine.

Uses: Analgesic, hypnotic and narcotic. It is also used as diaphoretic and in treatment of diarrhoea. Codeine is used as expectorant. It checks excessive peristalsis and contracts the pupil of eye. The syrup of codeine phosphate is used in cough and bronchitis.

Question No. 04. What are biological source, chemical constituents and uses of Ergot?

Answer: *Synonym:* Ergot of rye, Ergota

Biological Source: It is a dried sclerotium of fungus *Claviceps purpurea*.

Family: Graminae

Chemical Constituents:

1. It contains indole group of alkaloids
2. Water soluble indole alkaloids is ergometrine and water insoluble are ergotamine and ergotoxin.
3. It also contains ergocryptine, ergocristine, ergocornine and methylegometrine.

Uses: It is used in labour to assist delivery and to reduce post-partum haemorrhage. Ergotamine is used in the treatment of migraine.

Question No.5. Give the biological source, chemical constituents, uses and identification test of Starch.

Answer: *Biological Source:* It consists of polysaccharide granules obtained from the grains of maize *Zea mays*.

Family: Gramineae

Chemical Constituents: Starch contains chemically two different polysaccharides amylose and amylopectin.

Uses:

- 1) It is useful as nutritive.
- 2) It is used as demulcent, protective and absorbent.
- 3) It is used as antidote in the treatment of iodine poisoning.

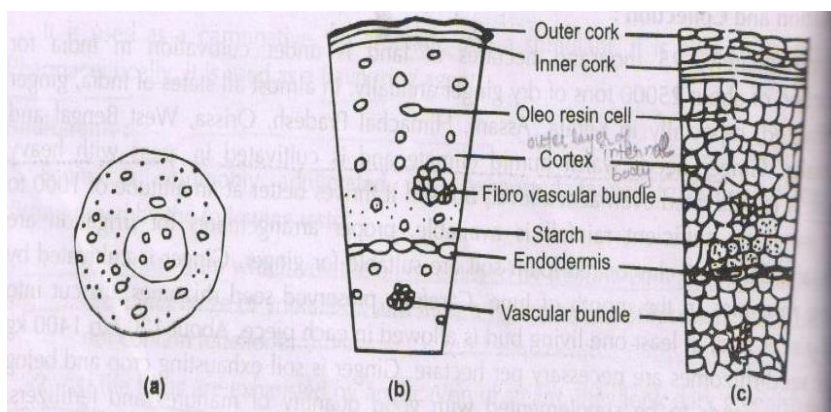
Identification tests:

- 1) Boil 1 gm of starch with 15 ml of water and cool. The translucent viscous jelly is produced.
- 2) The above jelly turns deep blue by the addition of solution of iodine. The blue colour disappears on warming and reappears on cooling.

Question No.6. Give the biological source, chemical constituents, uses of Ginger and draw neat well labelled diagram of Transverse Section (T.S.) of Ginger.

Answer: Biological Source: It consists of rhizomes of *Zingiber officinale*. It contains not less than 0.8% of total gingerols on dried basis.

Family: Zingiberaceae



T.S. of Ginger

Chemical Constituents: 1. Ginger contains 0.25 to 3% of volatile oil, 5 to 8% resinous matter.

2. The pungent principle of Ginger is gingerol .

Uses:

1. Ginger is used as condiment.
2. Ginger is used as aromatic, carminative, flavouring agent, stimulant and stomachic.
3. Ginger oil is used in mouth washes, ginger beverages and liquor.

Question No. 7. Discuss the various methods of extraction of volatile oil.

Answer: Volatile oil is obtained by steam distillation, solvent extraction and mechanical means such as ecuelle and enfleurage techniques.

a) Hydro distillation: Method comprising of water distillation, water & steam distillation and steam distillation is used for extraction of volatile oil from herbal drugs. The fresh material is subjected to hydro distillation in case of leaf drugs. Air dried subterranean parts are extracted by steam distillation.

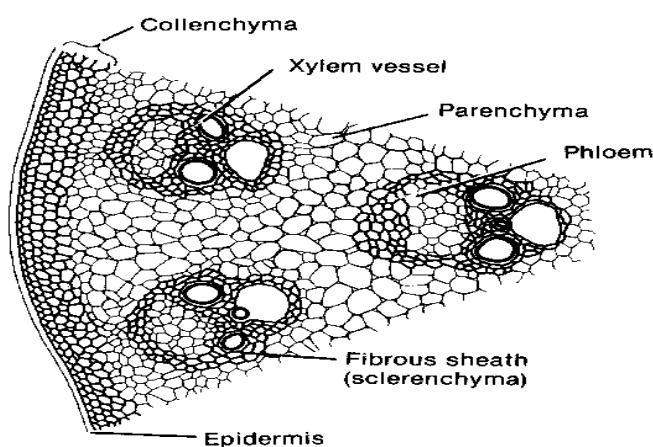
b) Enfleurage: Method is used for extraction of delicate perfumes. The fresh flower petals are mechanically spread on layer of fatty material, allowed to imbibe and the exhausted petals are replaced

by fresh material. The process is continued till the fatty layer saturated with volatile principles which are then extracted with lipid solvent.

c) **Ecuelle method:** Ecuelle method is used for extraction of citrus oil, wherein oil cells in ring are ruptured mechanically using pointed projections by twisting raw material over them in clockwise direction either mechanically or manually.

Question No. 8. Give the biological source, chemical constituents and uses of Cinnamon, and also draw a neat well labelled diagram of Transverse Section (T.S.) of Cinnamon.

Answer: Biological Source: Cinnamon consists of the dried inner bark of the shoots of coppiced tree of *Cinnamomum zeylanicu*, Family- Lauraceae.



T.S. of Cinnamon

Chemical Constituents: Volatile oils, tannins, eugenol, calcium oxalate, cinnamaldehyde, pinene and cymene

Uses: 1. Carminative, stomachic, mild astringent, flavouring agent, stimulant, aromatic and antiseptic.
2. It is used as spice, preparation of candy, dentifrices and perfumes.

Question No.9. What are glycosides? Give the identification tests and major therapeutic uses of glycosides.

Answer: They are the organic compounds from plants and animal sources which on acid hydrolysis give one or more sugar molecules and non-sugar molecules. The sugar molecule is called as glycone & non-sugar molecule is called as aglycone.

Identification test of glycosides:

- 1) **Keller-Killiani Test:** Powdered Drug + Alcohol \longrightarrow Filterate + Lead sulphate + H_2O
Drug (Filterate) + $CHCl_3$ + 5% glacial acetic acid + 1 or 2 drops of H_2SO_4 \longrightarrow Blue color
- 2) **Legal's Test:**

Drug+ Few ml of pyridine + 2 drops of Sodium + drops of 20% NaOH solution → Deep red colour nitroprusside

3) Borntrager's Test:

Powdered drug boiled with dilute H₂SO₄, filtered and cooled. The filtrate is extracted with chloroform or benzene + dilute ammonia → The ammoniacal layer get change pink to red.

4) Baljet Test:

Glycoside + sodium picrate → Yellow color

Uses: Analgesic (Gaultheria), cardiotoxic (Strophanthus, Digitalis), antirheumatic (Silicin), antipeptic ulcer (Liquorice), irritant (Sinigrine in Black mustard), laxative (Anthraquinone derivative, Senna, Cascara, Aloe).

Question No. 10. Write short note on Animal fibres.

Answer: Animal fibres: Silk, wool and horse hairs are fibres used in Pharmaceutical industry.

a) Wool

Biological Source: Wool fibres are prepared from the fleece of sheep *Ovis aries*.

Family: Bovidae

Chemical Constituents: Wool contains a sulphur containing protein known as keratin, rich in amino acid cystine.

Uses: Wool is used as filtering and straining medium and in the manufacture of dressings like domette and crepe bandages and flannel.

Chemical tests: 1) Wool is insoluble in 66% sulphuric acid, concentrated HCl and cuoxam.

2) When lead acetate is added to a solution of wool in caustic soda, a black precipitates is formed owing to high sulphur content.

3) Wool hairs are soluble in 1.25 M sodium hydroxide solution.

4) Wool hairs are stained with ammoniacal copper oxide solution.

b) Silk:

Biological Source: Silk fibres are prepared from the cocoons of *Bombyx mori*.

Family: Bombycidae

Chemical Constituents: 1. Silk contains a protein known as fibroin.

2. Fibroin on hydrolysis yields amino acids glycine and alanine.

Uses: Special types of sutures, sieves and ligatures are prepared from silk.

Question No. 11. Give the biological source, chemical constituents of Ergot and Cinchona.

Answer: a) Ergot

Biological Source: It is a dried sclerotium of fungus *Claviceps purpurea*.

Family: Hypocreaceae

Chemical Constituents: 1. It contains indole group of alkaloids.

2. Water soluble indole alkaloids is ergometrine and water insoluble are ergotamine and ergotoxin.

3. It also contains ergocryptine, ergocristine, ergosine and methylergometrine.

b) Cinchona:

Biological Source: Cinchona is the dried bark of cultivated trees of *Cinchona calisaya*.

Family: Rubiaceae

Chemical Constituent: Quinine, cinchotannic acid, quinidine, cinchonidine, cinchonine.

Question No. 12. Define the following terms and give at least one example with each.

a) Mydriatic b) Hypnotic

Answer: a) Mydriatic: A mydriatic is an agent that induces dilation of the pupil. e.g. atropine

b) Hypnotic: Drug that produces sleep e.g. opium.

Opium: Biological source: Opium is dried latex obtained from capsule of *Papaver somniferum*.

Family: Papaveraceae.

Chemical Constituents: 1. It contains more than 25 different alkaloids.

2. It contains morphine, codeine, thebaine, noscapine and papaverine.

Uses: 1. It is also used as sedative, analgesics and hypnotic.

2. It is also used as diaphoretic, expectorant and as respiratory stimulant.

Question No.13. Write a short note on anthraquinone glycoside.

Answer: Senna:

Biological Source: It consists of dried leaflets of *Cassia angustifolia*.

Family: Leguminosae.

Chemical Constituents: 1. It mainly contains anthraquinone glycosides.

2. It also contains (2-3%) of sennoside A, B, C, D.

3. It also contains aloe emodine, rhein, emodine.

4. It contains mucilage, resin and calcium oxalate.

Uses:

1. Senna leaves are used as laxative and carminative.

2. It acts as an irritant purgative.

Question No.14. Differentiate between Organized and Unorganized drugs.

Answer:

Organized drug	Unorganized drug
1. Cellular structure is present.	1. Cellular structure is absent.
2. Organized drugs are part of plant, animal like, fruits, seeds, and roots.	2. Unorganized drugs are obtained from parts of plant & animal by extraction, distillation incision.; Expression
3. Botanical and Zoological terminology (T.S) can be used to describe these drugs.	3. For study of unorganized drug physical constituent like density, viscosity, refractive index, optical rotation & chemical test are important criteria
4. They are solid in nature	4. They are solid, semi solid, or liquids
5. Examples of organized drugs are Fennel, Dill and clove etc.	5. Examples of unorganized drugs are Lemon oil, Starch, Catechu etc.

SECTION D

Each question carries Ten marks.

1×10 =10

Question No.1. Describe various systems of classification of drug of natural origin with examples.

Question No.2. Write a short note on Drug adulteration and evaluation.

Question No.3. Discuss the enzymes used in pharmaceutical industry with two examples.

Question No.4. What are antitussives? Explain any two drugs under this category.

Question No.5. Explain the complete pharmacognosy of clove along with its diagram.

Question No.6. Write the complete pharmacognosy of Rhubarb.

Question No.7. Write the complete pharmacognosy of Coriander.

Question No.8. Write the complete pharmacognosy of Digitalis.

Question No.9. Write the complete pharmacognosy of Fennel.

Question No.10. Write biological source, chemical constituent and uses of the following drugs: (a) Aloe (b) Asafoetida (c) Black pepper (d) Ipecacuanha (e) Catechu

ANSWER

Question No.1. Describe various systems of classification of drug of natural origin with examples.

Answer. Classification of natural drugs: The crude drugs obtain from the different sources are used in treatment of wide spectrum of diseases. For their study it is necessary to arrange them in scientific and systematic manner.

For pharmacognostic study, crude drugs can be arranged in one of the following classes: -

1) Alphabetical classification: Either the latin names or English names of drugs are considered for this purpose of classification. This classification is adopted by following books: -

- a) British Pharmacopoeia (English),
- b) British Pharmaceutical Codex (English),
- c) United States Pharmacopoeia and National Formulary,
- d) Indian Pharmacopoeia.

Disadvantages:

- 1) This type of classification does not help in distinguishing the drugs of plant, animal and mineral sources
- 2) They do not indicate whether the drugs are organised or unorganized.

Examples: Acacia, benzoin, cinchona, dill, ergot and fennel.

2) Taxonomical classification: It is a type of biological classification and restricted mainly to crude drugs, which are obtained from plant and animals. It indicates the phylum, class, sub-class, order, family, genus & varieties of the crude drugs.

Disadvantage:

- 1) It is difficult to recognize the organized and unorganized nature of crude drugs in their morphological studies.

Examples:

Phylum	:	Spermatophyta.
Division	:	Angiospermae.
Class	:	Dicotyledons.
Order	:	Rosales.
Family	:	Leguminosae.
Genus	:	Glycyrrhiza.
Species	:	Glycyrrhiza glabra.

3) Morphological classification: In this type of classification crude drugs are divided into the parts of plant like leaves, fruits, flowers, woods, barks, dried juices, extracts etc.

Advantage: This method is more convenient for practical study especially when the chemical nature of the drug is not clearly known.

Examples: Parts of Plant Drugs

Woods	Sandalwood
Barks	Arjuna
Flowers	Clove
Fruits	Lemon
Leaves	Senna, Eucalyptus
Seeds	Nux vomica

4) Pharmacological (Therapeutic) classification: This type of classification involves the grouping of crude drug according to their pharmacological action of their chief active constituent or their therapeutic use.

Examples: Carminatives : Coriander, fennel, cinnamon.
Purgatives : Senna, rhubarb, cascara, castor-oil.
Cardiotonics : Digitalis, arjuna.

5) Chemical classification: The crude drugs are divided into different groups according to chemical nature of their most important constituent.

Advantage:

It is most preferable method of study because pharmacological activity depends on the nature of the chemical constituents. So, crude drug containing alkaloids are grouped together.

Examples: Glycosides : Digitalis, senna, aloe.
Alkaloids : Nux - Vomica, cinchona, datura, opium.
Volatile oils : Clove, eucalyptus.
Lipids : Castor oil, beeswax, cod liver oil.

6) Chemotaxonomical classification: It is based on the fact that there are certain compounds which have been found to be characterizing certain groups.

Example: Volatile oils are found in plants belonging to the family Umbelliferae and Rutaceae.

Question No. 02. Write a short note on Drug adulteration and evaluation.

Answer. (a) Drug adulteration: It is broadly defined as admixture or substitution of original articles with defective, inferior or harmful substances. The reasons for adulteration are:

- 1) Scarcity (shortage) of the drug.
- 2) High price of original drug.

Following are the various methods used for drug adulteration:

- 1) Replacement by exhausted drug: This is observed in case of costly drugs such as cloves, tea.
- 2) Substitution with superficially similar but inferior drug: The common example of substitution is adulteration of cloves by mother cloves.
- 3) Substitution by artificially manufactured substances: For example artificial invert sugar is mixed with honey.
- 4) Substitution by sub-standard commercial varieties: Nux-vomica seeds are adulterated with *Strychnos nux-blanda*.
- 5) Presence of organic matter obtained from the same plant: For example cloves are mixed with cloves stalks.
- 6) Adulteration with non-plant material: Several times, waste from the market are collected and admixed with drugs like amber colour glass is mixed in colophony.

b) Evaluation: It means confirmation of its identity and determination of its quality & purity and detection of nature of adulteration. Evaluation of a drug is mainly done through five methods:

- i) Morphological (Organoleptic) evaluation.
- ii) Microscopic evaluation.
- iii) Chemical evaluation.
- iv) Physical evaluation.
- v) Biological evaluation.

i) Morphological (Organoleptic) evaluation: This type of evaluation involves test carried with the help of sense organs. It refers to evaluation of drug by colour, odour, taste, size, shape and special features like touch, texture etc.

- 1) Color: Some drugs are green in colour when dried in shade but become pale exposure to sunlight.
- 2) Smell: Some drugs have characteristic smell which helps in their easy identification, example: Cardamom, cinnamon, clove i.e., the drugs that contain volatile oil.
- 3) Taste: Drug can be evaluated by taste also, example, liquorice sweet in taste, ginger and capsicum has pungent taste.

ii) Microscopic evaluation: This evaluation is very useful in identification of different varieties of drug and its adulterants. The drug is examined under microscope which can be done after powdering or

cutting a thin section of drug, i.e., cell contains starch grains, calcium oxalate, trichomes, fibers, vessels that can be studied in this evaluation. For examples: lignified trichomes in nux-vomica, glandular trichomes of mint.

This evaluation has significant role in the study of qualitative & quantitative evaluation of crude drugs. This can be achieved by specific feature such as stomatal index, stomatal number, vein islet number, palisade ratio, vein termination number. Lycopodium spore methods are used for the determination of starch grains in wheat or ginger powder.

iii) Physical evaluation: It is very essential for the determination of quality and purity of drug. In this evaluation physical constants are determined, example, viscosity for drug containing gum and swelling factors for mucilage containing drugs. The various parameters used for physical evaluation of drug are:

1) **Moisture content:** The presence of excessive moisture content in a drug will destroy its quality due to growth of micro-organism. For example digitalis should not contain moisture content more than 5%.

2) **Melting point:** It is a useful parameter for determining the purity of crude drug. It is very helpful for the evaluation of solid fixed oil and waxes e.g. the melting point of coca butter should be in between 30–33°C.

3) **Refractive index:** It is a ratio of velocity of light in vacuum to velocity in the substance. It is a physical constant and very useful for standardization of volatile and fixed oil.

4) **Volatile oil content:** Volatile oil content present in the crude drugs like clove, cardamom, rose, cinnamon etc. is determined, e.g. clove contains not less than 15% volatile oil.

iv) Chemical evaluation: It is determination of active constituents in drug by chemical methods. The following are various methods used in chemical evaluation of crude drugs:

1) **Instrumental Methods:** Various types of instruments are used for evaluation of crude drugs like colorimetry, fluorimetry & spectrophotometry etc.

2) **Chemical constants:** Some chemical constants like acid value, iodine value & ester value are also used for the identification of fixed oil and fats etc.

3) **Individual chemical test:** Chemical test are also used for identifying particular drugs, example, various tests are done to detect alkaloids i.e., Mayer's reagent test, Hager's reagent test etc, Iodine test are done for detection of starch.

v) **Biological evaluation:** When physical or chemical means are not able to produce satisfactory result in crude drugs then the drugs are evaluated by biological methods. In this evaluation the tests are performed on living animals, animal preparations, isolated living tissues, microorganisms and intact organs and this method is known as bioassay. For example Antibiotics and vitamins are microbiologically evaluated on yeast, mold and the living bacteria. Biological evaluation is expensive, time consuming and less precise than chemical evaluation.

Question No.3 Discuss the enzymes used in pharmaceutical industry with two examples.

Answer. Enzymes: These are biological catalyst, proteinous in nature, non-living, high molecular weight substances produced by living organism. It serves as catalyst in many complex chemical reactions that make up life processes. The enzymes contain several common properties

- 1) Enzymes are colloidal in nature, soluble in water and dilute salt solutions.
- 2) These are most active at temp between 35° to 40°C.
- 3) These are destroyed at temp above 65° and it becomes inactive at 0°C.
- 4) They are sensitive to pH and presence of other substances in medium.

The enzymes used in pharmaceutical industry are

a) Papaya:

Biological source: Papain is a proteolytic enzymes obtained from the dried and purified latex of the unripe fruit of *Carica papaya*.

Family: Caricaceae.

Description:

- 1) It occurs as light brown or white coloured amorphous powder.
- 2) It is soluble in water and insoluble in alcohol chloroform and ether.
- 3) This enzyme shows maximum proteolytic activity at pH 5 and temp. between 60 to 90°

Chemical constituents: Papaya contains several enzymes like papain and chymopapain which on hydrolysis gives polypeptides and amides.

Uses:

- 1) It is used as protein digestant and an anti-inflammatory agent.
- 2) It is used in clearance of protein from the surface of contact lenses and in clarification of beverages.

b) Diastase:

Biological source: Diastase is an amylolytic enzyme found in saliva or pancreatic juice of animals so it is also known as animal diastase. Malt diastase is found in germinated barley grains *Hordeum vulgare*.

Family: Gramineae

Description: It is yellowish white, amorphous powder obtained from the infusion of malt. Diastase has faint characteristic odour. It is thermolabile and sensitive to a temperature more than 45⁰C. Diastase is active at 35-40⁰ C in solution having pH range of 6-7.

Uses:

- 1) Diastase from various sources is used as digestant.
- 2) It is used in the production of predigested starchy food and also for the conversion of starch to fermentable sugars.
- 3) It is used in brewing industries.

Question No. 4. What are antitussives? Explain any two drugs under this category.

Answer. Antitussives: Antitussives are the agents having ability to suppress or relieve coughing. They are used only for dry unproductive cough. They may alter or hasten the expectoration by acting upon pulmonary membranes. Examples- Opium, Vasaka, Codeine and Tolu Balsam.

(a) Vasaka:

Biological source: It consists of the fresh and dried leaves of *Adhatoda vasica*.

Family: Acanthaceae.

Geographical source: Plains of India and Himalayan ranges upto 1000 m, Sri Lanka and Malaysia.

Chemical constituents: Vasaka contains a number of alkaloids. Vasicine and vasicinone are two major alkaloids isolated from the drug.

Uses:

- 1) It is used as an expectorant, bronchodilator and as mild bronchial antispasmodic.
- 2) The alkaloid vasicine has an abortifacient effect and has oxytocic action.

(b) Tolu Balsam:

Biological source: It is obtained by incision from the trunk of *Myroxylon balsomum*.

Family: Leguminosae.

Geographical source: The tolu balsam trees are large and grow abundantly in Columbia. The trees are cultivated in the West Indies, particularly in Cuba.

Chemical constituents: The drug contains about 80% of the resin esters chiefly as tolueresinotannol. It also contains benzyl benzoate, benzyl cinnamate, vanillin and free cinnamic and benzoic acids.

Uses:

- 1) It is an expectorant and antiseptic.
- 2) It is common ingredient of cough mixtures. It is also used as a flavouring agent in medicinal syrups, confectionary and chewing gums. It is an ingredient of compound benzoin tincture.

Question No. 5. Explain the complete pharmacognosy of clove along with its diagram.

Answer. Carminative: These are soothing medicament that act by relieving pain in stomach and intestine

and expel flatulence and gas from GI tract by increasing peristalsis e.g. Clove, Cardamom, Asafoetida.

Clove:

Biological source: It consists of dried flower buds of *Eugenia caryophyllus*.

Family: Myrtaceae.

Geographical source: It is indigenous to Molucca Island but cultivated in islands of Madagascar and West Indies.

Collection and preparation: The flower buds are collected from the stems by hand when their lower parts turn to crimson from green. The collected cloves are dried in the open on coconut mats.

Organoleptic characters:

Colour: Crimson to dark brown.

Odour: Slightly aromatic.

Taste: Pungent and aromatic followed by numbness.

Size: About 10-17.5 mm in length, 4 mm in width, 2 mm thick.

Shape: Hypanthium is surmounted with 4 thick acute divergent sepals surrounded by dome shaped corolla. The corolla consists of unexpanded membranous petals with several stamens and single stiff prominent style. Clove is heavier than water.

Microscopic characters: The epidermis of clove is covered with thick cuticle. The epidermis itself consists of straight walled cells and large anomocytic stomata. The oil glands, which are ovoid and schizolysigenous are found in all parts of the drug. Phloem fibres, which are isolated, are occasionally found in the spongy tissues. Cluster crystals of calcium oxalate and small number of stone cells are found in the drug. Clove does not contain starch.

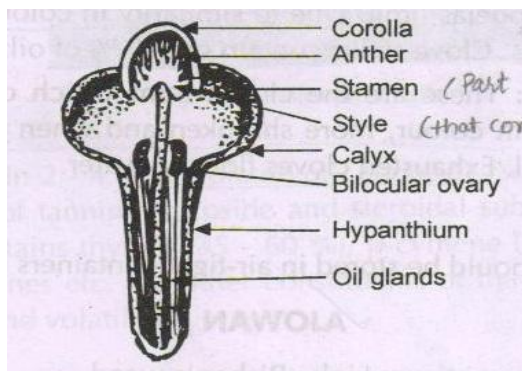


Fig A: Vertical section of clove

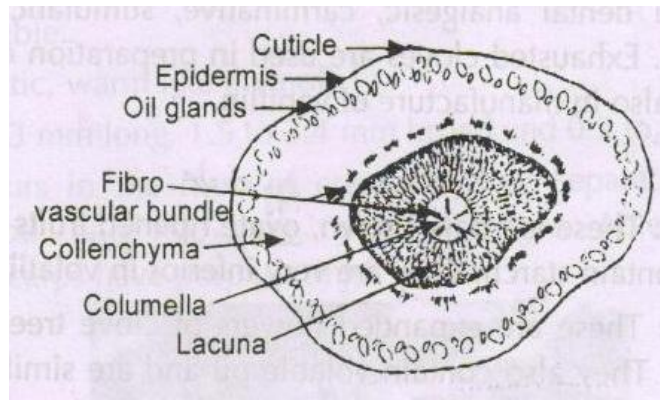


Fig B: T.S of Clove passing through hypanthium (diagrammatic)

Chemical constituents:

- 1) Clove contains about 15 to 20% of volatile oil, 10 to 13% of tannin, resin, eugenin.
- 2) The volatile oil of drug contains eugenol, eugenol acetate, esters, ketones and alcohols.

Uses:

- 1) It is used as dental analgesic, carminative, stimulant, flavouring agent, aromatic and antiseptic.
- 2) It is used in the preparation of cigarettes.
- 3) It is useful in perfumery.

Question No. 6. Write the complete pharmacognosy of Rhubarb.

Answer. Rhubarb

Biological source: It consists of rhizome and roots of *Rheum salmatum*.

Family: Polygonaceae.

Geographical source: The plant is grown at an altitude of 3000 meters. Chinese rhubarb is found in China, Tibet, Nepal, Europe and Germany. In India the plant is available in the Himalayan region from Kashmir to Sikkim and is cultivated in Assam.

Cultivation & collection: The plant is a perennial herb containing very stout and thick roots and rhizomes. The drug rhubarb is collected from 6-8 years old plants by digging out rhizomes during September to October. The rhizomes are cut in transverse slices and drugs are dried in shade or by artificial heat.

Organoleptic characters:

Colour - Brown or yellow.

Odour – Fragrant.

Taste - Bitter and astringent.

Size - Pieces of rhubarb are 2 to 20 cm in length and 2 cm in diameter.

Shape - Rhizomes are sub-cylindrical.

Chemical constituents: 1) It contains anthraquinone derivatives.

2) It contains rhein and its glycoside emodin and aloe-emodin.

3) It also contains free gallic acid, starch and calcium oxalate.

Uses:

1) It is used as a mild purgative in larger doses.

2) It is used as bitter stomachic and powder roots applied externally in ulcer.

3) It contains tannins hence it is associated with the astringent effect after purgation.

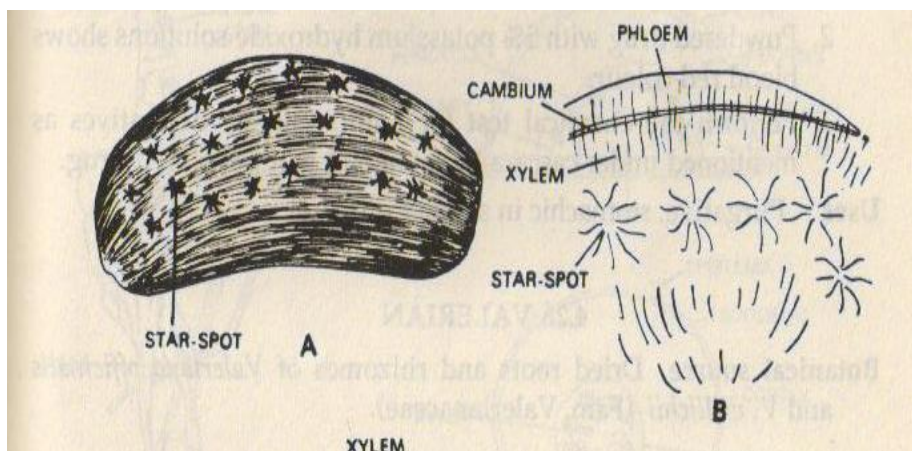


Fig. A: Rhubarb rhizomes, Fig. B: Transverse section of rhubarb.

Chemical test:

(1) When powdered drug is kept with ammonia for 15 minutes it produces pink colour.

(2) Borntrager's Test → Boil the drug with dilute H_2SO_4 , Filter and cool the filtrate and add organic solvent (acetone) followed by ammonia solution will turn the colour of solution to pink.

Question No. 7. Write the complete pharmacognosy of Coriander.

Answer: Coriander

Biological source: It is the dried ripe fruits of *Coriandrum sativum*.

Family: Umbelliferae.

Geographical source: The plant coriander is indigenous to Italy. The plant is widely cultivated in India, Egypt, China & Russia. In India the plant is cultivated throughout the country.

Collection & preparation: The plant is annual herb, about 0.7 to 1 meter height containing small white and pinkish flowers. The green plant and unripe fruits give unpleasant odour like bug but odour disappears during ripening and changes to an aromatic odour. Plants are cut and collected when the fruits are ripen. After drying fruits are separated.

Organoleptic characters:

Colour - Yellowish brown to brown.

Odour – Aromatic.

Taste - Spicy and characteristic.

Size - Fruits are 2 to 4 mm in diameter and 4-8 mm in length

Chemical constituents: 1) It contains volatile oil (about 0.3 to 1%).

2) It also contains camphor, borneol, fixed oils & tannin. Coriander leaves also contain vitamin A.

Uses: 1) It is used as carminative.

2) It is used as aromatic, stimulant and flavoring agent.

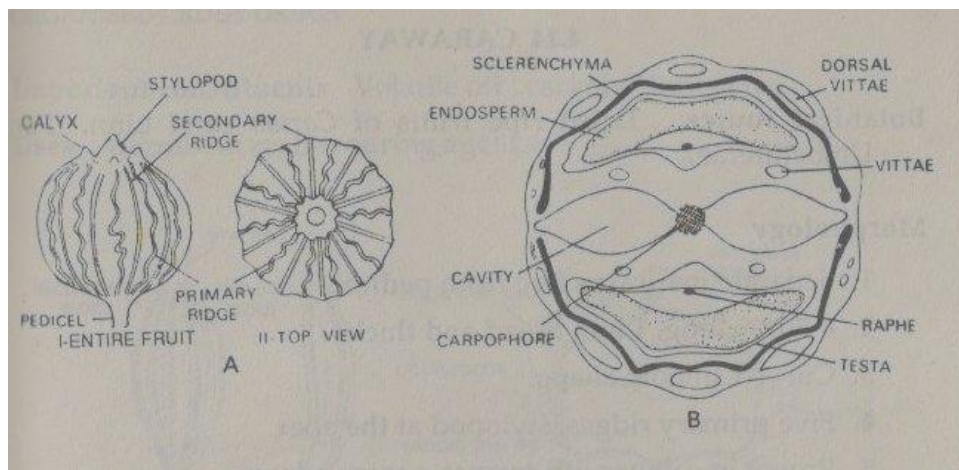


Fig. A: Coriander fruit, Fig. B: Transverse section (T.S) of fruit of coriander.

Question No. 8. Write the complete pharmacognosy of Digitalis.

Answer: Digitalis:

Biological source: It consists of leaves of *Digitalis purpurea*.

Family: Scrophulariaceae.

Geographical source: It is cultivated and collected in England, other parts of Europe, United States and India.

Cultivation & collection: Digitalis is a biennial or perennial herb. It is about 1 to 2 metre in height. The seeds of digitalis are small in size, so they are mixed with sand for sowing. Leaves are collected in both the years but the leaves collected in the first year have highest glycoside content. Leaves are collected when 2/3 of the flowers are fully developed. The seedling is then transplanted into the field. Generally the leaves are collected in the early afternoon, with a belief that maximum cardio-active glycosides are present at the time. The leaves are immediately dried after collection below 60°C in vacuum dryer and dried leaves are stored in air tight containers. The dried leaves should not contain

more than 5% moisture, since it promotes hydrolysis of cardiac glycosides resulting in loss of cardiac activity.

Organoleptic characters:

Colour - Dark grayish-green.

Odour – Slight.

Taste -Bitter.

Size - 10-40 cm long and 4-20 cm wide.

Shape – Ovate-lanceolate to broadly ovate.

Chemical constituents:

- 1) It mainly contains cardiac glycoside (about 0.2 to 0.45%).
- 2) It contains purpurea glycoside A and purpurea glycoside B.
- 3) It also contains digitoxin, gitoxin, digitoxigenin, gitoxigenin, digitose, gitaloxin.
- 4) It also contains saponin, flavanoids, tannins and pectin.

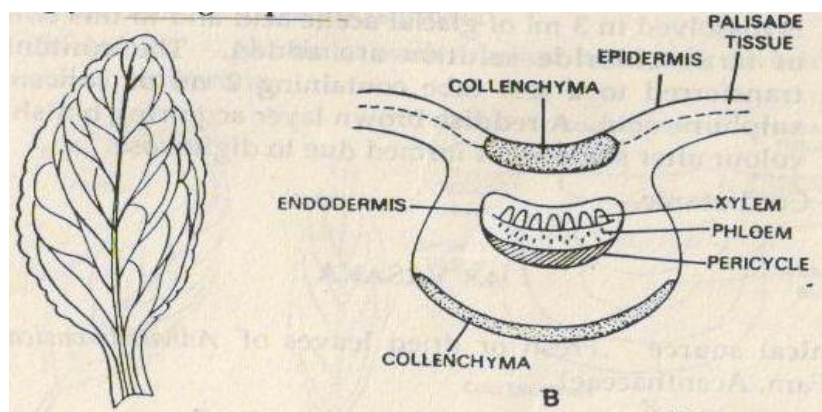


Fig.A: Leaf of Digitalis purpurea, Fig.B: Transverse section of Digitalis leaf.

- Uses:**
- 1) It is a cardiac stimulant and tonic.
 - 2) It also used as a diuretic.
 - 3) It is used in the treatment of congestive heart failure.

Question No. 9. Write the complete pharmacognosy of Fennel.

Answer: Fennel (Saunf)

Biological source: It consists of dried ripe fruits of *Foeniculum vulgare*.

Family: Umbelliferae.

Geographical source: It is cultivated in many parts of Europe, China, Egypt and India.

Collection & preparation: The plant is biennial or perennial tall herb. Seeds are sown in spring, ripen fruits with stem are collected in autumn. They are dried in sun and thrashing is done for separation of fruits.

Organoleptic characters:

Colour - Green to Yellowish-brown.

Odour - Strongly Aromatic.

Taste - Sweet aromatic and mucilaginous.

Size - 5-10 mm long and 2-4 mm broad.

Shape – Straight.

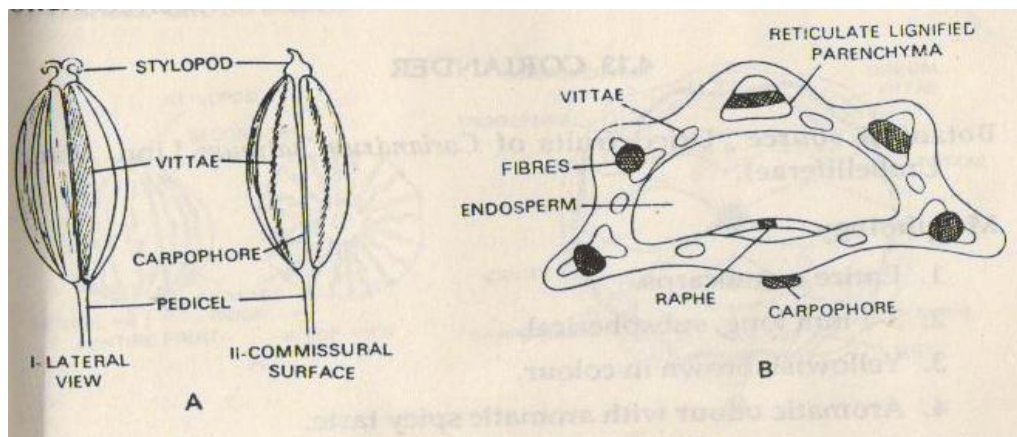


Fig A: Fruits of fennel, Fig B: Transverse section of mesocarp of fennel.

- Chemical constituents:**
- 1) It contains volatile oil, fixed oil and proteins.
 - 2) The main constituent of fennel is fenchone and phenolic ether anethole.
 - 3) It also contains ascorbic acid, citral.
- Uses:**
- 1) It is used as flavouring agent.
 - 2) It is used as carminative.
 - 3) It is used as stimulant and stomachic.

Question No.10. Write biological source, chemical constituent and uses of the following drugs: (a) Aloe (b) Asafoetida (c) Black pepper (d) Ipecacuanha (e) Catechu

Answer: (a) Aloe:

Biological source: It consists of dried juice of leaves of plant known as *Aloe barbadensis* (Curacao aloes), *Aloe perryi* (Socotrine aloes), and *Aloe ferox* (Cape aloes).

Family: Liliaceae.

Chemical constituent: 1) It contains to 10 to 30% aloenin.

2) It also contains barbaloin, beta- barbaloin and isobarbaloin.

3) It also contains aloe-emodin, and resin.

Uses:

1) It is used as irritant purgative.

2) It stimulates the growth of hairs and prevents wrinkles.

3) It is used in the cosmetic industry as a protective.

(b) Asafoetida:

Biological source: Asafoetida is an oleo gum resin obtained by making by incision from living rhizomes and roots of *Ferula foetida*.

Family: Umbelliferae.

Chemical constituents: 1) Asafoetida contains resin (40-65%), gum (20 to 25 %) and volatile oil (4-20%).

2) The chief constituent of resin is ferulic acid.

3) The chief constituent of volatile oil is secondary butyl propanyl disulphide. Other constituent of oil are di and trisulphide, pinene, terpene.

4) Umbelliferone is absent in free form.

Uses:

1) It is used as carminative, expectorant, antispasmodic and anthelmintic.

2) It is also used in veterinary practice.

3) It is used as flavouring agent in sauces and pickles.

(c) Black pepper:

Biological source: It consists of dried, unripe fruits of *Piper nigrum*.

Family: Piparaceae.

Chemical constituents: 1) Black pepper contains alkaloids like piperine, piperidine.

2) It also contains volatile oil, phellandrene, caryophyllene, and camphene.

3) It also contains α -pinene, β -pinene, resin and starch.

4) It also contains Vitamins and amino acid.

Uses:

1) It is used as carminative.

2) It is used as stomachic.

3) It is used as condiment.

4) It is also useful in sore throat, dyspepsia and in skin disease.

(d) Ipecacuanha:

Biological source: It consists of dried rhizomes and roots of *Cephaelis ipecacuanha*.

Family: Rubiaceae.

Chemical constituents: 1) It contains about 2 - 2.5 % of total alkaloids such as emetine, cephaeline and psychotrine.

2) It also contains glucosidal tannin, ipecacuanhin of starch and calcium oxalate.

Uses:

1) It is used as an expectorant and emetic.

2) It is also used in the treatment of amoebic dysentery.

3) Ipecac with opium (Dover's powder) is given as a diaphoretic.

(e) Catechu:

Biological source: It is a dried aqueous extract prepared by boiling the heart wood of *Acacia catechu_wild*.

Family: Leguminosae.

Chemical constituents: 1) It contains 4 – 10 % of acacatechins, catechutannic acid and flavonoids like quercetin.

2) Gummy material (20 - 30 %) is also present in catechu.

Uses:

1) It is used as astringent in diarrhoea.

2) It is used in cough, has cooling and digestive property.