



# **PRACTICAL LAB MANUAL**

## **Introduction to Pharmacognosy BP110P**

### **B.Pharm I<sup>st</sup> Semester**

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## EX NO 1

### MORPHOLOGICAL STUDY OF MEDICINAL PLANTS

#### Aim:

To study the morphology, biological source, family and identifying characters of selected medicinal plants belonging to different pharmacological categories.

#### Background

Morphological evaluation is one of the simplest and most important methods for the identification of crude drugs. It involves the study of external characters such as size, shape, colour, surface characteristics, texture, fracture, odour and taste. The knowledge of morphology helps in authentication of medicinal plants and detection of adulteration or substitution. The selected medicinal plants are widely used in traditional systems of medicine and possess significant therapeutic activities.

#### REQUIREMENTS

Fresh or dried medicinal plant specimens, herbarium sheets, hand lens, dissecting needle, forceps, measuring scale and practical record book.

#### PROCEDURE

1. Collect the authenticated medicinal plant specimens.
2. Observe each specimen carefully with the naked eye and hand lens.
3. Record the common name, biological source and family of each plant.
4. Examine the external morphological characters such as habit, root, stem, leaves, flowers, fruits or useful plant parts.
5. Note the characteristic identifying features of each drug.
6. Compare the observed characters with standard pharmacognostical descriptions.
7. Record the important therapeutic uses of each medicinal plant.

#### OBSERVATION

| S. No. | Category                    | Common Name | Biological Source                           | Family     | Morphological Characters                                                                               |
|--------|-----------------------------|-------------|---------------------------------------------|------------|--------------------------------------------------------------------------------------------------------|
| 1.     | Adaptogen & Immunomodulator | Ashwagandha | <i>Withania somnifera</i> (L.) Dunal (Root) | Solanaceae | Erect branched shrub; roots long, cylindrical, buff coloured, slightly tapering, characteristic odour. |

| S. No. | Category                    | Common Name  | Biological Source                                      | Family         | Morphological Characters                                                             |
|--------|-----------------------------|--------------|--------------------------------------------------------|----------------|--------------------------------------------------------------------------------------|
| 2.     | Adaptogen & Immunomodulator | Tulsi        | <i>Ocimum tenuiflorum</i> L. (Leaves)                  | Lamiaceae      | Aromatic branched herb with opposite leaves, hairy stem and purple or white flowers. |
| 3.     | Adaptogen & Immunomodulator | Amla         | <i>Phyllanthus emblica</i> L. (Fruit)                  | Phyllanthaceae | Nearly spherical yellowish-green fruits with six vertical furrows and sour taste.    |
| 4.     | Hepatoprotective            | Milk Thistle | <i>Silybum marianum</i> (L.) Gaertn. (Seeds)           | Asteraceae     | Large prickly herb; black shiny seeds with silky pappus.                             |
| 5.     | Hepatoprotective            | Kutki        | <i>Picrorhiza kurroa</i> Royle ex Benth. (Rhizome)     | Plantaginaceae | Small perennial herb with creeping rhizomes and wrinkled surface.                    |
| 6.     | Cardiovascular Drug         | Garlic       | <i>Allium sativum</i> L. (Bulb)                        | Amaryllidaceae | Bulb composed of numerous cloves enclosed in papery scales with pungent odour.       |
| 7.     | Cardiovascular Drug         | Arjuna       | <i>Terminalia arjuna</i> (Roxb.) Wight & Arn. (Bark)   | Combretaceae   | Large tree with smooth grey bark exfoliating in flat strips.                         |
| 8.     | Antidiabetic                | Gymnema      | <i>Gymnema sylvestre</i> (Retz.) R.Br. ex Sm. (Leaves) | Apocynaceae    | Woody climber with opposite elliptic leaves and milky latex.                         |

| S. No. | Category                      | Common Name  | Biological Source                                             | Family         | Morphological Characters                                         |
|--------|-------------------------------|--------------|---------------------------------------------------------------|----------------|------------------------------------------------------------------|
| 9.     | Antidiabetic                  | Fenugreek    | <i>Trigonella foenum-graecum</i> L. (Seeds)                   | Fabaceae       | Hard yellowish-brown rhomboidal seeds with characteristic odour. |
| 10.    | Anti-inflammatory & Analgesic | Turmeric     | <i>Curcuma longa</i> L. (Rhizome)                             | Zingiberaceae  | Cylindrical branched rhizomes, yellow internally, aromatic.      |
| 11.    | Anti-inflammatory & Analgesic | Boswellia    | <i>Boswellia serrata</i> Roxb. ex Colebr. (Oleogum resin)     | Burseraceae    | Yellowish-brown resin tears with balsamic odour.                 |
| 12.    | CNS Drug                      | Brahmi       | <i>Bacopa monnieri</i> (L.) Wettst. (Whole plant)             | Plantaginaceae | Small succulent creeping herb with opposite fleshy leaves.       |
| 13.    | Antimicrobial & Antiviral     | Giloy        | <i>Tinospora cordifolia</i> (Willd.) Hook.f. & Thomson (Stem) | Menispermaceae | Large climbing shrub with succulent stem bearing lenticels.      |
| 14.    | Antimicrobial & Antiviral     | Neem         | <i>Azadirachta indica</i> A.Juss. (Leaves)                    | Meliaceae      | Large evergreen tree with pinnate leaves and serrated leaflets.  |
| 15.    | Antimicrobial & Antiviral     | Andrographis | <i>Andrographis paniculata</i> (Burm.f.) Nees (Whole plant)   | Acanthaceae    | Erect annual herb with quadrangular stem and lanceolate leaves.  |
| 16.    | Gastrointestinal Drug         | Psyllium     | <i>Plantago ovata</i> Forssk.                                 | Plantaginaceae | Small boat-shaped seeds,                                         |

| S. No. | Category             | Common Name | Biological Source                        | Family        | Morphological Characters                                           |
|--------|----------------------|-------------|------------------------------------------|---------------|--------------------------------------------------------------------|
|        |                      |             | (Seeds)                                  |               | pale pinkish-brown with mucilaginous coat.                         |
| 17.    | Dermatological Agent | Aloe        | <i>Aloe vera</i> (L.) Burm.f. (Leaves)   | Asphodelaceae | Succulent leaves arranged in rosette with serrated margins.        |
| 18.    | Women's Health       | Chasteberry | <i>Vitex agnus-castus</i> L. (Fruit)     | Lamiaceae     | Small dark brown berries with aromatic odour.                      |
| 19.    | Women's Health       | Shatavari   | <i>Asparagus racemosus</i> Willd. (Root) | Asparagaceae  | Climbing shrub with fasciculated tuberous roots.                   |
| 20.    | Respiratory Drug     | Vasaka      | <i>Justicia adhatoda</i> L. (Leaves)     | Acanthaceae   | Evergreen shrub with opposite lanceolate leaves and white flowers. |

## CONCLUSION

From the above morphological study, the given medicinal plants were identified on the basis of their external morphological characters, biological source, family and characteristic features. Their therapeutic importance in various disease conditions was also studied.

## REFERENCES

- Kokate CK. *Practical Pharmacognosy*. 4th Edition. Vallabh Prakashan, New Delhi; 1994.
- Khandelwal KR. *Practical Pharmacognosy: Techniques and Experiments*. 30th Edition. Nirali Prakashan, Pune.
- Trease GE, Evans WC. *Pharmacognosy*. 16th Edition. Saunders Elsevier.
- Indian Pharmacopoeia Commission. *Indian Pharmacopoeia*. Latest Edition.
- The Ayurvedic Pharmacopoeia of India. Government of India.

## EX NO 2

### ORGANOLEPTIC EVALUATION AND POWDER MICROSCOPICAL CHARACTERS OF TULSI AND ASHWAGANDHA

#### Aim:

To study the organoleptic evaluation and powder microscopical characters of Tulsi and Ashwagandha.

#### Background

Organoleptic evaluation is one of the simplest and most reliable methods used for the identification of crude drugs. It involves the study of characteristics such as colour, odour, taste, size, shape and texture using the sense organs. Powder microscopy is an important pharmacognostical technique employed for the identification of powdered crude drugs by observing their characteristic cellular structures under a microscope. These evaluations help in authentication of crude drugs and detection of adulteration.

#### REQUIREMENTS

Compound microscope, glass slides, cover slips, watch glass, dissecting needle, forceps, glycerin, chloral hydrate solution, phloroglucinol solution, concentrated hydrochloric acid, saffranin solution, microscope brush, Tulsi leaf powder and Ashwagandha root powder.

#### PROCEDURE

##### A. Organoleptic Evaluation

1. Observe the colour, odour, taste, size, shape and texture of the supplied crude drug samples.
2. Record the observations carefully.
3. Compare the observed characters with the standard pharmacognostical descriptions.

##### B. Powder Microscopy

1. Place a small quantity of powdered drug on a clean glass slide.
2. Add one or two drops of glycerin and prepare a temporary mount.
3. For identification of lignified tissues, stain another portion of the powder with phloroglucinol followed by one drop of concentrated hydrochloric acid.
4. Place a cover slip carefully to avoid air bubbles.
5. Observe the slide first under low power and then under high power of the compound microscope.
6. Identify and record the characteristic powder microscopic features.
7. Repeat the procedure separately for Tulsi and Ashwagandha powders.

#### OBSERVATION

## A. Organoleptic Evaluation

| S. No. | Parameter | Tulsi ( <i>Ocimum tenuiflorum</i> ) | Ashwagandha ( <i>Withania somnifera</i> ) |
|--------|-----------|-------------------------------------|-------------------------------------------|
| 1.     | Colour    | Green to dark green                 | Buff to light brown                       |
| 2.     | Odour     | Strongly aromatic and pleasant      | Characteristic, slightly horse-like       |
| 3.     | Taste     | Aromatic, pungent, slightly bitter  | Bitter and slightly acrid                 |
| 4.     | Texture   | Brittle leaf powder                 | Coarse fibrous powder                     |
| 5.     | Nature    | Leaf powder                         | Root powder                               |

## B. Powder Microscopy

| S. No. | Drug        | Characteristic Powder Microscopical Characters                                                                                                                                              |
|--------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.     | Tulsi       | Covering trichomes, glandular trichomes, diacytic stomata, spiral and pitted xylem vessels, lignified fibres, calcium oxalate crystals and fragments of epidermis.                          |
| 2.     | Ashwagandha | Simple and compound starch grains, bordered pitted vessels, lignified fibres, stone cells, cork cells, medullary rays, parenchymatous cells containing starch and calcium oxalate crystals. |

## RESULT

The characteristic organoleptic and powder microscopical characters of Tulsi and Ashwagandha were observed and compared with the standard pharmacognostical descriptions.

## CONCLUSION

From the above organoleptic evaluation and powder microscopic examination, the supplied crude drugs were identified as **Tulsi** (*Ocimum tenuiflorum*) and **Ashwagandha** (*Withania somnifera*) based on their characteristic sensory properties and diagnostic microscopic features.

## REFERENCES

- Kokate CK. *Practical Pharmacognosy*. 4th Edition. Vallabh Prakashan, New Delhi; 1994.
- Khandelwal KR. *Practical Pharmacognosy: Techniques and Experiments*. Nirali Prakashan, Pune.
- Trease GE, Evans WC. *Pharmacognosy*. 16th Edition. Saunders Elsevier.
- Wallis TE. *Textbook of Pharmacognosy*. CBS Publishers & Distributors.
- Indian Pharmacopoeia Commission. *Indian Pharmacopoeia*. Latest Edition.

### **EX NO 3**

## **ORGANOLEPTIC EVALUATION AND POWDER MICROSCOPICAL CHARACTERS OF AMLA AND ARJUNA**

### **Aim:**

To study the organoleptic evaluation and powder microscopical characters of Amla and Arjuna.

### **Background**

Organoleptic evaluation is a simple and rapid method for the identification of crude drugs based on sensory characteristics such as colour, odour, taste, texture and appearance. Powder microscopy is an important pharmacognostical technique used for the identification of powdered crude drugs by observing characteristic tissues and cellular inclusions under the microscope. These methods are widely employed for authentication and quality control of herbal drugs.

### **REQUIREMENTS**

Compound microscope, glass slides, cover slips, watch glass, dissecting needle, forceps, glycerin, chloral hydrate solution, phloroglucinol solution, concentrated hydrochloric acid, safranin solution, microscope brush, Amla fruit powder and Arjuna bark powder.

### **PROCEDURE**

#### **A. Organoleptic Evaluation**

1. Observe the supplied crude drug samples carefully.
2. Note the colour, odour, taste, texture and nature of each sample.
3. Compare the observed characteristics with standard pharmacognostical descriptions.
4. Record the observations.

#### **B. Powder Microscopy**

1. Place a small quantity of powdered drug on a clean glass slide.
2. Add one or two drops of glycerin and prepare a temporary mount.
3. Prepare another mount by treating the powder with phloroglucinol followed by one drop of concentrated hydrochloric acid to stain lignified tissues.
4. Carefully place a cover slip avoiding air bubbles.
5. Observe the slide under low power followed by high power of the compound microscope.
6. Identify the characteristic powder microscopic features.
7. Repeat the procedure separately for Amla and Arjuna powders.

### **OBSERVATION**

## A. Organoleptic Evaluation

| S. No. | Parameter | Amla ( <i>Phyllanthus emblica</i> )            | Arjuna ( <i>Terminalia arjuna</i> ) |
|--------|-----------|------------------------------------------------|-------------------------------------|
| 1.     | Colour    | Yellowish-brown to brown                       | Pinkish-brown to reddish-brown      |
| 2.     | Odour     | Slight, characteristic                         | Slight, characteristic              |
| 3.     | Taste     | Strongly sour followed by sweet and astringent | Astringent and slightly bitter      |
| 4.     | Texture   | Hard, rough powder                             | Coarse fibrous powder               |
| 5.     | Nature    | Fruit powder                                   | Bark powder                         |

## B. Powder Microscopy

| S. No. | Drug   | Characteristic Powder Microscopical Characters                                                                                                                                                     |
|--------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.     | Amla   | Stone cells (sclereids), simple starch grains, calcium oxalate crystals, groups of fibres, spiral and pitted vessels, parenchymatous cells containing tannins and fragments of epidermis.          |
| 2.     | Arjuna | Abundant lignified fibres, sclereids (stone cells), cork cells, medullary ray cells, calcium oxalate crystals, pitted and bordered pitted vessels, starch grains and tannin-containing parenchyma. |

## RESULT

The organoleptic characteristics and powder microscopical features of Amla and Arjuna were observed and compared with the standard pharmacognostical descriptions.

## CONCLUSION

From the above organoleptic evaluation and powder microscopic examination, the supplied crude drugs were identified as **Amla** (*Phyllanthus emblica*) and **Arjuna** (*Terminalia arjuna*) based on their characteristic sensory properties and diagnostic microscopic features.

## REFERENCES

- Kokate CK. *Practical Pharmacognosy*. 4th Edition. Vallabh Prakashan, New Delhi; 1994.
- Khandelwal KR. *Practical Pharmacognosy: Techniques and Experiments*. Nirali Prakashan, Pune.
- Trease GE, Evans WC. *Pharmacognosy*. 16th Edition. Saunders Elsevier.
- Wallis TE. *Textbook of Pharmacognosy*. CBS Publishers & Distributors.
- Indian Pharmacopoeia Commission. *Indian Pharmacopoeia*. Latest Edition.

## EX NO 4

### ORGANOLEPTIC EVALUATION AND POWDER MICROSCOPICAL CHARACTERS OF TURMERIC AND PSYLLIUM HUSK

#### Aim:

To study the organoleptic evaluation and powder microscopical characters of Turmeric and Psyllium husk.

#### Background

Organoleptic evaluation is a primary method used for the identification and quality assessment of crude drugs based on their sensory characteristics such as colour, odour, taste, texture and appearance. Powder microscopy is an essential pharmacognostical technique used to identify powdered crude drugs by examining their characteristic cellular structures under the microscope. The combined study of organoleptic and microscopic characters helps in authentication, quality control and detection of adulteration of herbal drugs.

#### REQUIREMENTS

Compound microscope, glass slides, cover slips, watch glass, dissecting needle, forceps, glycerin, chloral hydrate solution, phloroglucinol solution, concentrated hydrochloric acid, iodine solution, safranin solution, microscope brush, Turmeric rhizome powder and Psyllium husk powder.

#### PROCEDURE

##### A. Organoleptic Evaluation

1. Observe the supplied crude drug samples carefully.
2. Record the colour, odour, taste, texture and nature of each sample.
3. Compare the observed characteristics with standard pharmacognostical descriptions.
4. Record the observations.

##### B. Powder Microscopy

1. Place a small quantity of powdered drug on a clean glass slide.
2. Add one or two drops of glycerin and prepare a temporary mount.
3. Prepare another mount by treating the powder with phloroglucinol followed by one drop of concentrated hydrochloric acid to identify lignified tissues.
4. Add iodine solution to a separate mount of turmeric powder for identification of starch grains.
5. Place a cover slip carefully avoiding air bubbles.
6. Observe the slide under low power followed by high power of the compound microscope.
7. Identify and record the characteristic powder microscopic features.
8. Repeat the procedure separately for Turmeric and Psyllium husk powders.

## OBSERVATION

### A. Organoleptic Evaluation

| S. No. | Parameter | Turmeric ( <i>Curcuma longa</i> ) | Psyllium Husk ( <i>Plantago ovata</i> ) |
|--------|-----------|-----------------------------------|-----------------------------------------|
| 1.     | Colour    | Bright yellow to orange-yellow    | Creamish white to pale buff             |
| 2.     | Odour     | Characteristic aromatic           | Odourless or faint characteristic       |
| 3.     | Taste     | Slightly bitter, pungent          | Mucilaginous, bland                     |
| 4.     | Texture   | Fine smooth powder                | Light, fibrous and flaky                |
| 5.     | Nature    | Rhizome powder                    | Seed husk powder                        |

### B. Powder Microscopy

| S. No. | Drug          | Characteristic Powder Microscopical Characters                                                                                                                                                       |
|--------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.     | Turmeric      | Abundant simple and compound starch grains, thin-walled parenchymatous cells, oleoresin cells, reticulate and spiral vessels, fibres and yellow colouring matter distributed throughout the powder.  |
| 2.     | Psyllium Husk | Fragments of epidermal cells, mucilaginous cells, elongated polygonal cells with wavy walls, non-lignified fibres, spiral vessels, parenchymatous cells and abundant mucilage which swells in water. |

## RESULT

The organoleptic characteristics and powder microscopical features of Turmeric and Psyllium husk were observed and compared with the standard pharmacognostical descriptions.

## CONCLUSION

From the above organoleptic evaluation and powder microscopic examination, the supplied crude drugs were identified as **Turmeric (*Curcuma longa*)** and **Psyllium husk (*Plantago ovata*)** based on their characteristic sensory properties and diagnostic microscopic features.

## REFERENCES

- Kokate CK. *Practical Pharmacognosy*. 4th Edition. Vallabh Prakashan, New Delhi; 1994.
- Khandelwal KR. *Practical Pharmacognosy: Techniques and Experiments*. Nirali Prakashan, Pune.
- Trease GE, Evans WC. *Pharmacognosy*. 16th Edition. Saunders Elsevier.
- Wallis TE. *Textbook of Pharmacognosy*. CBS Publishers & Distributors.
- Indian Pharmacopoeia Commission. *Indian Pharmacopoeia*. Latest Edition.

## EX NO 5

### ORGANOLEPTIC EVALUATION AND POWDER MICROSCOPICAL CHARACTERS OF BRAHMI AND FENUGREEK

#### Aim:

To study the organoleptic evaluation and powder microscopical characters of Brahmi and Fenugreek.

#### Background

Organoleptic evaluation is a simple and rapid method for the identification of crude drugs based on their sensory characteristics such as colour, odour, taste, texture and appearance. Powder microscopy is an important pharmacognostical technique used to identify powdered crude drugs by observing their characteristic cellular structures under the microscope. The combined study of organoleptic and microscopic characters helps in the authentication, standardization and quality control of herbal drugs.

#### REQUIREMENTS

Compound microscope, glass slides, cover slips, watch glass, dissecting needle, forceps, glycerin, chloral hydrate solution, phloroglucinol solution, concentrated hydrochloric acid, iodine solution, safranin solution, microscope brush, Brahmi whole plant powder and Fenugreek seed powder.

#### PROCEDURE

##### A. Organoleptic Evaluation

1. Observe the supplied crude drug samples carefully.
2. Record the colour, odour, taste, texture and nature of each sample.
3. Compare the observed characteristics with standard pharmacognostical descriptions.
4. Record the observations.

##### B. Powder Microscopy

1. Place a small quantity of powdered drug on a clean glass slide.
2. Add one or two drops of glycerin and prepare a temporary mount.
3. Prepare another mount by treating the powder with phloroglucinol followed by one drop of concentrated hydrochloric acid to identify lignified tissues.
4. Add iodine solution to a separate mount for the detection of starch grains, wherever applicable.
5. Carefully place a cover slip avoiding air bubbles.
6. Observe the slide under low power followed by high power of the compound microscope.
7. Identify and record the characteristic powder microscopic features.
8. Repeat the procedure separately for Brahmi and Fenugreek powders.

## OBSERVATION

### A. Organoleptic Evaluation

| S. No. | Parameter | Brahmi ( <i>Bacopa monnieri</i> ) | Fenugreek ( <i>Trigonella foenum-graecum</i> ) |
|--------|-----------|-----------------------------------|------------------------------------------------|
| 1.     | Colour    | Green to dark green               | Yellowish-brown to light brown                 |
| 2.     | Odour     | Slight, characteristic            | Strong, characteristic aromatic                |
| 3.     | Taste     | Bitter, slightly sweet            | Bitter and mucilaginous                        |
| 4.     | Texture   | Fine, soft powder                 | Coarse powder                                  |
| 5.     | Nature    | Whole plant powder                | Seed powder                                    |

### B. Powder Microscopy

| S. No. | Drug      | Characteristic Powder Microscopical Characters                                                                                                                                                        |
|--------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.     | Brahmi    | Fragments of epidermal cells with anisocytic stomata, thin-walled parenchymatous cells, spiral and annular xylem vessels, non-lignified fibres, calcium oxalate crystals and starch-containing cells. |
| 2.     | Fenugreek | Abundant polygonal epidermal cells, thick-walled endosperm cells, aleurone grains, mucilage-containing cells, simple starch grains, spiral and reticulate vessels, fibres and oil-containing cells.   |

## RESULT

The organoleptic characteristics and powder microscopical features of Brahmi and Fenugreek were observed and compared with the standard pharmacognostical descriptions.

## CONCLUSION

From the above organoleptic evaluation and powder microscopic examination, the supplied crude drugs were identified as **Brahmi** (*Bacopa monnieri*) and **Fenugreek** (*Trigonella foenum-graecum*) based on their characteristic sensory properties and diagnostic microscopic features.

## REFERENCES

- Kokate CK. *Practical Pharmacognosy*. 4th Edition. Vallabh Prakashan, New Delhi; 1994.
- Khandelwal KR. *Practical Pharmacognosy: Techniques and Experiments*. Nirali Prakashan, Pune.
- Trease GE, Evans WC. *Pharmacognosy*. 16th Edition. Saunders Elsevier.
- Wallis TE. *Textbook of Pharmacognosy*. CBS Publishers & Distributors.
- Indian Pharmacopoeia Commission. *Indian Pharmacopoeia*. Latest Edition.

## EX NO 6

### DETERMINATION OF MOISTURE CONTENT OF CRUDE DRUGS

#### Aim:

To determine the moisture content of the given crude drug by the Loss on Drying (LOD) method.

#### Background

Moisture content is one of the important quality control parameters for crude drugs. Excess moisture promotes the growth of microorganisms, insects and fungi, leading to deterioration of the drug and decomposition of its active constituents. It also accelerates enzymatic reactions and reduces the stability and shelf-life of herbal materials. Therefore, determination of moisture content is essential for proper storage, quality evaluation and standardization of crude drugs. The Loss on Drying (LOD) method is commonly employed for estimating moisture content by measuring the loss in weight after drying the sample at a specified temperature.

#### REQUIREMENTS

**Apparatus:** Moisture content apparatus (Hot air oven), weighing balance, porcelain dish or weighing bottle, desiccator, forceps.

**Sample:** Powdered crude drug.

#### PROCEDURE

1. Clean and dry the weighing bottle or porcelain dish and weigh it accurately ( $W_1$ ).
2. Accurately weigh about 10 g of the powdered crude drug into the dish and record the combined weight ( $W_2$ ).
3. Place the dish in a hot air oven maintained at **105°C**.
4. Dry the sample for about 3–4 hours or until a constant weight is obtained.
5. Remove the dish carefully using forceps and allow it to cool in a desiccator for 30 minutes.
6. Weigh the cooled dish containing the dried sample and record the weight ( $W_3$ ).
7. Repeat the drying, cooling and weighing until two consecutive weights differ by not more than 0.5 mg.
8. Calculate the percentage moisture content using the following formula.

#### CALCULATION

$$\text{Moisture Content (\% w/w)} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where,

- $W_1$  = Weight of empty dish (g)
- $W_2$  = Weight of dish + sample before drying (g)

- $W_3$  = Weight of dish + sample after drying (g)

### OBSERVATION

| S. No. | Observation                                     | Reading     |
|--------|-------------------------------------------------|-------------|
| 1.     | Weight of empty dish ( $W_1$ )                  | _____ g     |
| 2.     | Weight of dish + sample before drying ( $W_2$ ) | _____ g     |
| 3.     | Weight of dish + sample after drying ( $W_3$ )  | _____ g     |
| 4.     | Weight of sample taken                          | _____ g     |
| 5.     | Loss in weight                                  | _____ g     |
| 6.     | Percentage moisture content                     | _____ % w/w |

### RESULT

The percentage moisture content of the given crude drug was determined by the Loss on Drying method and found to be \_\_\_\_\_ % w/w.

### CONCLUSION

From the above experiment, the moisture content of the supplied crude drug was determined successfully by the Loss on Drying method. The moisture content obtained indicates the quality and storage stability of the crude drug.

### REFERENCES

- Kokate CK. *Practical Pharmacognosy*. 4th Edition. Vallabh Prakashan, New Delhi; 1994.
- Khandelwal KR. *Practical Pharmacognosy: Techniques and Experiments*. Nirali Prakashan, Pune.
- **Indian Pharmacopoeia**. Latest Edition. Indian Pharmacopoeia Commission.
- **Quality Control Methods for Medicinal Plant Materials**. World Health Organization (WHO). Geneva.

## EX NO 7

### DETERMINATION OF SWELLING INDEX AND FOAMING INDEX OF CRUDE DRUGS

#### Aim:

To determine the swelling index and foaming index of the given crude drug.

#### Background

The swelling index is an important quality control parameter for crude drugs containing mucilage, pectin or gums. It is defined as the volume in millilitres occupied by the swelling of 1 g of plant material under specified conditions. Drugs such as Isapgol (Psyllium), Linseed and Tragacanth possess high swelling indices due to their mucilage content.

The foaming index is used to evaluate crude drugs containing saponins. Saponins produce stable foam when shaken with water. The foaming index provides an estimate of the saponin content of herbal drugs and is useful in their identification and quality control. Drugs such as Liquorice, Quillaja and Soapnut exhibit characteristic foaming properties.

#### REQUIREMENTS

**Apparatus:** Stoppered measuring cylinder (25 ml), conical flask (500 ml), volumetric flask (100 ml), stoppered test tubes, measuring cylinder, pipette, water bath.

**Chemicals:** Distilled water.

**Sample:** Powdered crude drug (Isapgol seeds/Psyllium for swelling index and a saponin-containing crude drug for foaming index).

#### PROCEDURE

##### A. Determination of Swelling Index

1. Accurately weigh **1 g** of the powdered crude drug and transfer it into a **25 ml stoppered measuring cylinder**.
2. Add sufficient distilled water to make the volume up to **20 ml**.
3. Shake the cylinder gently at intervals during the first hour.
4. Allow the cylinder to stand undisturbed for **24 hours** at room temperature.
5. Measure the total volume occupied by the swollen material.
6. Record the swelling index in millilitres per gram of the crude drug.

##### B. Determination of Foaming Index

1. Accurately weigh **1 g** of the coarsely powdered crude drug and transfer it into a **500 ml conical flask**.
2. Add **100 ml** of boiling distilled water and maintain gentle boiling for **30 minutes**.

3. Cool the decoction and filter it into a **100 ml volumetric flask**.
4. Make up the volume to **100 ml** with distilled water.
5. Take **10 clean stoppered test tubes** and label them from **1 to 10**.
6. Transfer successive volumes of **1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 ml** of the decoction into the respective test tubes.
7. Make up the volume in each test tube to **10 ml** with distilled water.
8. Close the tubes with stoppers and shake each tube vigorously for **15 seconds**.
9. Allow the tubes to stand for **15 minutes**.
10. Measure the height of the foam in each test tube.
11. Identify the tube in which foam measuring **1 cm or more** persists after 15 minutes.
12. Calculate the foaming index using the formula.

## CALCULATION

### Swelling Index

Swelling Index = Volume occupied by the swollen material (ml) per gram of crude drug

### Foaming Index

$$\text{Foaming Index} = \frac{1000}{a}$$

Where,

**a** = Volume (ml) of the decoction used in the tube showing **1 cm or more persistent foam** after 15 minutes.

If further dilution is required,

$$\text{Foaming Index} = \frac{1000 \times 10}{a}$$

## OBSERVATION

### A. Swelling Index

| S. No. | Observation                 | Reading    |
|--------|-----------------------------|------------|
| 1.     | Weight of crude drug        | _____ g    |
| 2.     | Initial volume of water     | 20 ml      |
| 3.     | Final volume after swelling | _____ ml   |
| 4.     | Swelling Index              | _____ ml/g |

## B. Foaming Index

| Test Tube | Volume of Decoction (ml) | Height of Foam after 15 min (cm) |
|-----------|--------------------------|----------------------------------|
| 1         | 1                        | _____                            |
| 2         | 2                        | _____                            |
| 3         | 3                        | _____                            |
| 4         | 4                        | _____                            |
| 5         | 5                        | _____                            |
| 6         | 6                        | _____                            |
| 7         | 7                        | _____                            |
| 8         | 8                        | _____                            |
| 9         | 9                        | _____                            |
| 10        | 10                       | _____                            |

**Foaming Index = \_\_\_\_\_**

## RESULT

The swelling index and foaming index of the supplied crude drug were determined and found to be:

- **Swelling Index = \_\_\_\_\_ ml/g**
- **Foaming Index = \_\_\_\_\_**

## CONCLUSION

From the above experiment, the swelling index and foaming index of the supplied crude drug were successfully determined. These parameters are useful for the evaluation, authentication and quality control of crude drugs containing mucilage and saponins.

## REFERENCES

- Kokate CK. *Practical Pharmacognosy*. 4th Edition. Vallabh Prakashan, New Delhi; 1994.
- Khandelwal KR. *Practical Pharmacognosy: Techniques and Experiments*. Nirali Prakashan, Pune.
- World Health Organization. *Quality Control Methods for Medicinal Plant Materials*. Geneva.
- Indian Pharmacopoeia. Latest Edition. Indian Pharmacopoeia Commission.

## EX NO 8

### DETERMINATION OF STOMATAL NUMBER AND STOMATAL INDEX OF LEAF

#### Aim:

To determine the stomatal number and stomatal index of the given leaf.

#### Background

Stomata are minute pores present on the epidermis of leaves and young stems. Each stoma consists of a pair of guard cells enclosing a stomatal pore, through which gaseous exchange and transpiration occur. The number and distribution of stomata vary among different plant species and serve as valuable diagnostic parameters for the identification and standardization of crude drugs.

The **stomatal number** is defined as the average number of stomata present per square millimetre of the epidermis. The **stomatal index** is the percentage ratio of the number of stomata to the total number of epidermal cells, including stomata, in a given area. Since the stomatal index is relatively constant for a species, it is considered a reliable pharmacognostical parameter.

#### REQUIREMENTS

**Apparatus:** Compound microscope, glass slides, cover slips, watch glass, forceps, dissecting needle, razor blade, brush, stage micrometer, eyepiece micrometer (if required).

**Chemicals:** Chloral hydrate solution, glycerin, safranin solution, distilled water.

**Sample:** Fresh leaf (e.g., Tulsi or Vasaka).

#### PROCEDURE

1. Take a fresh leaf and remove a small portion from the middle region avoiding the midrib.
2. Peel off the lower epidermis carefully with the help of forceps. If peeling is difficult, boil the leaf in chloral hydrate solution until the tissues become transparent.
3. Wash the epidermal peel with distilled water.
4. Stain the peel with safranin for about 1–2 minutes and wash off the excess stain.
5. Mount the peel in glycerin on a clean glass slide and place a cover slip carefully.
6. Observe the preparation under low power and then under high power of the compound microscope.
7. Count the number of stomata and epidermal cells in several microscopic fields of known area.
8. Calculate the average number of stomata per square millimetre to obtain the stomatal number.
9. Calculate the stomatal index using the formula given below.

## CALCULATION

### Stomatal Number

Average number of stomata present per square millimetre of the leaf epidermis.

### Stomatal Index

$$\text{Stomatal Index (I)} = \frac{S}{E+S} \times 100$$

Where,

- S = Number of stomata in the given area
- E = Number of epidermal cells (excluding guard cells) in the same area

## OBSERVATION

| S. No. | Observation                   | Reading                   |
|--------|-------------------------------|---------------------------|
| 1.     | Number of stomata (S)         | _____                     |
| 2.     | Number of epidermal cells (E) | _____                     |
| 3.     | Area observed                 | _____ mm <sup>2</sup>     |
| 4.     | Stomatal Number               | _____ per mm <sup>2</sup> |
| 5.     | Stomatal Index                | _____ %                   |

## RESULT

- Stomatal Number = \_\_\_\_\_ per mm<sup>2</sup>
- Stomatal Index = \_\_\_\_\_ %

## CONCLUSION

The stomatal number and stomatal index of the given leaf were determined successfully. These parameters are useful in the identification, authentication and quality control of medicinal plant materials.

## REFERENCES

- Kokate CK. *Practical Pharmacognosy*. 4th Edition. Vallabh Prakashan, New Delhi; 1994.
- Khandelwal KR. *Practical Pharmacognosy: Techniques and Experiments*. Nirali Prakashan, Pune.
- Trease GE, Evans WC. *Pharmacognosy*. 16th Edition. Saunders Elsevier.
- Indian Pharmacopoeia Commission. *Indian Pharmacopoeia*. Latest Edition.
- World Health Organization. *Quality Control Methods for Medicinal Plant Materials*. Geneva.

## EX NO 9

### DETERMINATION OF VEIN ISLET NUMBER AND VEIN TERMINATION NUMBER OF LEAF

#### Aim:

To determine the vein islet number and vein termination number of the given leaf.

#### Background

Vein islet number and vein termination number are important quantitative microscopic parameters used in the identification and standardization of medicinal leaves. A **vein islet** is the small area of green tissue enclosed by the ultimate divisions of veins, whereas a **vein termination** is the free end of the ultimate veinlet within a vein islet. These values remain fairly constant for a particular species and are therefore valuable diagnostic characters in pharmacognosy. The determination of these parameters is especially useful in the authentication of crude drugs and detection of adulteration.

#### REQUIREMENTS

**Apparatus:** Compound microscope, glass slides, cover slips, watch glass, forceps, dissecting needle, razor blade, camera lucida or stage micrometer (if available), brush.

**Chemicals:** Chloral hydrate solution, sodium hydroxide solution (5%), safranin solution, glycerin, distilled water.

**Sample:** Fresh leaf (e.g., Tulsi, Vasaka or other medicinal leaf).

#### PROCEDURE

1. Select a fresh mature leaf free from disease and mechanical damage.
2. Cut a small piece of the leaf from the region midway between the midrib and the margin.
3. Boil the leaf piece in chloral hydrate solution or 5% sodium hydroxide solution until it becomes transparent.
4. Wash thoroughly with distilled water to remove excess reagent.
5. Stain the cleared leaf with safranin for 1–2 minutes and wash with water.
6. Mount the leaf piece in glycerin on a clean glass slide and place a cover slip carefully.
7. Observe the preparation under low power of the compound microscope.
8. Select four different microscopic fields of known area and count the number of complete vein islets enclosed within each field.
9. Count the free veinlet endings (vein terminations) present within the same area.
10. Calculate the average vein islet number and vein termination number per square millimetre.

#### OBSERVATION

| S. No. | Observation                            | Reading                   |
|--------|----------------------------------------|---------------------------|
| 1.     | Number of vein islets in Field 1       | _____                     |
| 2.     | Number of vein islets in Field 2       | _____                     |
| 3.     | Number of vein islets in Field 3       | _____                     |
| 4.     | Number of vein islets in Field 4       | _____                     |
| 5.     | Average Vein Islet Number              | _____ per mm <sup>2</sup> |
| 6.     | Number of vein terminations in Field 1 | _____                     |
| 7.     | Number of vein terminations in Field 2 | _____                     |
| 8.     | Number of vein terminations in Field 3 | _____                     |
| 9.     | Number of vein terminations in Field 4 | _____                     |
| 10.    | Average Vein Termination Number        | _____ per mm <sup>2</sup> |

## CALCULATION

### Vein Islet Number

$$\text{Vein Islet Number} = \frac{\text{Total number of vein islets observed}}{\text{Number of fields observed}}$$

### Vein Termination Number

$$\text{Vein Termination Number} = \frac{\text{Total number of vein terminations observed}}{\text{Number of fields observed}}$$

Express the results as the **average number per square millimetre** of leaf surface.

## RESULT

- Vein Islet Number = \_\_\_\_\_ per mm<sup>2</sup>
- Vein Termination Number = \_\_\_\_\_ per mm<sup>2</sup>

## CONCLUSION

The vein islet number and vein termination number of the supplied leaf were determined successfully. These quantitative microscopic parameters are useful for the identification, authentication and quality control of medicinal leaves.

## REFERENCES

- Kokate CK. *Practical Pharmacognosy*. 4th Edition. Vallabh Prakashan, New Delhi; 1994.
- Khandelwal KR. *Practical Pharmacognosy: Techniques and Experiments*. Nirali Prakashan, Pune.
- Trease GE, Evans WC. *Pharmacognosy*. 16th Edition. Saunders Elsevier.
- Indian Pharmacopoeia Commission. *Indian Pharmacopoeia*. Latest Edition.
- World Health Organization. *Quality Control Methods for Medicinal Plant Materials*. Geneva.

## EX NO 10

### DETERMINATION OF ASH VALUE AND EXTRACTIVE VALUES OF CRUDE DRUGS

#### Aim:

To determine the total ash value, acid-insoluble ash value, water-soluble extractive value and alcohol-soluble extractive value of the given crude drug.

#### Background

Evaluation of crude drugs by determining ash value and extractive values is an important part of pharmacognostical standardization. **Ash values** indicate the amount of inorganic matter present in the drug and help in detecting contamination, adulteration and improper handling. **Total ash** represents the total amount of inorganic residue remaining after incineration, while **acid-insoluble ash** indicates the presence of silica and other earthy materials.

**Extractive values** estimate the quantity of active constituents extracted with specific solvents. Water-soluble and alcohol-soluble extractive values are useful in evaluating the quality, purity and chemical constituents of crude drugs and detecting exhausted or adulterated samples.

#### REQUIREMENTS

**Chemicals:** Dilute hydrochloric acid, chloroform water, alcohol (90%), distilled water.

**Apparatus:** Silica crucible, muffle furnace, analytical balance, desiccator, ashless filter paper, conical flask (250 ml), shallow flat-bottomed evaporating dish, water bath, hot air oven, measuring cylinder, pipette.

**Sample:** Powdered crude drug.

#### PROCEDURE

##### A. Determination of Total Ash

1. Accurately weigh about **3 g** of the powdered crude drug into a previously ignited and weighed silica crucible.
2. Incinerate the sample by gradually increasing the temperature until it becomes free from carbon.
3. Cool the crucible in a desiccator and weigh.
4. Calculate the percentage of total ash with reference to the air-dried drug.

##### B. Determination of Acid-Insoluble Ash

1. Boil the total ash obtained above with **25 ml** of dilute hydrochloric acid for **5 minutes**.

2. Filter through an ashless filter paper.
3. Wash the residue with hot water until free from acid.
4. Ignite the filter paper containing the residue in the same crucible.
5. Cool in a desiccator and weigh.
6. Calculate the percentage of acid-insoluble ash with reference to the air-dried drug.

### C. Determination of Water-Soluble Extractive Value

1. Accurately weigh about **5 g** of coarsely powdered crude drug into a **250 ml stoppered conical flask**.
2. Add **100 ml of chloroform water**.
3. Shake frequently during the first **6 hours**.
4. Allow to stand for **18 hours**.
5. Filter rapidly to avoid solvent loss.
6. Transfer **25 ml** of the filtrate to a previously weighed shallow evaporating dish.
7. Evaporate to dryness on a water bath.
8. Dry the residue at **105°C** to constant weight.
9. Calculate the percentage of water-soluble extractive.

### D. Determination of Alcohol-Soluble Extractive Value

1. Accurately weigh about **5 g** of coarsely powdered crude drug into a **250 ml stoppered conical flask**.
2. Add **100 ml of 90% alcohol**.
3. Shake frequently during the first **6 hours**.
4. Allow to stand for **18 hours**.
5. Filter rapidly.
6. Transfer **25 ml** of the filtrate into a previously weighed evaporating dish.
7. Evaporate to dryness on a water bath.
8. Dry the residue at **105°C** to constant weight.
9. Calculate the percentage of alcohol-soluble extractive.

## CALCULATIONS

### Total Ash

$$\text{Total Ash (\% w/w)} = \frac{\text{Weight of ash}}{\text{Weight of air-dried drug}} \times 100$$

### Acid-Insoluble Ash

$$\text{Acid-Insoluble Ash (\% w/w)} = \frac{\text{Weight of acid-insoluble ash}}{\text{Weight of air-dried drug}} \times 100$$

### Water-Soluble Extractive

$$\text{Water-Soluble Extractive (\% w/w)} = \frac{\text{Weight of residue}}{\text{Weight of drug}} \times 100$$

### Alcohol-Soluble Extractive

$$\text{Alcohol-Soluble Extractive (\% w/w)} = \frac{\text{Weight of residue}}{\text{Weight of drug}} \times 100$$

### OBSERVATION

| S. No. | Parameter                           | Observation |
|--------|-------------------------------------|-------------|
| 1.     | Weight of powdered drug             | _____ g     |
| 2.     | Weight of total ash                 | _____ g     |
| 3.     | Total ash value                     | _____ % w/w |
| 4.     | Weight of acid-insoluble ash        | _____ g     |
| 5.     | Acid-insoluble ash value            | _____ % w/w |
| 6.     | Weight of residue (water extract)   | _____ g     |
| 7.     | Water-soluble extractive value      | _____ % w/w |
| 8.     | Weight of residue (alcohol extract) | _____ g     |
| 9.     | Alcohol-soluble extractive value    | _____ % w/w |

### RESULT

The quality control parameters of the supplied crude drug were determined as follows:

- **Total Ash Value** = \_\_\_\_\_ % w/w
- **Acid-Insoluble Ash Value** = \_\_\_\_\_ % w/w
- **Water-Soluble Extractive Value** = \_\_\_\_\_ % w/w
- **Alcohol-Soluble Extractive Value** = \_\_\_\_\_ % w/w

### CONCLUSION

The ash values and extractive values of the supplied crude drug were determined successfully. These parameters are useful for the evaluation of purity, quality, identity and detection of adulteration of crude drugs and are routinely employed in pharmacognostical standardization.

### REFERENCES

- Kokate CK. *Practical Pharmacognosy*. 4th Edition. Vallabh Prakashan, New Delhi; 1994.
- Khandelwal KR. *Practical Pharmacognosy: Techniques and Experiments*. 9th Edition. Nirali Prakashan, Pune.
- Joshi S, Aeri V. *Practical Pharmacognosy*. 1st Edition. Frank Bros. & Co., New Delhi; 2009.
- Indian Pharmacopoeia Commission. *Indian Pharmacopoeia*. Latest Edition.
- World Health Organization. *Quality Control Methods for Medicinal Plant Materials*. Geneva.

## EX NO 11

### DETERMINATION OF FOREIGN ORGANIC MATTER OF CRUDE DRUGS

#### Aim:

To determine the percentage of foreign organic matter present in the given crude drug.

#### Background

Foreign organic matter consists of any part of the medicinal plant or any other organic material that is not included in the official definition of the crude drug. It may include stems, leaves, fruits, seeds, weeds, moulds, insect fragments, or parts of other plants that are accidentally or deliberately mixed with the drug during collection, processing, handling or storage. Determination of foreign organic matter is an important quality control parameter as prescribed in the Indian Pharmacopoeia and World Health Organization guidelines. Excess foreign matter reduces the purity, quality and therapeutic efficacy of crude drugs.

#### REQUIREMENTS

**Apparatus:** Analytical balance, watch glass, tray, forceps, spatula, magnifying lens or hand lens.

**Sample:** Crude drug.

#### PROCEDURE

1. Accurately weigh about **100 g** of the supplied crude drug sample.
2. Spread the sample uniformly on a clean white tray or watch glass.
3. Examine the sample carefully with the naked eye and with the help of a magnifying lens.
4. Separate all foreign organic matter such as stems, leaves, weeds, insect parts, mouldy material and other extraneous organic substances using forceps.
5. Collect the separated foreign matter in a clean watch glass.
6. Weigh the foreign organic matter accurately.
7. Calculate the percentage of foreign organic matter with reference to the weight of the original sample.

#### CALCULATION

$$\text{Foreign Organic Matter (\% w/w)} = \frac{\text{Weight of Foreign Organic Matter}}{\text{Weight of Sample Taken}} \times 100$$

#### OBSERVATION

| S. No. | Observation                                | Reading |
|--------|--------------------------------------------|---------|
| 1.     | Weight of crude drug sample                | _____ g |
| 2.     | Weight of foreign organic matter separated | _____ g |

| S. No. | Observation                          | Reading |
|--------|--------------------------------------|---------|
| 3.     | Percentage of foreign organic matter | % w/w   |

## RESULT

The percentage of foreign organic matter present in the supplied crude drug was found to be \_\_\_\_\_ % w/w.

## CONCLUSION

The foreign organic matter present in the supplied crude drug was separated and determined successfully. The percentage obtained serves as an important quality control parameter for assessing the purity and authenticity of the crude drug.

## REFERENCES

- Kokate CK. *Practical Pharmacognosy*. 4th Edition. Vallabh Prakashan, New Delhi; 1994.
- Khandelwal KR. *Practical Pharmacognosy: Techniques and Experiments*. 9th Edition. Nirali Prakashan, Pune.
- Joshi S, Aeri V. *Practical Pharmacognosy*. 1st Edition. Frank Bros. & Co., New Delhi; 2009.
- Indian Pharmacopoeia Commission. *Indian Pharmacopoeia*. Latest Edition.
- World Health Organization. *Quality Control Methods for Medicinal Plant Materials*. Geneva.

## EX NO 12

### DETERMINATION OF DIMENSIONS OF CALCIUM OXALATE CRYSTALS AND PHLOEM FIBRES BY EYEPIECE MICROMETRY

#### Aim:

To determine the dimensions of calcium oxalate crystals and phloem fibres present in the given crude drug using an eyepiece micrometer.

#### Background

Micrometry is a microscopic technique used to measure the dimensions of various plant tissues and cellular structures. It involves the calibration of an eyepiece micrometer with a stage micrometer before taking measurements. The dimensions of calcium oxalate crystals and phloem fibres are important quantitative microscopic parameters used in the identification, authentication and standardization of crude drugs. Since the size of these structures varies among different plant species, their measurement serves as a valuable diagnostic character in pharmacognosy.

#### REQUIREMENTS

**Apparatus:** Compound microscope with mechanical stage, eyepiece micrometer, stage micrometer, glass slides, cover slips, watch glass, forceps, dissecting needle.

**Chemicals:** Glycerin water, chloral hydrate solution, phloroglucinol solution, concentrated hydrochloric acid.

**Sample:** Powdered crude drug.

#### PROCEDURE

##### A. Calibration of Eyepiece Micrometer

1. Insert the eyepiece micrometer into the microscope eyepiece.
2. Place the stage micrometer on the microscope stage.
3. Focus both the eyepiece and stage micrometer scales under suitable magnification.
4. Superimpose the two scales by rotating the eyepiece.
5. Make the zero marks of both scales coincide.
6. Find another point where the divisions of both scales exactly coincide.
7. Calculate the calibration factor for one division of the eyepiece micrometer.

##### B. Determination of Dimensions of Calcium Oxalate Crystals

1. Mount a small quantity of powdered crude drug in glycerin water on a clean glass slide.
2. Place a cover slip carefully and observe under the microscope.
3. Locate calcium oxalate crystals and measure their length and breadth using the calibrated eyepiece micrometer.
4. Measure at least **25 crystals**.

5. Multiply each reading by the calibration factor to obtain the dimensions in micrometres ( $\mu\text{m}$ ).
6. Calculate the average dimensions.

### C. Determination of Dimensions of Phloem Fibres

1. Boil a small quantity of powdered crude drug with chloral hydrate solution until cleared.
2. Stain the lignified fibres with phloroglucinol followed by one drop of concentrated hydrochloric acid.
3. Mount the stained powder in glycerin water.
4. Observe under the microscope and locate intact phloem fibres.
5. Measure the length and width of at least **25 fibres** using the calibrated eyepiece micrometer.
6. Convert the readings into micrometres using the calibration factor.
7. Calculate the average dimensions of the fibres.

### OBSERVATION

#### A. Calcium Oxalate Crystals

| S. No. | Eyepiece Reading | Calibration Factor ( $\mu\text{m}/\text{division}$ ) | Actual Size ( $\mu\text{m}$ ) |
|--------|------------------|------------------------------------------------------|-------------------------------|
| 1.     | _____            | _____                                                | _____                         |
| 2.     | _____            | _____                                                | _____                         |
| 3.     | _____            | _____                                                | _____                         |
| ...    | ...              | ...                                                  | ...                           |
| 25.    | _____            | _____                                                | _____                         |

Average Dimension = \_\_\_\_\_  $\mu\text{m}$

#### B. Phloem Fibres

| S. No. | Length (Divisions) | Width (Divisions) | Calibration Factor ( $\mu\text{m}/\text{division}$ ) | Length ( $\mu\text{m}$ ) | Width ( $\mu\text{m}$ ) |
|--------|--------------------|-------------------|------------------------------------------------------|--------------------------|-------------------------|
| 1.     | _____              | _____             | _____                                                | _____                    | _____                   |
| 2.     | _____              | _____             | _____                                                | _____                    | _____                   |
| 3.     | _____              | _____             | _____                                                | _____                    | _____                   |
| ...    | ...                | ...               | ...                                                  | ...                      | ...                     |
| 25.    | _____              | _____             | _____                                                | _____                    | _____                   |

Average Fibre Length = \_\_\_\_\_  $\mu\text{m}$

Average Fibre Width = \_\_\_\_\_  $\mu\text{m}$

### RESULT

- Average dimensions of calcium oxalate crystals = \_\_\_\_\_  $\mu\text{m}$
- Average length of phloem fibres = \_\_\_\_\_  $\mu\text{m}$
- Average width of phloem fibres = \_\_\_\_\_  $\mu\text{m}$

## CONCLUSION

The dimensions of calcium oxalate crystals and phloem fibres in the supplied crude drug were successfully determined using the eyepiece micrometer. These quantitative microscopic characters are useful for the identification, authentication and quality control of crude drugs.

## REFERENCES

- Kokate CK. *Practical Pharmacognosy*. 4th Edition. Vallabh Prakashan, New Delhi; 1994: 112–114.
- Khandelwal KR. *Practical Pharmacognosy: Techniques and Experiments*. 9th Edition. Nirali Prakashan, Pune; 2002: 159.
- Joshi S, Aeri V. *Practical Pharmacognosy*. 1st Edition. Frank Bros. & Co., New Delhi; 2009: 203–204.
- Trease GE, Evans WC. *Pharmacognosy*. 16th Edition. Saunders Elsevier.
- Indian Pharmacopoeia Commission. *Indian Pharmacopoeia*. Latest Edition.

## EX NO 13

### DETERMINATION OF PERCENTAGE PURITY OF POWDER DRUG USING LYCOPODIUM SPORE METHOD

#### Aim:

To determine the percentage purity of the given powdered crude drug using the Lycopodium spore method.

#### Background

The Lycopodium spore method is a quantitative microscopic technique employed to determine the percentage purity and amount of identifiable tissue present in powdered crude drugs. Lycopodium spores are used as an internal standard because they are uniform in size and number. A known weight of powdered drug is mixed with a known quantity of Lycopodium spores, and the characteristic diagnostic tissues of the drug and Lycopodium spores are counted under the microscope. By comparing the number of characteristic tissues with the known number of Lycopodium spores, the percentage purity of the powdered crude drug can be calculated. This method is useful for evaluating powdered herbal drugs and detecting adulteration.

#### REQUIREMENTS

**Apparatus:** Compound microscope, glass slides, cover slips, watch glass, analytical balance, mortar and pestle, dissecting needle, pipette.

**Chemicals:** Glycerin water, chloral hydrate solution, Lycopodium spore powder.

**Sample:** Powdered crude drug.

#### PROCEDURE

1. Accurately weigh about **50 mg** of the powdered crude drug.
2. Weigh an equal quantity (**50 mg**) of Lycopodium spore powder.
3. Mix both powders thoroughly in a mortar to obtain a homogeneous mixture.
4. Place a small quantity of the mixture on a clean glass slide.
5. Add one or two drops of glycerin water and prepare a temporary mount.
6. Place a cover slip carefully to avoid air bubbles.
7. Observe the preparation under the compound microscope.
8. Count the number of characteristic diagnostic tissues of the crude drug and the number of Lycopodium spores in several microscopic fields.
9. Continue counting until sufficient observations are obtained.
10. Calculate the percentage purity of the powdered drug using the appropriate formula.

#### CALCULATION

Let,

- N = Number of characteristic tissue fragments of the powdered drug counted.
- L = Number of Lycopodium spores counted.
- W = Weight of powdered crude drug taken (mg).
- S = Weight of Lycopodium powder taken (mg).
- M = Number of Lycopodium spores per mg of Lycopodium powder (approximately **94,000 spores/mg**).

The percentage purity of the powdered drug is calculated by comparing the number of characteristic tissue fragments with the known number of Lycopodium spores.

$$\text{Percentage Purity (\%)} = \frac{N \times S \times M}{L \times W}$$

### OBSERVATION

| S. No. | Observation                                           | Reading  |
|--------|-------------------------------------------------------|----------|
| 1.     | Weight of powdered drug (W)                           | _____ mg |
| 2.     | Weight of Lycopodium powder (S)                       | _____ mg |
| 3.     | Number of characteristic tissue fragments counted (N) | _____    |
| 4.     | Number of Lycopodium spores counted (L)               | _____    |
| 5.     | Number of Lycopodium spores per mg (M)                | 94,000   |
| 6.     | Percentage purity of powdered drug                    | _____ %  |

### RESULT

The percentage purity of the supplied powdered crude drug was determined by the Lycopodium spore method and found to be \_\_\_\_\_ %.

### CONCLUSION

The percentage purity of the powdered crude drug was successfully determined using the Lycopodium spore method. This quantitative microscopic technique is useful for evaluating the authenticity, quality and degree of adulteration of powdered crude drugs.

### REFERENCES

- Kokate CK. *Practical Pharmacognosy*. 4th Edition. Vallabh Prakashan, New Delhi; 1994.
- Khandelwal KR. *Practical Pharmacognosy: Techniques and Experiments*. 9th Edition. Nirali Prakashan, Pune.
- Trease GE, Evans WC. *Pharmacognosy*. 16th Edition. Saunders Elsevier.
- Indian Pharmacopoeia Commission. *Indian Pharmacopoeia*. Latest Edition.
- World Health Organization. *Quality Control Methods for Medicinal Plant Materials*. Geneva.

## EX NO 14

### EXPERIENTIAL LEARNING-BASED EXPERIMENT INVOLVING COLLECTION, IDENTIFICATION OF MEDICINAL PLANT MATERIAL, PREPARATION OF VOUCHER SPECIMENS AND EXCURSION VISIT TO MEDICINAL PLANT GARDEN

#### Aim:

To collect, identify and authenticate medicinal plant materials, prepare voucher specimens, and study medicinal plants during an educational excursion to a medicinal plant garden.

#### Background

Experiential learning is an effective teaching methodology that enables students to acquire practical knowledge through direct observation and hands-on experience. Collection and identification of medicinal plants are essential skills in Pharmacognosy, as they help in the authentication of crude drugs and prevention of adulteration. Preparation of voucher specimens provides a permanent record of the collected plant material for future reference and herbarium documentation. Educational visits to medicinal plant gardens offer opportunities to study medicinal plants in their natural or cultivated habitats, observe their morphological characteristics, understand their therapeutic importance and learn proper methods of cultivation and conservation.

#### REQUIREMENTS

**Materials Required:** Plant collection bag, pruning scissors, knife, newspaper sheets, blotting papers, herbarium press, herbarium sheets, labels, adhesive, thread, field notebook, pen, GPS/mobile camera (optional), hand lens.

**Study Material:** Fresh medicinal plant specimens and medicinal plant garden.

#### PROCEDURE

##### A. Collection of Medicinal Plant Material

1. Visit the medicinal plant garden or nearby natural habitat.
2. Select healthy medicinal plants free from disease and insect infestation.
3. Collect representative specimens containing leaves, flowers and fruits wherever possible.
4. Record the field observations such as date of collection, locality, habitat, vernacular name and collector's name.
5. Label each specimen properly for further identification.

##### B. Identification of Medicinal Plants

1. Observe the morphological characters such as habit, stem, leaves, flowers and fruits.

2. Compare the observed characters with standard floras, pharmacognosy manuals or authenticated herbarium specimens.
3. Record the botanical name, family, common name and medicinal uses of each plant.

### C. Preparation of Voucher Specimen

1. Arrange the collected plant specimen properly between newspaper sheets.
2. Place blotting papers on both sides and keep the specimen in a herbarium press.
3. Change the blotting papers periodically until the specimen is completely dried.
4. Mount the dried specimen on a standard herbarium sheet using adhesive or thread.
5. Prepare a voucher label containing the following information:
  - a) Botanical name
  - b) Family
  - c) Common name
  - d) Locality
  - e) Date of collection
  - f) Collector's name
6. Voucher specimen number
7. Preserve the prepared voucher specimen in the departmental herbarium for future reference.

### D. Excursion Visit to Medicinal Plant Garden

1. Visit the medicinal plant garden under the supervision of the faculty.
2. Observe the cultivation practices and maintenance of medicinal plants.
3. Study the morphological features and medicinal importance of different plant species.
4. Interact with the garden personnel regarding propagation, harvesting and conservation of medicinal plants.
5. Record the observations in the practical record book.

## OBSERVATION

### A. Details of Collected Medicinal Plants

| S. No. | Botanical Name | Common Name | Family | Part Collected | Therapeutic Use |
|--------|----------------|-------------|--------|----------------|-----------------|
| 1.     |                |             |        |                |                 |
| 2.     |                |             |        |                |                 |
| 3.     |                |             |        |                |                 |
| 4.     |                |             |        |                |                 |
| 5.     |                |             |        |                |                 |

| S. No. | Botanical Name | Common Name | Family | Part Collected | Therapeutic Use |
|--------|----------------|-------------|--------|----------------|-----------------|
|        |                |             |        |                |                 |

### B. Voucher Specimen Details

| S. No. | Voucher No. | Botanical Name | Date of Collection | Locality | Collector's Name |
|--------|-------------|----------------|--------------------|----------|------------------|
| 1.     |             |                |                    |          |                  |

### C. Excursion Visit Record

| S. No. | Observation                                       |
|--------|---------------------------------------------------|
| 1.     | Name of Medicinal Plant Garden: _____             |
| 2.     | Date of Visit: _____                              |
| 3.     | Number of medicinal plant species observed: _____ |
| 4.     | Important medicinal plants studied: _____         |
| 5.     | Remarks: _____                                    |

## RESULT

Medicinal plant materials were successfully collected, identified and authenticated. Voucher specimens were prepared and preserved, and an educational excursion to the medicinal plant garden was completed to study the morphology, cultivation and medicinal importance of various plant species.

## CONCLUSION

The experiential learning exercise provided practical knowledge regarding the collection, identification and authentication of medicinal plants. Preparation of voucher specimens and the educational visit to the medicinal plant garden enhanced understanding of plant morphology, taxonomy, conservation and the importance of medicinal plants in Pharmacognosy.

## REFERENCES

- Kokate CK. *Practical Pharmacognosy*. 4th Edition. Vallabh Prakashan, New Delhi; 1994.
- Khandelwal KR. *Practical Pharmacognosy: Techniques and Experiments*. 9th Edition. Nirali Prakashan, Pune.
- Trease GE, Evans WC. *Pharmacognosy*. 16th Edition. Saunders Elsevier.

- Indian Pharmacopoeia Commission. *Indian Pharmacopoeia*. Latest Edition.
- World Health Organization. *Quality Control Methods for Medicinal Plant Materials*. Geneva.
- Wallis TE. *Textbook of Pharmacognosy*. CBS Publishers & Distributors.