

# UNIT-12

## Phytochemical investigation of drugs

### Points to be covered in this topic

- ☐ INTRODUCTION
- ☐ HERBAL EXTRACTION
  - ❖ Maceration
  - ❖ Digestion
  - ❖ Percolation
  - ❖ Continuous hot extraction (Soxhlet extraction)
  - ❖ Infusion
  - ❖ Decoction

## 10.1 INTRODUCTION

Phytochemicals are naturally occurring and biologically active chemical compounds present in plants. Phytochemical investigation of drugs is the study of identifying, isolating, and characterizing these bioactive compounds in plants using techniques like chromatography and spectroscopy.



The systematic investigations of plant material for its phytochemical behavior involve several stages:

1. The procurement of raw material and quality control.
2. Extraction, purification and characterization of the constituents of pharmaceutical interest and, in process quality control.
3. Investigations of biosynthetic pathways to particular compounds.
4. Quantitative evaluation.

## 10.2 HERBAL EXTRACTION

Commonly employed technique for the separation of active ingredients from crude drug is called 'Extraction' which involves the use of different solvents on the basis of the physical nature the of crude drugs to be extracted, i.e., liquid or solid. The extraction process may be liquid—liquid or solid—liquid extraction.

Various extraction methods are given below:

- i. Maceration
- ii. Decoction
- iii. Digestion
- iv. Percolation
- v. Soxhlet extraction
- vi. Infusion

### 10.2.1 Maceration

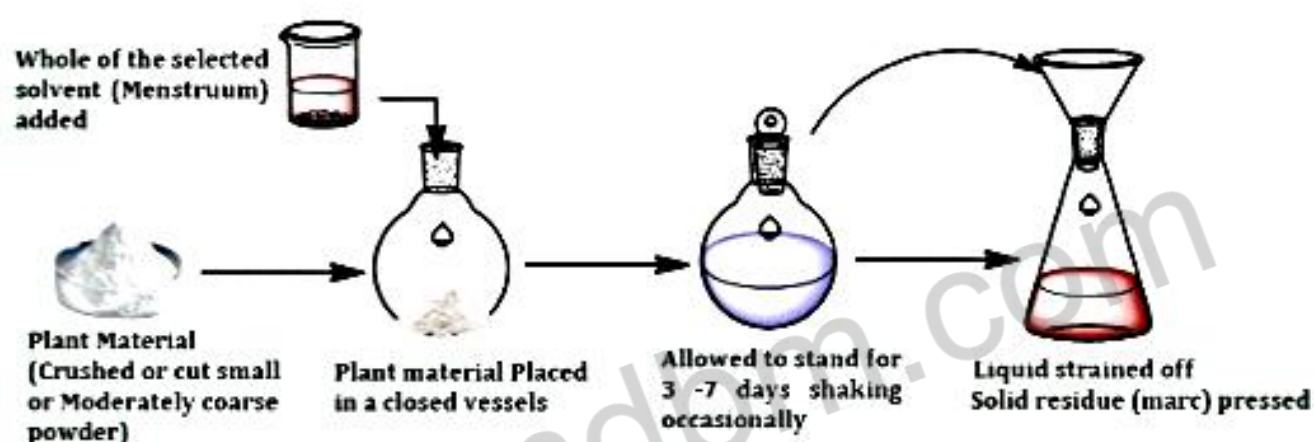
The maceration process involves separating the active portions of crude drugs by immersing them in a solvent or **menstruum**.





Steps involved in maceration process:

- i. Plant material is finely cut, crushed, or ground into moderately coarse powder.
- ii. Plant material is put into a sealed container.
- iii. Solvent (Menstruum) is added.
- iv. The mixture is allowed to stand for one week and is shaken occasionally.
- v. The fluid is strained.
- vi. Solid residue (**Marc**) is pressed to recover any remaining liquid.
- vii. Strained and expressed liquids are mixed.
- viii. Liquids are clarified through filtration or subsidence.



### 10.2.2 Digestion

- This is a form of maceration in **gentle heat** during the process of extraction.
- Heat helps to accelerate the extraction process by increasing the solubility and diffusion rate of chemical compounds from the plant material into the solvent.
- By utilizing heat, more effective extractions can be achieved with a higher yield of bioactive components.



### 10.2.3 Percolation

Percolation is the process of extracting the desired components from a crude drug material by allowing a **continuous downward displacement** of the solvent through the bed of crude drug material to get extract.

### Steps involved in maceration process:

- i. The powdered drug material is first moistened with enough menstruum to make it uniformly wet.
- ii. After standing for about 15 minutes, the damp material is transferred to a percolator, which is typically V-shaped and open at both ends.
- iii. Sufficient menstruum is added to saturate the drug in the percolator, and then the lid is placed on top.

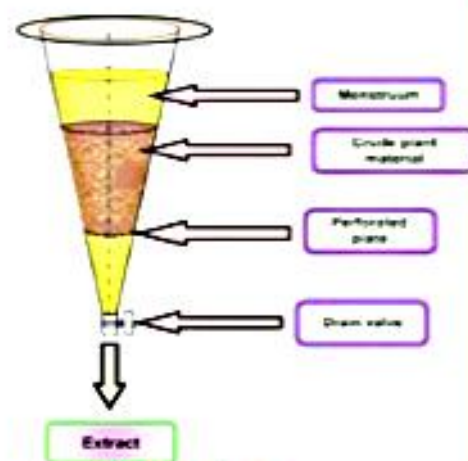


Fig: Percolator

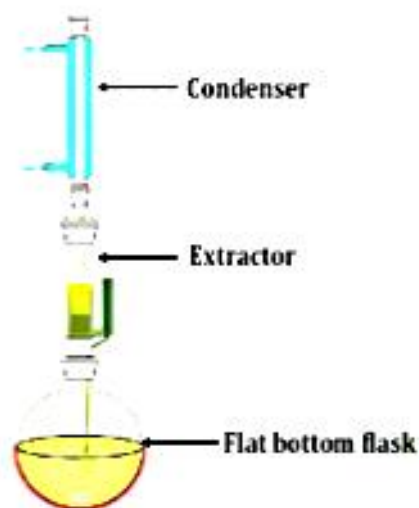
- i. Once liquid starts dripping out from the outlet of the percolator, the lower opening is closed to allow maceration for 24 hours inside this vessel.
- ii. The continued gradual percolation using sufficient menstruum produces 1,000 ml solution.
- iii. The concentration of products obtained through percolation tends to be higher than that obtained through the maceration process due to its dependence on solvent flow throughout the powdered drug.

### 10.2.4 Continuous hot extraction (Soxhlet extraction)

Soxhlet extraction is a **continuous extraction process** where the same solvent can be circulated through the extractor multiple times.

#### Steps involved in maceration process:

- i. The process involves extracting and evaporating the solvent, with the condensed liquid being returned to the drug for further extraction.
- ii. The apparatus consists of an extractor attached to a side tube and a siphon tube, allowing for easy transfer of liquids.
- i. The crude drug powder can be packed directly into the Soxhlet apparatus or in a thimble made of filter paper or muslin.
- ii. Fresh activated porcelain pieces are added to prevent solvent bumping during heating
- i. As vapors pass through the side tube, they condense and increase liquid levels in both flasks.





- i. A siphon is set up when enough liquid has been condensed for it to flow back into one flask while transferring contents from another flask.
- ii. This cycle can continue several times without changing solvents.  
 Soxhlet extraction **requires less solvent** but yields more concentrated products compared to other methods.

### 10.2.5 Infusion

- Infusion is the **process of extracting chemical compounds from plant materials** in a solvent such as water, oil, or alcohol, by allowing the material to remain suspended in the solvent over time, usually 15 min (a process often called steeping), with occasional stirring, and finally filtering off the liquid.
- This process is only applicable for **soft drugs** and drugs containing **water soluble constituents**.
- The **marc is not pressed**.
- **Boiling water** is commonly used as a solvent, since it has a **greater solvent action than cold water**.

#### Method of preparation:

- For the preparation of infusion, **coffee pots or tea pots or special infusion pots** are used.
- In that, firstly drug is placed in **bottom of the pot**. Then add hot water and stir three or four times during the period of infusion.
- Infusion also prepared in muslin cloth. In that case, the drug is placed in muslin cloth and enclosed, then suspended just below the level of the water in a beaker.
- In this process, **stirring is not required**.

### 10.2.6 Decoction

Decoction is the ancient and more popular process of extracting water soluble and **heat stable constituents** from crude drugs by boiling them in water for about 15 min.



- It is a simple **boiled solution of the drug**.
- Useful for a **water-soluble and heat-stable drug**.
- Drugs are boiled with water for usually **10 minutes**.
- Use for **hard and woody substances**  
**e.g.- Kwath preparation.**