Djilali BOUNAAMA- Khemis Miliana University
Faculty of Sciences and technology

Lab work: Organic chemistry
Specialty: Process Engineering
Level: 2nd year LMD

Experiment N°2: Extraction of essential oil from Thyme by Clevenger-type hydrodistillation.

GENERALITIES

An essential oil is a fragrant liquid that can range from fluid to thick and varies in color depending on the plants from which it is extracted. It is secreted by specialized cells found in leaves, flowers, roots, and seeds. Essential oils are generally volatile and are obtained through distillation methods or solvent extraction. Under normal conditions, these oils are also known as volatile oils or essences.

Thyme is a plant that belongs to the botanical family Lamiaceae within the genus *Thymus*. It is an erect shrub that can reach a height of 60 cm with numerous branches. The leaves are spatula-shaped, the inflorescence is in loose clusters, and the corolla is pink or pale pink.

The dried leaves of thyme are used in traditional medicine in the form of infusions and decoctions to treat whooping cough, bronchitis, and rheumatism. Antimicrobial and antispasmodic effects have been reported.

The essential oil of this species is considered a broad-spectrum antibiotic, an immune system regulator, an antiparasitic, an anti-hyperglobulinemia agent, and a general physical and mental tonic.

The chemical composition of the essential oil varies depending on the species and chemotypes considered. Regarding plants of the genus *Thymus*, there are different chemotypes of the essential oil, such as thymol and carvacrol.

1. OBJECTIVES :

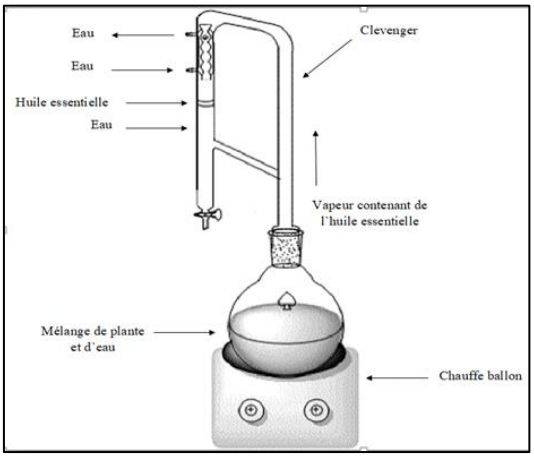
- To extract the essential oil from thyme using: Clevenger-type hydrodistillation.
- Monitor the kinetics of the extraction
- To calculate the yield of essential oil.

2. Principle:

The principle of hydrodistillation is simple: it involves boiling a mixture of water and the aerial parts of thyme. By heating, the plant cells containing the fragrant chemical species burst, and these compounds are then

carried away by the steam at temperatures low enough to prevent degradation. The steam in the apparatus is predominantly composed of water, with very little essential oil. This is why hydrodistillation must last relatively long to recover a sufficient quantity of essential oil. It is also why essential oil is such an expensive product: the cost of electrical energy to extract small amounts of essential oil is high.

3. MANIPULATION :



- **<u>Equipment and Products:</u>**
  - Heating mantle
  - Round-bottom flask
  - Support with clamp
  - Clevenger apparatus
  - Water inlet hose
  - Erlenmeyer flask
  - Water outlet hose

- **<u>Experimental</u> Protocol**

  Introduce into a 1000 mL flask:
  - 30 g of dry plant material.
  - 300 mL of distilled water (mass/volume ratio of 1/10).
  - Set the temperature near 100 °C (boiling point of water).

The mixture will be brought to a boil for 1 hour and 30 minutes. The essential oil will then be carried away by the steam and subsequently condensed. The condensed vapor will lead to an organic phase (essential oil) that will separate from the hydrosol by decantation.

- Note the yield of the extraction every 10 minutes.
- Collect and store the essential oil in a refrigerator at 4 °C in the dark.

4. QUESTIONS :

1. Draw the setup used for the hydrodistillation of thyme essential oils.
2. What is the principle of hydrodistillation?
3. Specify the role of the condenser.
4. Describe the organoleptic properties of the obtained essential oil.
5. Calculate the yield of the essential oil extraction from thyme.
6. Plot the yield curve of essential oils as a function of extraction time.
7. Provide a conclusion.