Faculty of Pharmacy

Department of Pharmacy

2nd stage

First semester

Organic Chemistry

# Lab 1: Simple Distillation

Lecturer

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# Distillation

- An important organic process used to separate two or more than two liquids having different boiling points from a liquid mixture.
- Distillation based on the boiling point of the liquid (physical properties).

- Aim: To purify or separate a mixture of two miscible liquids (liquids that mix) with different boiling points.

The boiling point may be defined as the temperature at which the vapor pressure of a liquid is equal to the external pressure.

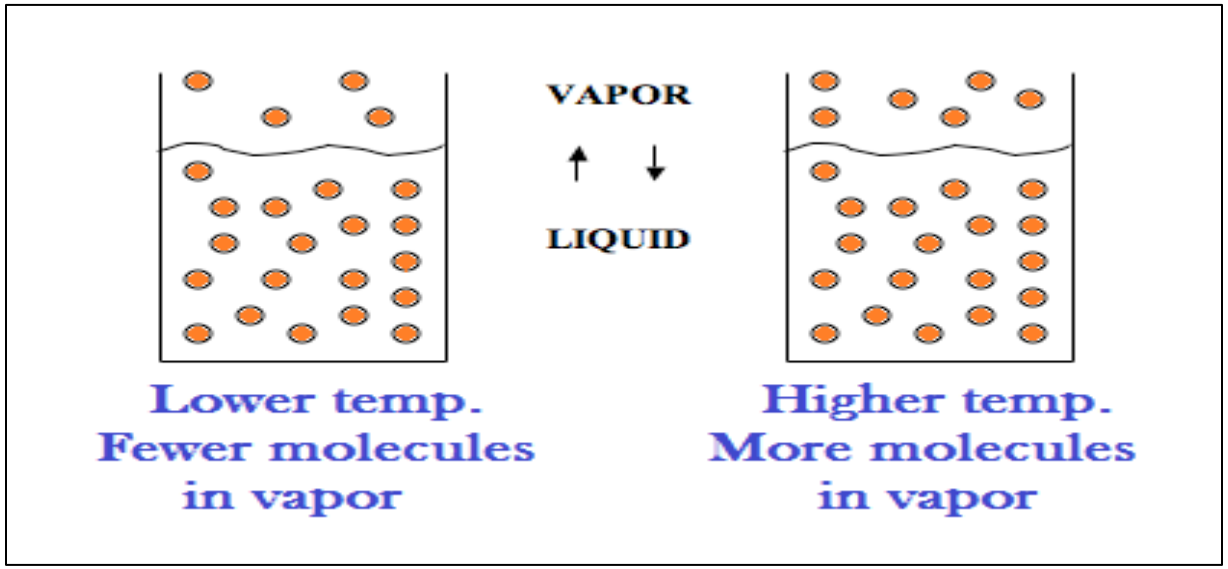
# Types of distillation

- *Simple distillation*
- *Fractional distillation*
- *Vacuum distillation*
- *Steam distillation*

# Simple distillation

It is a process of separation & purification of liquid organic compounds by selective evaporation & condensation.

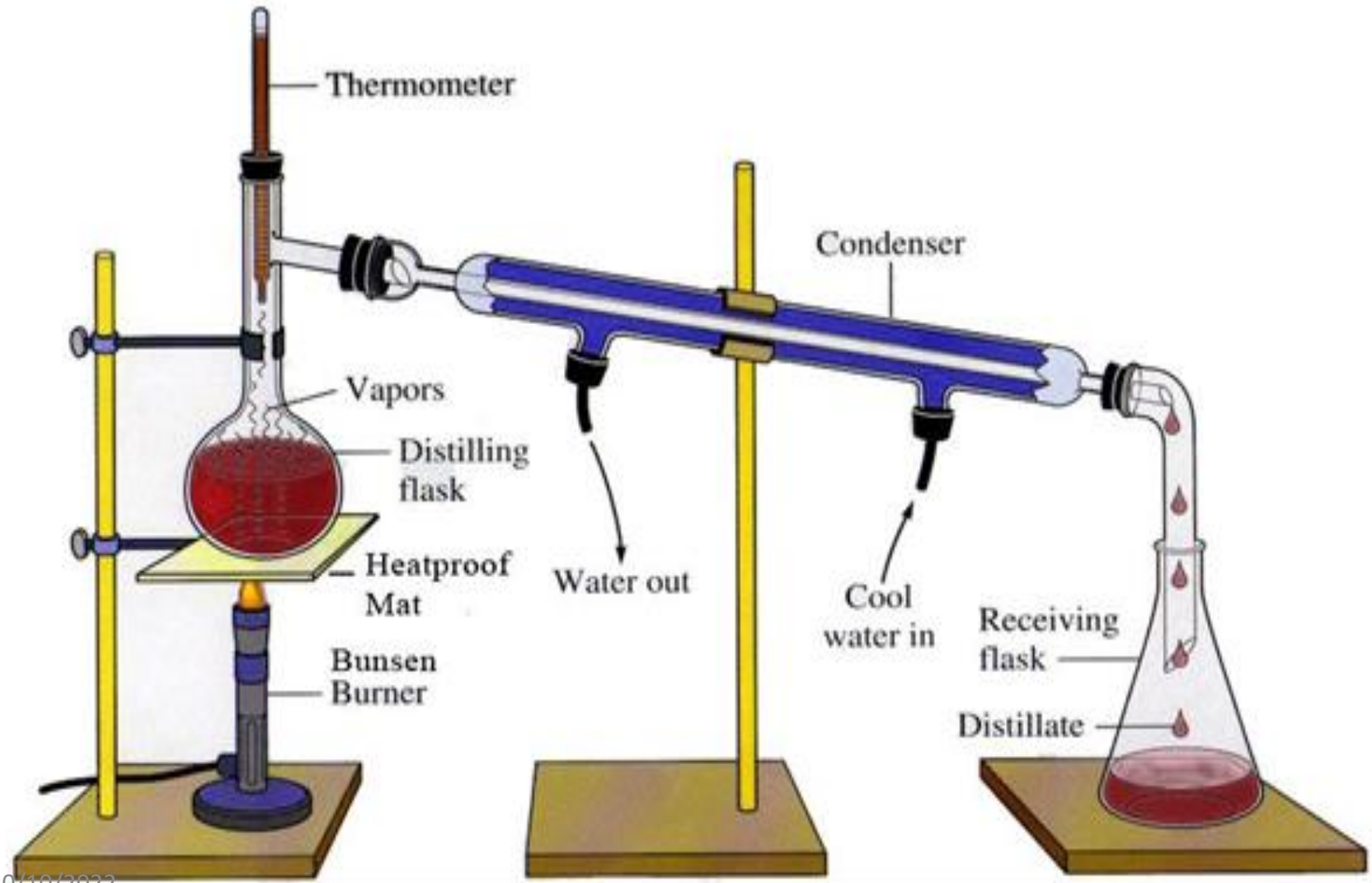
The temperatures at which a liquid distills is a definite value at a given pressure , for every pure organic compound called boiling point



# Simple distillation

- Separating liquids boiling below 150 ˚C at 1 atm. The liquids should dissolve in each other and the difference in boiling point between various liquid components should be at least 25˚C.

# Simple distillation



# How does it work

1. Mix 50ml of D.W with 25ml of unknown liquid (A), and mix the same volume of D.W with unknown (B) and make sure that all glassware is tightly closed (round bottom flask, thermometry and the condenser).
2. As the mixture is heated, the temperature rises until it reaches the temperature of the lowest boiling substance in the mixture,
3. The other components of the mixture remain in their original phase in the mixture.
4. The resultant hot vapor passes into a condenser and is converted to the liquid, and then collected in a receiver flask.
5. The other components of the mixture remain in their original phase until the most volatile substance has all boiled off.
6. Then the temperature of the gas phase rises again until it reaches the boiling point of a second component in the mixture, and so on.

# Separation of liquid mixture by simple distillation

1. A mixture composed of unknown (**A**) and (**water**) with boiling point (--?-- & 100) °C respectively is heated.
2. The lowest boiling point (**A**) will vaporized and elevated from the solution till it reach the top of the system, with recording its real b.p. with the help of thermometer.
3. The rises vapor (**A**) will converts to the liquid form by the action of the condenser, then collect at the receiver.
4. Finally the highest boiling point (**water**) will remain in the distillation flask.
5. The students must find the unknown A and B with the help of references.

# Solid-liquid mixture

Take fixed volume of the (water+KMnO4) for solid and liquid mixture and put the sample in the round bottom flask, then add boiling chips to the flask, heat the mixture to near 100 degree and check the boiling of the mixture at 100 $^{o}$C , the water will start boiling and will remain at that temperature till all water molecules have been converted to gaseous state. Then, turn off the source of heat, measure the volume of purified water. calculate the percentage of the pure substance using the equation below:

% of pure liquid = Volume of pure liquid/ volume of mixture x 100

# Liquid-liquid Mixture

Take fixed volume of the (------+Water) for Liquid-liquid mixture and put the sample in the round bottom flask, then add boiling chips to the flask, heat the mixture to near 50-60 $^{o}$C and check the boiling of the mixture, the substance with the lowest boiling point will start boiled and will remain at that temperature till all have been converted to gaseous state. Then heat the liquid remaining will increase till to start evaporation Calculate the percentage of pure acetone and pure water using the previous equation.

# Applications

- Remove impurities from Water.
- Air is distilled to separate its components.
- Separation of volatile oil.
- Purification of organic solvent.
- Separation of drug obtained from plant and animal.
- Purification of drug from animal source.
- Separation of crude oil components.

# Questions

1. Why is it necessary to add boiling chips to the round flask?
2. What is the purpose of the condenser?
3. Draw a labeled diagram showing the process of distillation.
4. Mention the various uses of Distillation.
5. A condenser has two taps.
6. Two water samples, labeled ‘A’ and ‘B,’ are given to you. Sample “A” boils at 100°C, while sample “B” boils at 102°C. Which water sample will not freeze at 0°C?