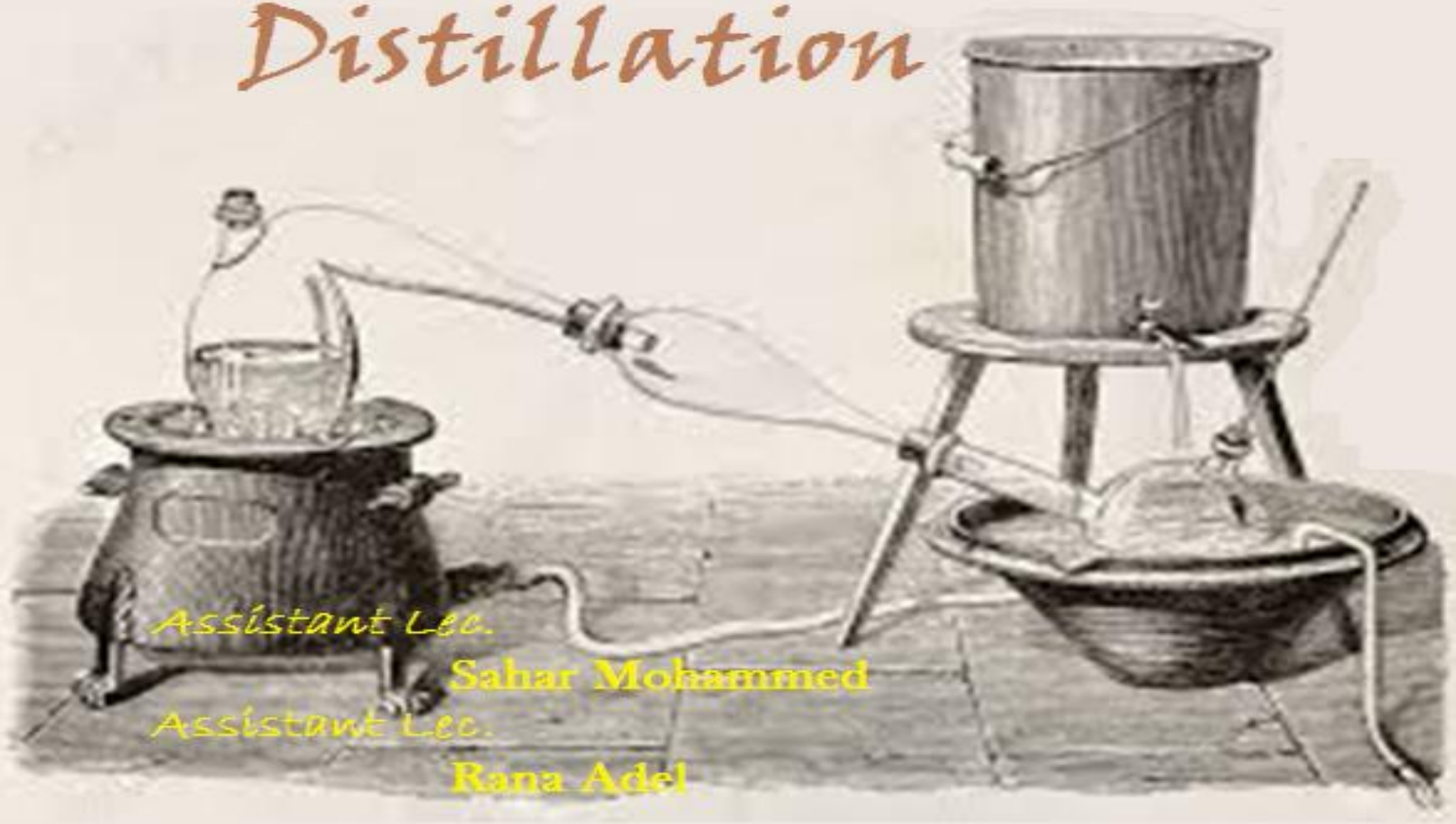
Distillation



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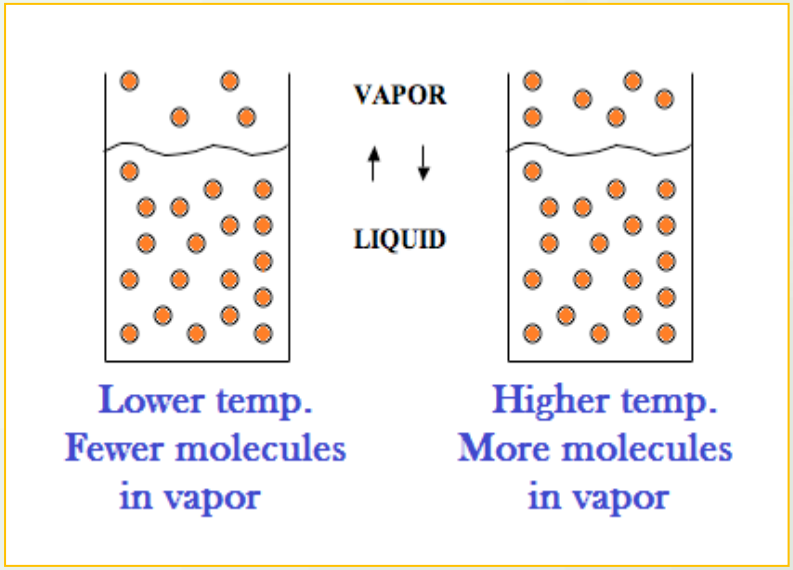
Distillation

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

It may result in complete separation (nearly pure) , or ,a partial separation that increase the concentration of selected cpd. of the mixture.

The temp . at which a liquid distills is a definite value at a given pressure , for every pure organic cpd called boiling point.



Aim of the Distillation:

1- **Purification of liquid organic cpd.**
2- **Determination of the boiling point.**
3- **Separation of liquid organic substances from each other or from a non-volatile solid cpd.s**

Types of distillation:

1- Simple distillation.
2- Vacuum distillation.
3- Steam distillation.
4- Fractional distillation.
5- Reflex.

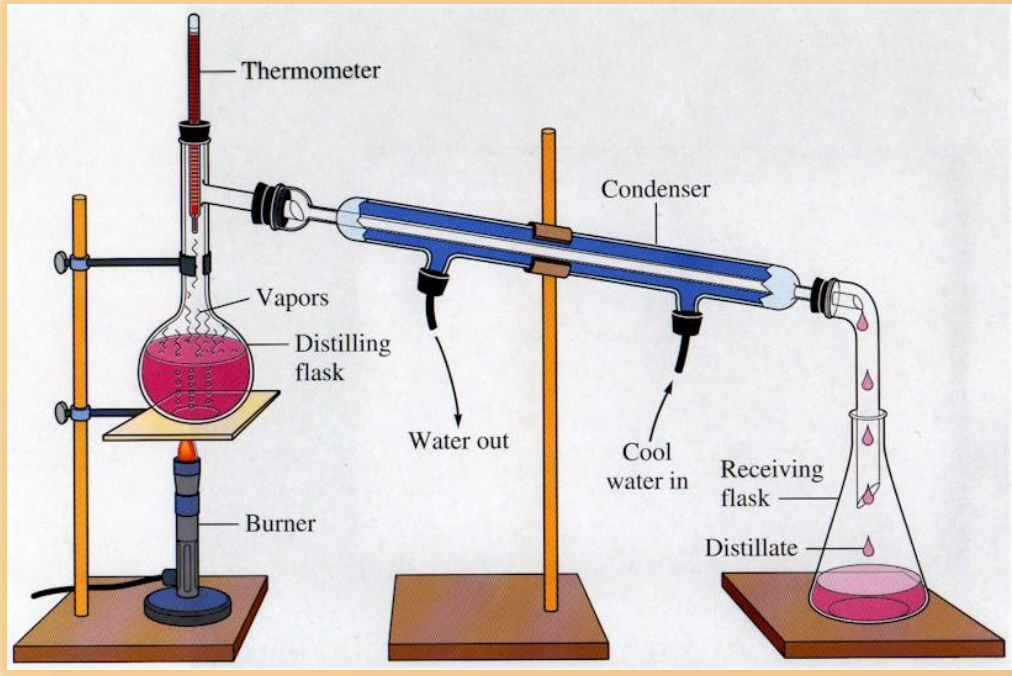
Simple Distillation:

In simple distillation the vapor is immediately channeled into a condenser, so the distillate is identical to the composition of the vapors at the given temp. & pressure. That concentration follows **Raoult's law**.

It is effective as purification process when,

1- The liquid bp.s differ greatly (25 °C).

2- Separating liquids from non-volatile solids or oils

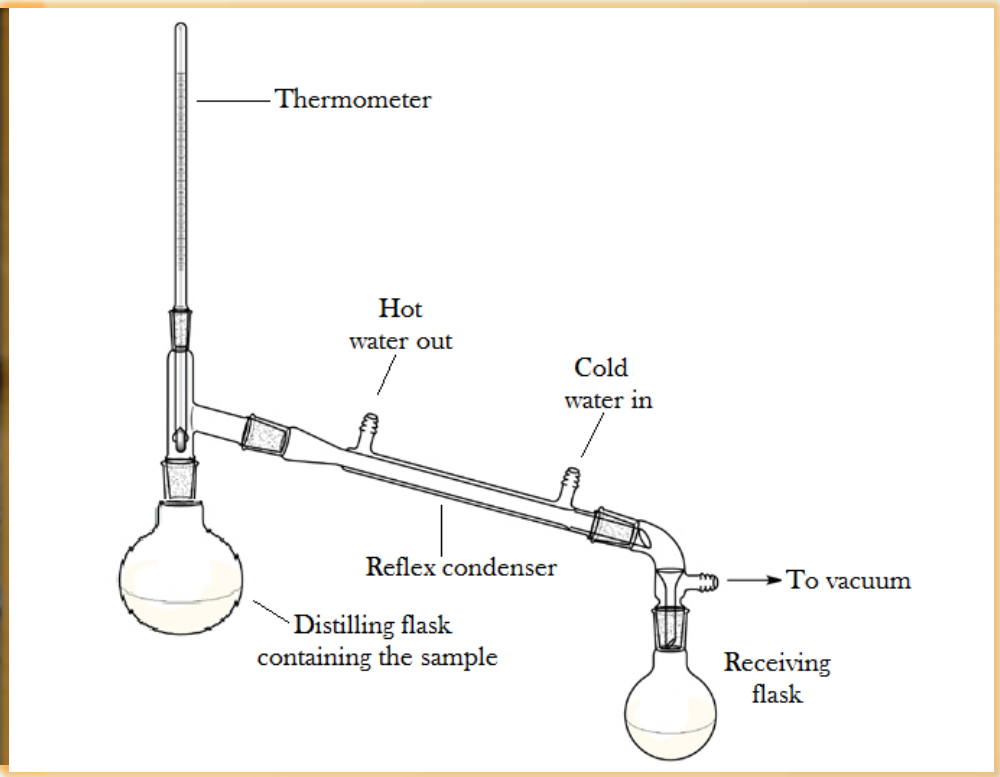


For these cases,

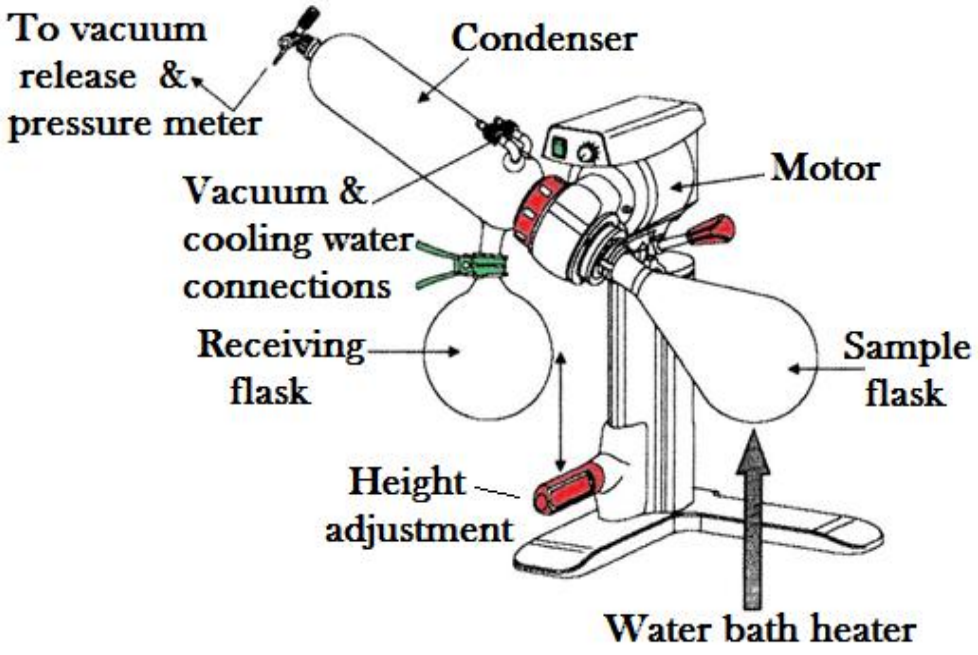
the vapor pressure of the components is different enough that the distillate may be sufficiently pure for it's intended purpose.

Vacuum Distillation:

Some cpd.s have very high b.p.s or unstable to heat. To boil such cpds it is better to lower the pressure at which such cpds are boiled instead of increasing the temp. Once the pressure is lowered to the vapor pressure of the cpd , at a given temp., boiling & the rest of the distillation process can commence. This technique is referred to as vacuum distillation.

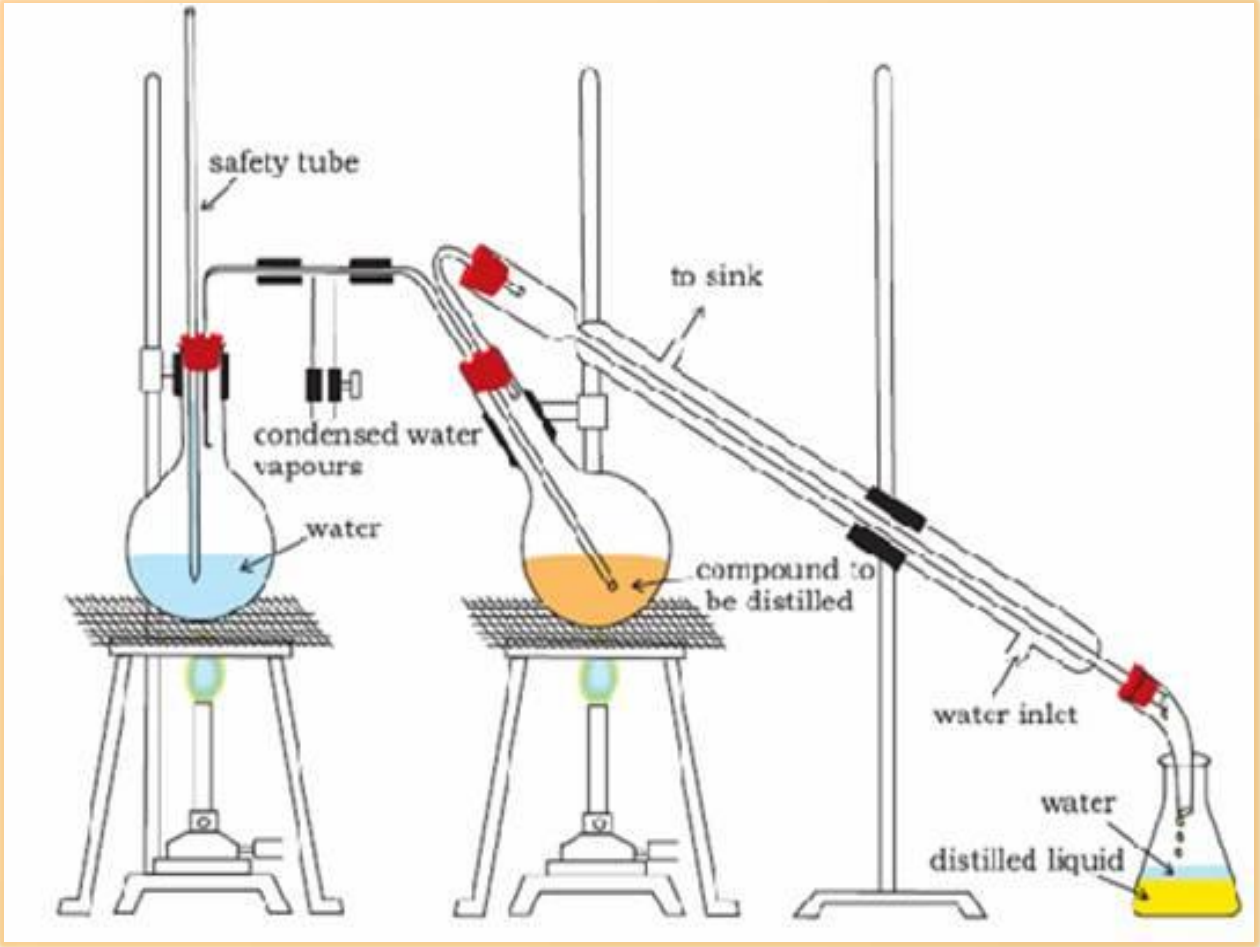


Rotary Evaporator



Steam Distillation:

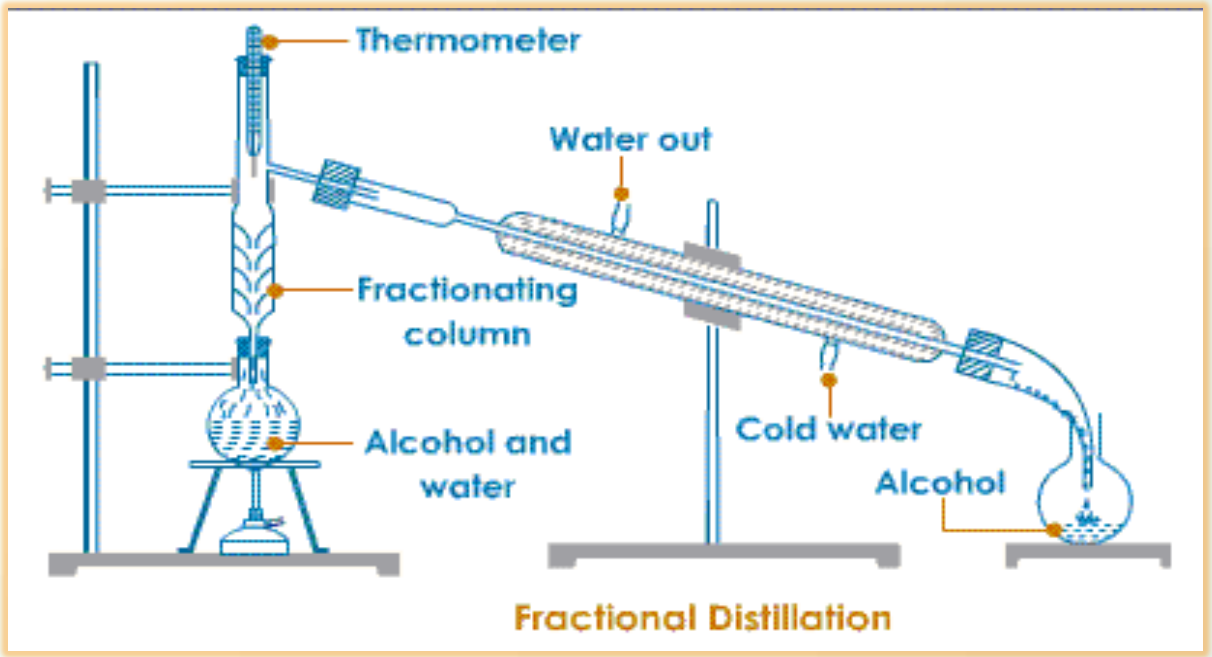
This method is used for the separation of water immiscible compound of low volatility from non- volatile tarry products which are formed as by-products in many reactions.



Fractional Distillation:

It is used to separate mixtures in which the components have boiling points that differ by only a few degrees, by employing a fractionating column in the distillation apparatus.

So, fractional distillation is a process of collecting separate fractions according to controlled boiling ranges during the distillation of a mixture of substances.

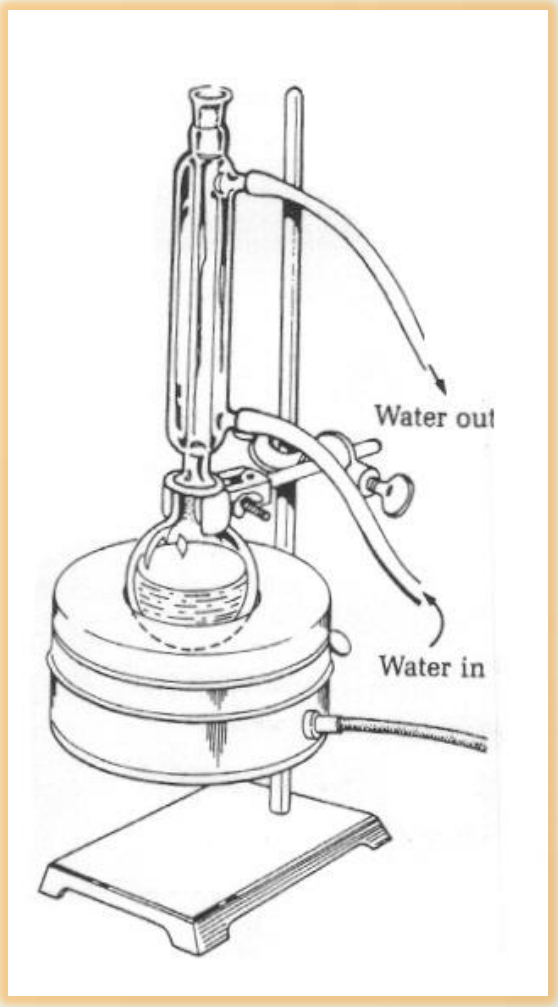


Fractionating column
Packed column

Reflex Distillation:

Reflex is a distillation technique involves the condensation of vapors & the return of this condensate to the system from which it originated.

This method is used to keep or prevent the reactants from loss by evaporation during a reaction.



Azeotropic mixture:

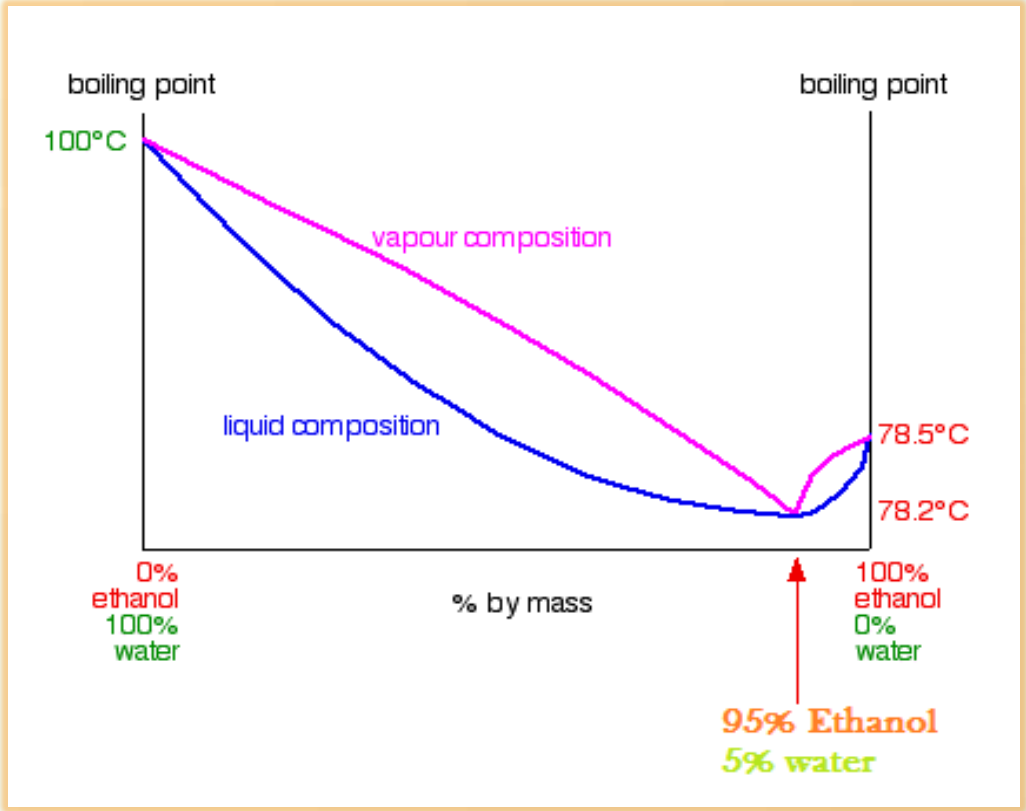
Azeotropic , a constant boiling, mixture is a mixture of two or more liquids whose proportions cannot be altered by simple distillation.

This happens because when an azeotrope is boiled, the vapor pressure has the same proportions of constituents as the unboiled mixture.

For example,

95% Ethyl alcohol & 5% water produce an Azeotropic mixture, which boils at 78.15 °C.

Ethanol , Benzene and Water azeotrope boils at 64.9 °C.



Name of experiment: **SIMPLE DISTILLATION**

Aim of experiment: Purification of Ethanol

Procedure:

1- Put 100 ml of ethanol in a boiling flask.

2- Add 2-3 pieces of boiling chips.

3- Start the water running slowly through the condenser.

4- Heat until boiling.

5- Adjust the temperature so that distillation proceeds at 2-3 drops per second. Discard the first 2-3 ml of the distillate.

6- Continue distillation until you collect 30-60 ml.

7- Record the boiling point of your liquid, Ethanol.

Discussion & Notes:

* Pure cpd.s distill over a very narrow range of temp.
* The b.p. is affected by impurities; some may increase the b.p.s, others may decrease it & some may not affect it.
* Usually the 1st few milliliters of the distillate contain water or volatile impurities, 2nd portion contains the substance.
* 2 - 3 pieces of broken porcelain chips are placed in the boiling flask with the substance to be distilled to prevent bumping by producing a constant stream of bubbles that keep the liquid in motion.
* If the liquid is volatile (low b.p.), the flask is heated by a water bath rather than by a flame.