

# DISTILLATION

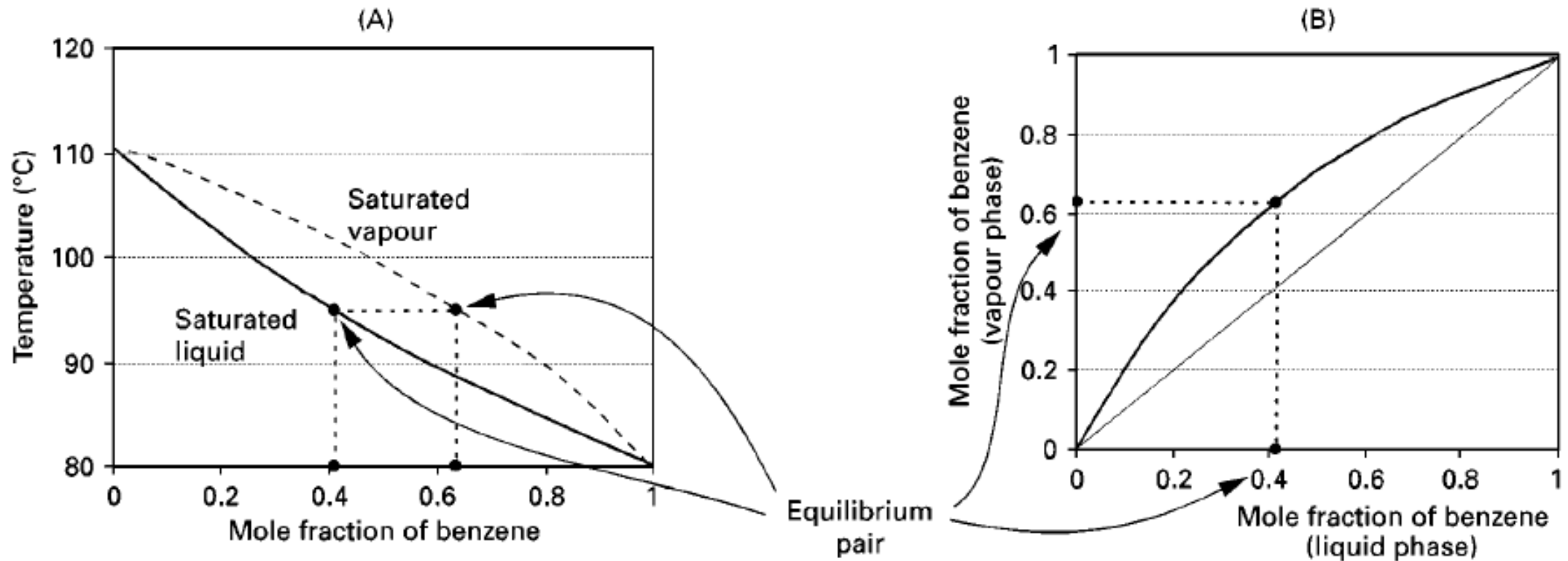
- The most commonly used method for the separation of homogeneous fluid mixtures.
- Separation exploits differences in **boiling point** or **volatility**, between the components in the mixture.
- Repeated vaporization and condensation of the mixture allows virtually complete separation of most homogeneous fluid mixtures.
- The vaporization requires the input of energy. This is the principal disadvantage of distillation: its **high energy usage**.



- However, distillation has **three principle advantages** over alternative methods for the separation of homogeneous fluid mixtures:
- The ability to handle **a wide range of feed flow rates**.
- The ability to separate feeds with **a wide range of feed concentrations**.
- The ability to produce **high product purity**.



# Binary Mixture of Benzene and Toluene



# Distillation Techniques

Distillation techniques may be classified into several different types including:

- Distillation at atmospheric pressure
- Distillation under reduced pressure
- Steam distillation
- Molecular distillation (short-path distillation)
- Azeotropic distillation
- Isopiestic distillation



# Steam Distillation

- Steam distillation is a means of distilling that part of a sample that is volatile in steam at a lower temperature than would otherwise be the case.
- This method is typically used for removing phenols from an aqueous sample. A means of introducing steam into the distillation flask must be provided.



# Molecular Distillation

- Molecular distillation (shortpath distillation) is used principally for compounds normally having high boiling points.
- In such cases, very low pressures are needed to achieve the desired low boiling points.



# Azeotropic Distillation

- Azeotropic distillation occurs when a mixture of two materials distills at constant composition.
- This technique is commonly used to remove water from samples.
- As an example, toluene may be added to a complex sample containing water, the distillation process results in the toluene-water azeotrope distilling. The distillate can then be examined to determine the water content of the original sample.



# Isopiestic Distillation

- Isopiestic distillation is a convenient way of producing metal-free aqueous samples of volatile acids.
- The 'crude' acid is placed in an open container, such as a beaker, in a desiccator containing also an open beaker of pure water. The acid vaporizes and subsequent condensation in the pure water produces an aqueous sample of the volatile acid without any of the involatile contaminants such as metals.

