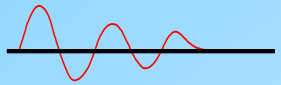

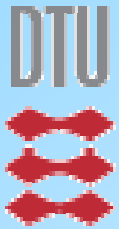

Separation of Azeotropic Mixtures

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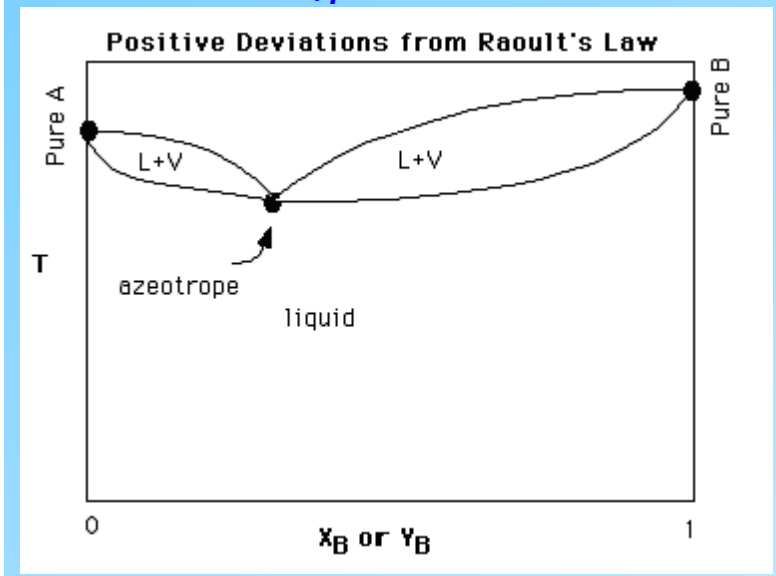
Introduction

Azeotrope

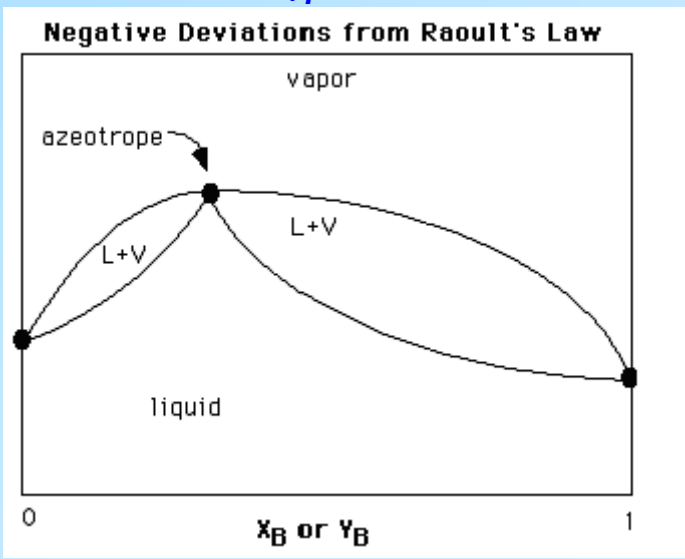
mixture of two or more compounds that in the vapour-liquid equilibrium have the same compositions and have a unique constant boiling point

$$x_i \gamma_i P_i^S = y_i P$$

$\gamma_i > 1$



$\gamma_i < 1$



Introduction

Azeotropic mixtures

Homogeneous

a single liquid phase is in equilibrium with the vapour phase

Heterogeneous

multiple liquid-phase is in equilibrium with the vapour phase

Double

two azeotropic points

Introduction

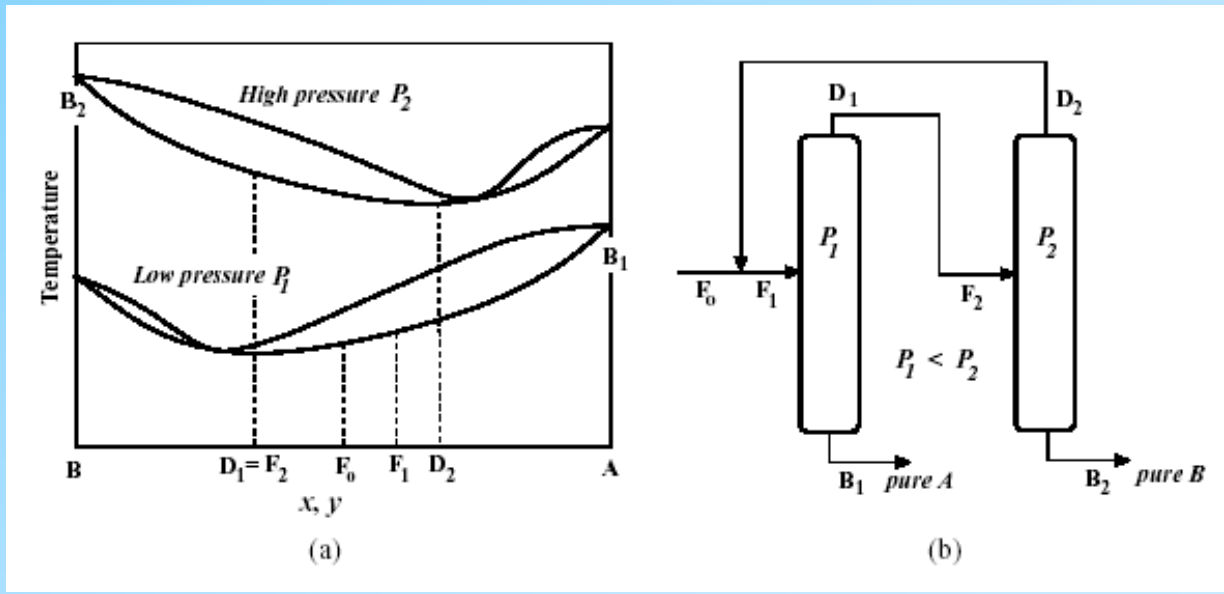
Techniques to separate azeotropic mixtures:

- **Reactive distillation** –reaction of one component
- **Heterogeneous Azeotropic distillation - two liquid phases**
- **Distillation using ionic salts – volatility modification**
- **Pressure-swing distillation**
- **Homogeneous azeotropic distillation** or **Extractive distillation**

Introduction

Pressure-swing distillation

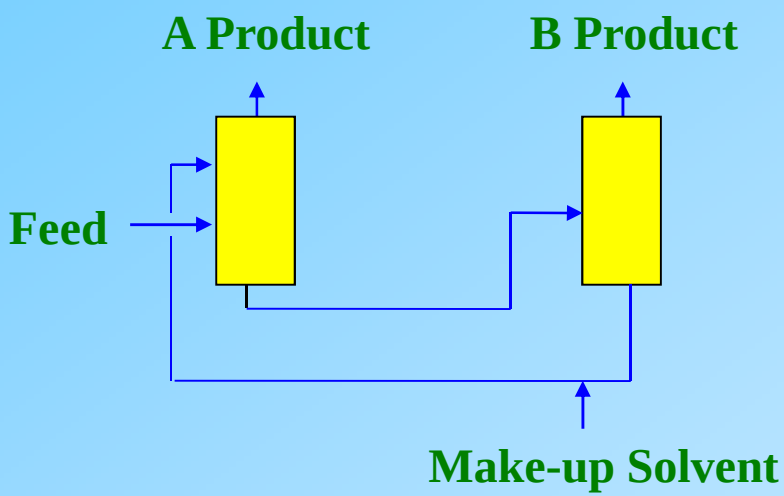
By increasing or decreasing the operating pressure in individual columns, the azeotrope composition can change or even make azeotropes appear or disappear (or transform into heteroazeotropes)



minimum-boiling binary azeotrope

Introduction

Solvent-based distillation (extractive)



The solvent must...

- affect the liquid-phase behaviour of the key components differently
- be higher boiling than the key components of the separation (typically more than 30°C)
- be non-volatile in the extractive column
- not form additional azeotropes with the components in the mixture to be separated