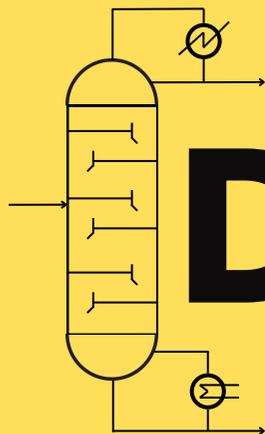




UNDERSTANDING:



DISTILLATION

BASICS, INTERNALS & TYPES



WHAT IS DISTILLATION?

Distillation is a separation process that uses differences in boiling points to separate components of a liquid mixture. By heating the mixture, the more volatile components vaporize first, and these vapors are then condensed back into a liquid to achieve separation.

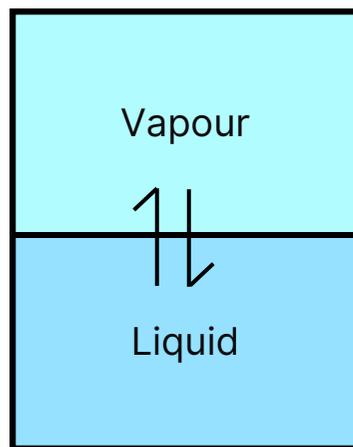
Difference in Boiling Points!

Relative Volatility
Difference?

How does a vapour and
liquid behave?

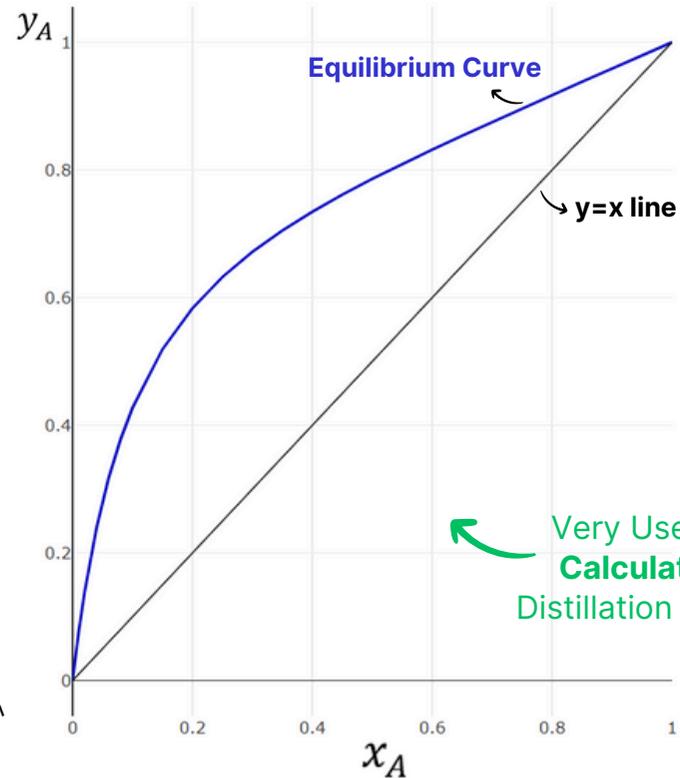
VLE DIAGRAM
(Vapor Liquid Equilibrium)

(Chemical Eng. Thermodynamics)



Calculation of Liquid and
vapor phase composition
at different standard
temp and pressure
conditions

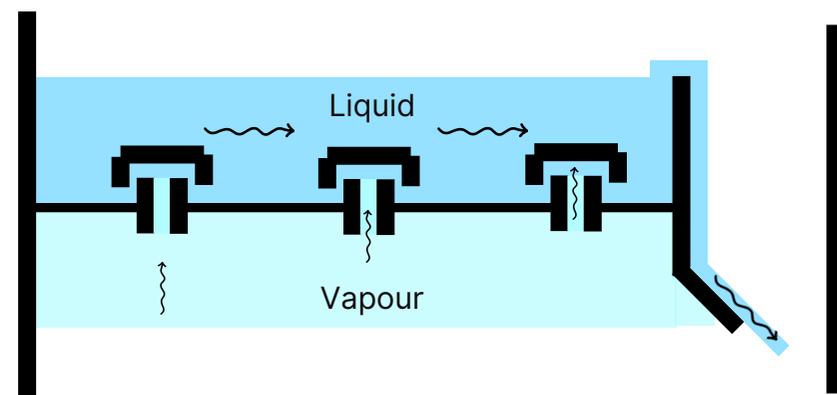
Analogous
Phenomenon



OR

T=	P=
x_A	y_A

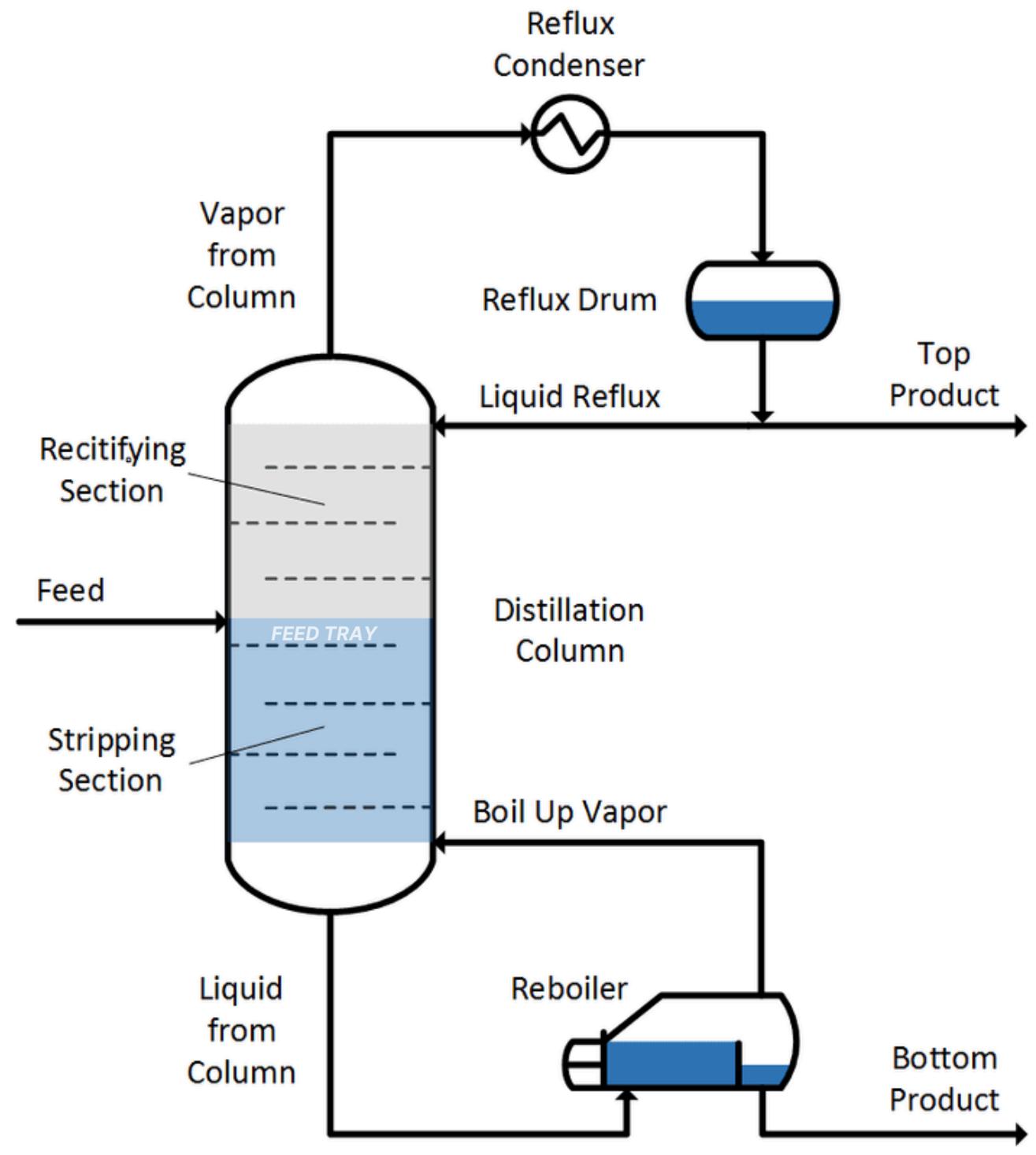
Equilibrium Data



Each Tray inside a Distillation Column is at a VLE and is governed by eqns. of thermodynamics



DISTILLATION COLUMN



© Neutrium



COLUMN INTERNALS & AUXILIARIES

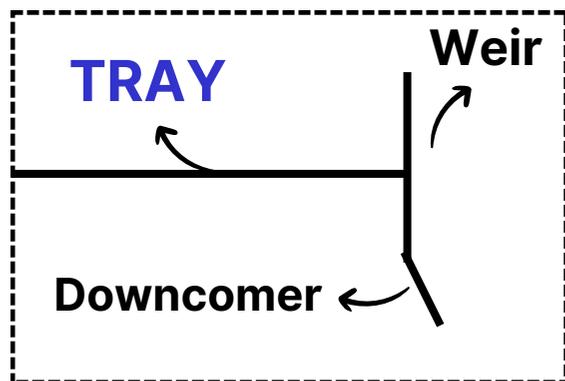
STAGE

Tray Stage

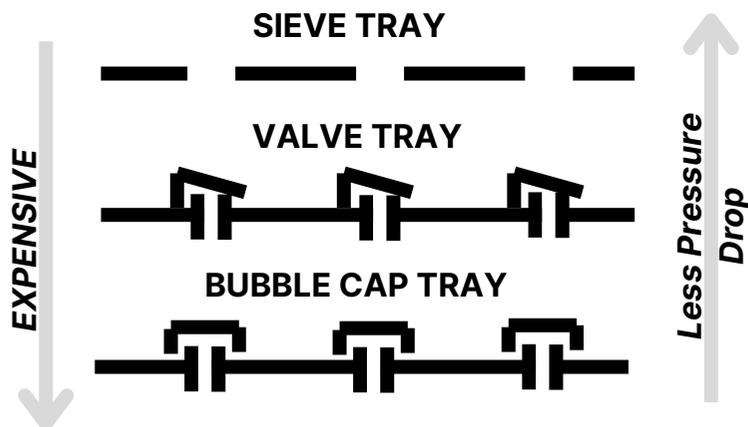
Consisting of trays or plates designed to facilitate vapor-liquid interaction through bubbling, weeping, or other mechanisms.

COST ↑ **ΔP** ↑ **VERSATILITY** ↑
MAINTENANCE DIFFICULTY ↓ **SUITABLE COLUMN DIA.** ↑

INSIDE A TRAY SECTION



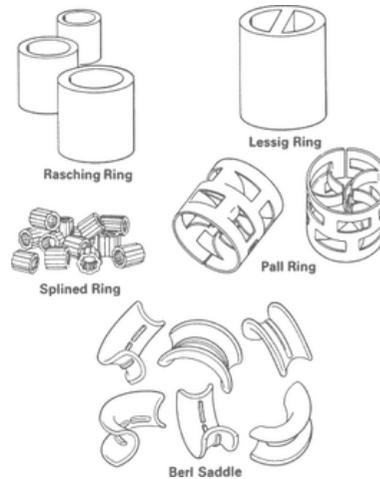
TRAY TYPES



Packed Bed

Section filled with packing materials (structured or random) to increase surface area for vapor-liquid contact.

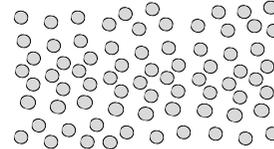
COST ↓ **ΔP** ↓ **VERSATILITY** ↓
MAINTENANCE DIFFICULTY ↑ **SUITABLE COLUMN DIA.** ↓



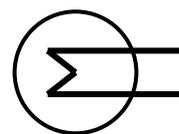
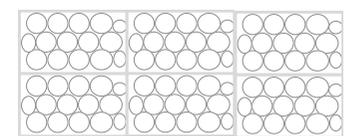
SOME COMMON PACKINGS

PACKING TYPES

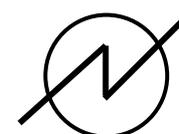
RANDOM



STRUCTURED



REBOILER



CONDENSOR

TOTAL

Complete conversion of all the incoming liquid/vapor

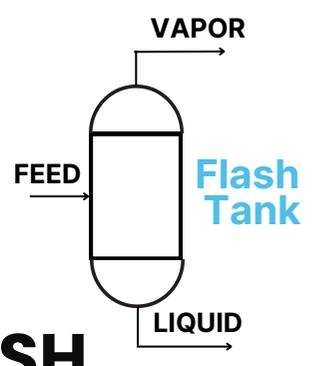
PARTIAL

Partial conversion of incoming Liquid/vapor i.e. creation of two phases

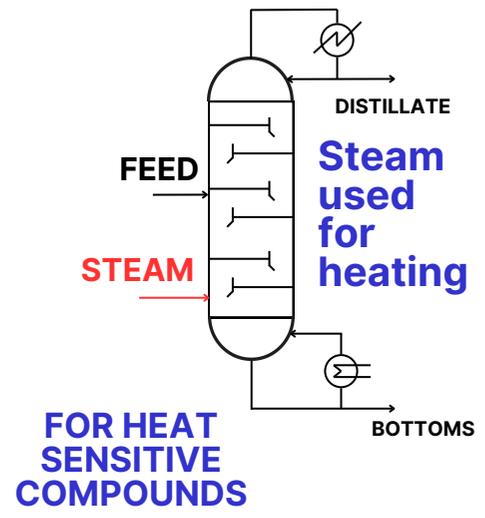


A single-stage separation process where a liquid mixture is partially vaporized, and the vapor and liquid phases are separated.

**NO TRAYS
NO STAGES**



FLASH DISTILLATION



FOR HEAT SENSITIVE COMPOUNDS

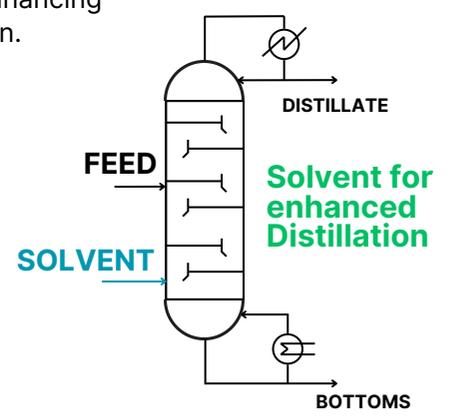
STEAM DISTILLATION

Using steam to lower the boiling points of components, enabling separation at reduced temperatures.

EXTRACTIVE DISTILLATION

Utilizes a high-boiling solvent (entrainer) to alter relative volatilities of components, enhancing separation.

FOR CLOSE BOILING POINT MIXTURES

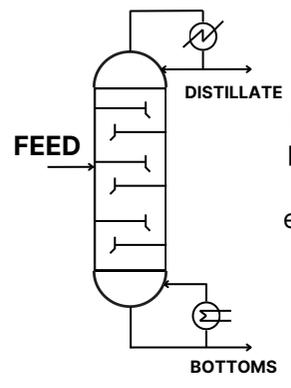


TYPES OF DISTILLATION

ORDINARY DISTILLATION

FOR EASILY SEPARABLE COMPOUNDS

(SIMPLE / FRACTIONAL)

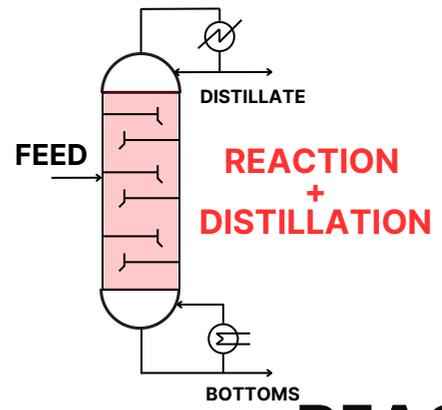


Staged Column

REACTIVE DISTILLATION

FOR PROCESS INTENSIFICATION

Combines chemical reaction and distillation in a single unit, where reaction products are simultaneously separated.



AZEOTROPIC DISTILLATION

FOR AZEOTROPE MIXTURES

Employs an entrainer to break azeotropes, allowing the separation of components with constant boiling mixtures.

