Title : Gas-Liquid Operations

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Lecture No : 1

Source of information : Book: Mass Transfer Operation by Treybal

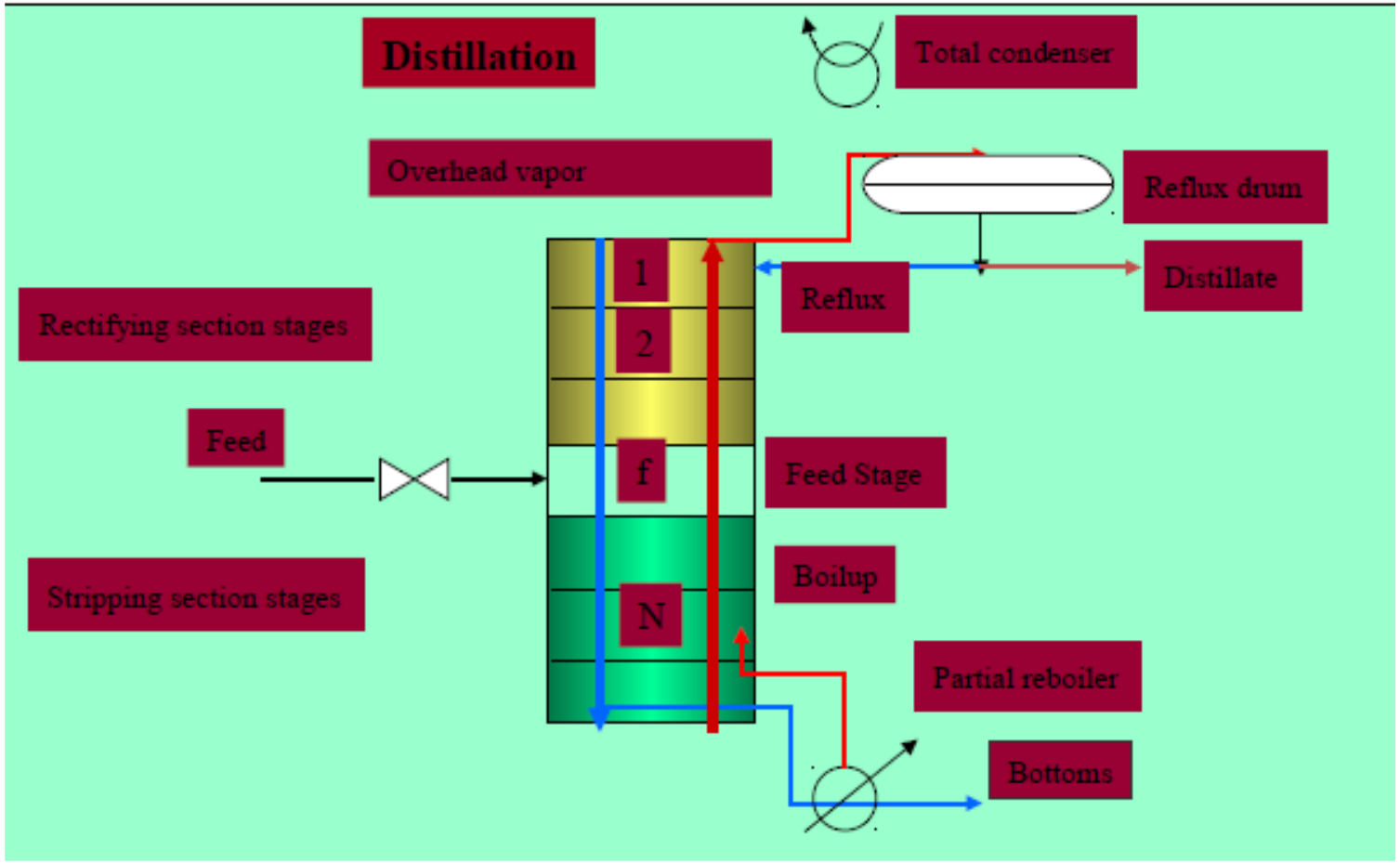
GAS LIQUID OPERATIONS

Gas absorption principles:

Liquid/Gas Absorption operations includes absorption, stripping and desorption soluble vapour absorbed from mixture with a liquid (solute), solute is then regenerated can also have gas absorption with reaction.

- The removal of one or more selected components from a mixture of gases by absorption into a suitable liquid is the second major operation of chemical engineering that is based on interphase mass transfer controlled largely by rates of diffusion.
- Thus, acetone can be recovered from an acetone–air mixture by passing the gas stream into water in which the acetone dissolves while the air passes out.
- Similarly, ammonia may be removed from an ammonia–air mixture by absorption in water.
- In each of these examples the process of absorption of the gas in the liquid may be treated as a physical process, the chemical reaction having no appreciable effect.

VAPOUR LIQUID OPERATIONS



Distillation and V-L Equilibria

Types of Distillation

Action on an Ideal Plate

Mass Balance in a Distillation Column

Determination of Ideal Number of Plates – McCabe–Thiele Analysis

Differential or batch distillation

Flash or equilibrium distillation

Continuous Rectification – Binary systems

Differential distillation:

- The simplest examples of batch distillation at a single stage.
- Starting with a still pot, initially full, heated at a constant rate.
- In this process the vapour formed on boiling the liquid is removed at once from

  the system.
- Since this vapour is richer in the more volatile component, with this result the composition of the product progressively alters.
- Thus, whilst the vapour formed over a short period is in equilibrium with the liquid
- At the end of the process the liquid, which has been vaporized, is removed as the bottom product.

- Let S be the number of mols of material in the still and x be the mol fraction of component A.
- Suppose an amount dS, containing a mol fraction y of A, be vaporised.

Then a material balance on component A gives:

$$ydS = d(Sx)$$

$$= S\,dx + x\,Ds$$

- The integral on then right-hand side can be solved graphically if th equilibrium relationship between y and x is available.
- Thus, if over the range concerned the equilibrium relationship is a straight line of the form $y = m x + c$

- This process consists of only a single stage, a complete separation is impossible unless the relatively volatility is finite.
- Application is restricted to conditions where a preliminary separation is to be followed by a more rigorous distillation, where high purifies is not required, or where the mixture is very easily separated

Assignment-2

- Give examples of Gas-liquid/ Vapour-liquid Operations in mass transfer?
- Explain differential distillation process?
- Give material balance process of differential distillation?

- Hard copy submission date (31/3/2020).
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