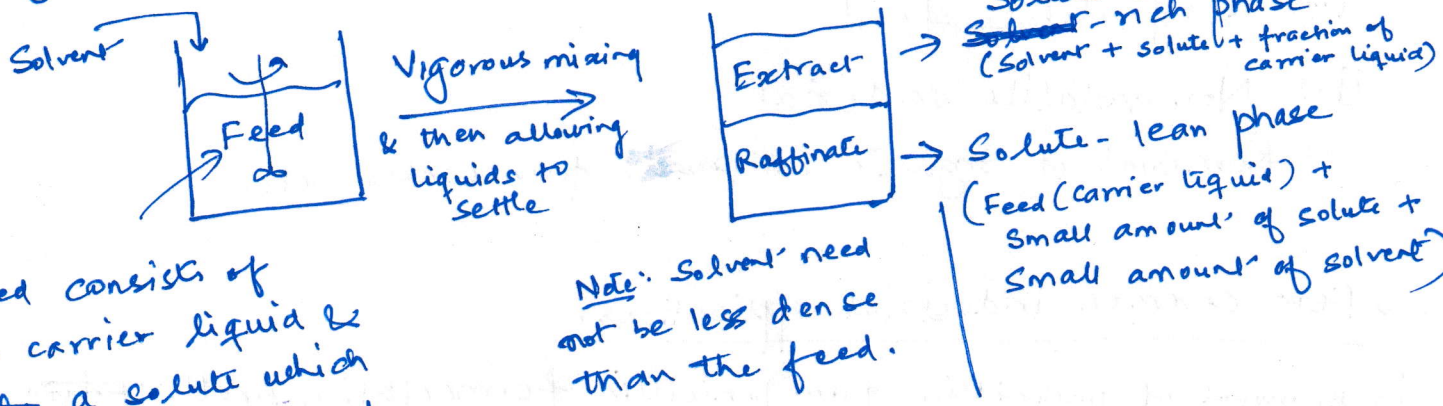
Liquid - Liquid Extraction

- Mass transfer operation in which the feed (liquid) is brought into intimate contact with a second immiscible or slightly miscible liquid to achieve mass transfer of solute from the feed to the solvent.

- For easy separation, the feed & the solvent should differ in density & should not have very low IFT (inter-facial tension) between them.

- A simple view of liquid-liquid extraction (LLE) is given below:

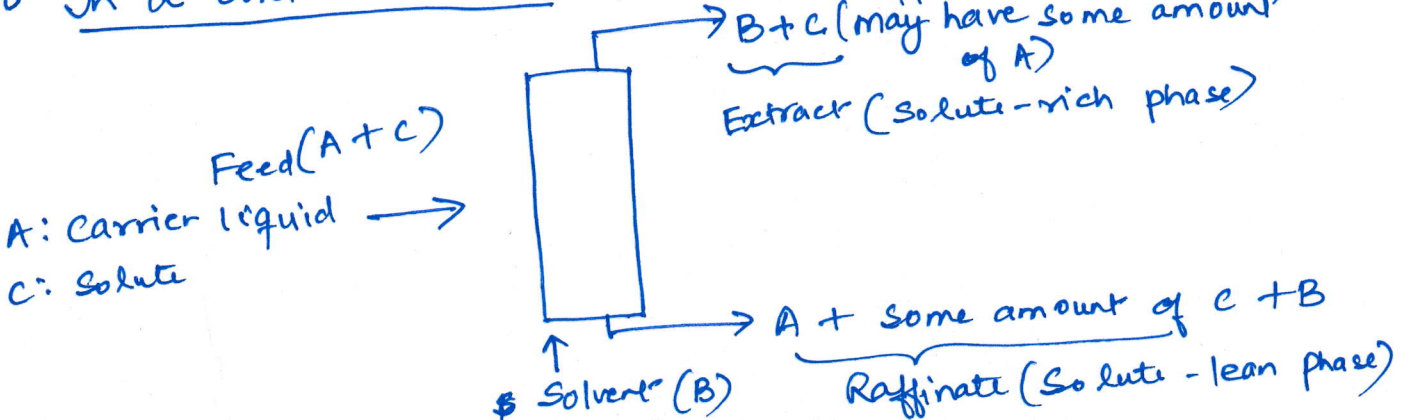


Feed consists of the carrier liquid & a solute which needs to be removed.

Note: Solvent need not be less dense than the feed.

- Note: If the carrier liquid & solvent are partially miscible, then the extract (solute-rich phase) has some amount of carrier liquid also. Similarly, the raffinate (solute-lean phase) has some amount of solvent.

- In a continuous mode: Schematics appears as shown below



- Although LLE is more complex than say distillation & often need a distillation unit to recover solvent from the extract & raffinate, in many cases LLE is preferred. for example:

(i) When components of the mixture being separated have similar boiling points (distillation can not be used in such cases)

(ii) Separation of heat sensitive material

(iii) Very dilute feed

(iv) Non-volatile material

(v) Removal of organic compounds from water, etc.

- Few common industrial applications:

(i) Removal of penicillin from penicillin fermentation broth using n-butyl-acetate

(ii) Removal of BTX (Benzene - Toluene - Xylene) from petroleum fractions using sulpholane.