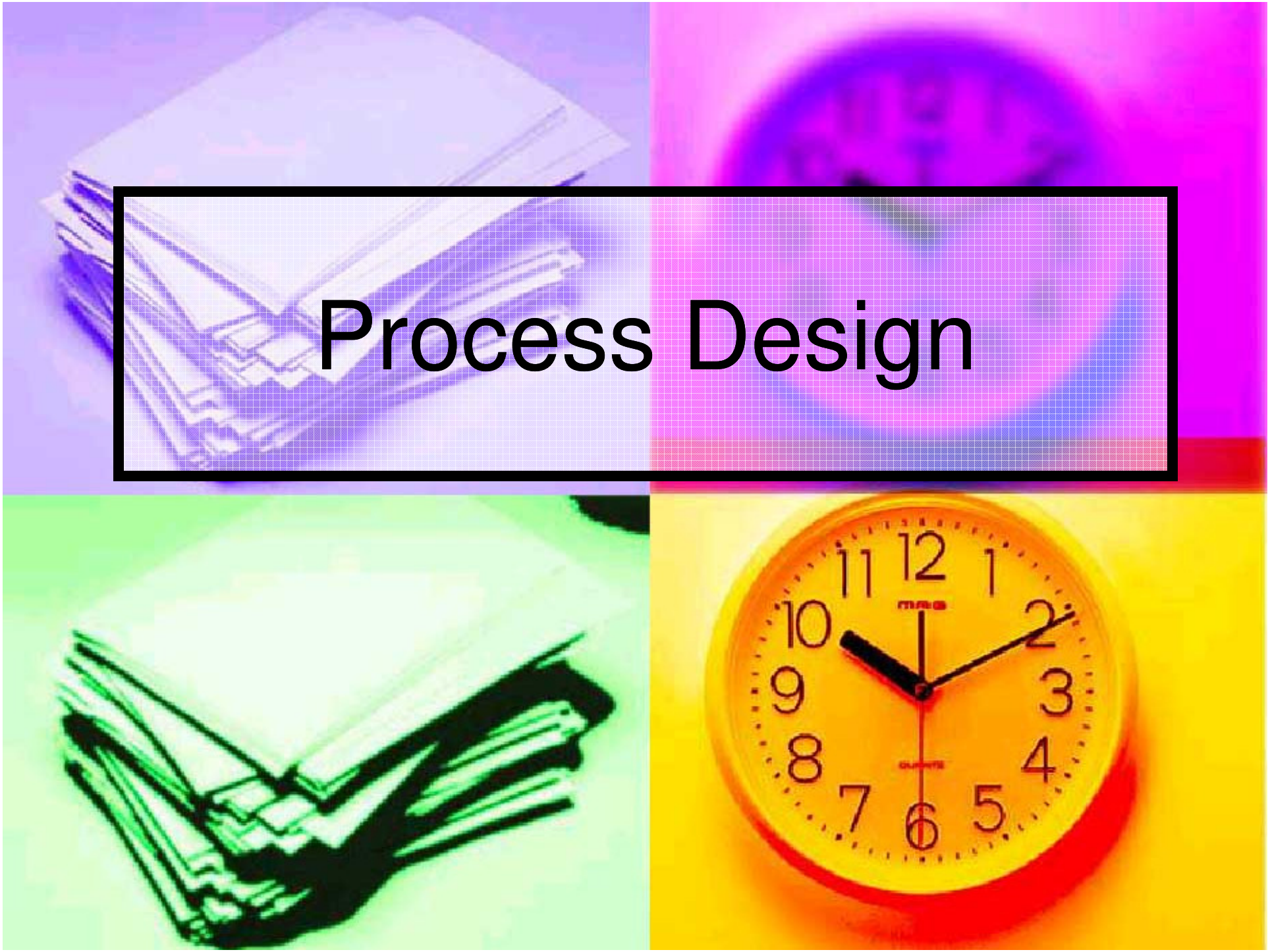
# Process Design



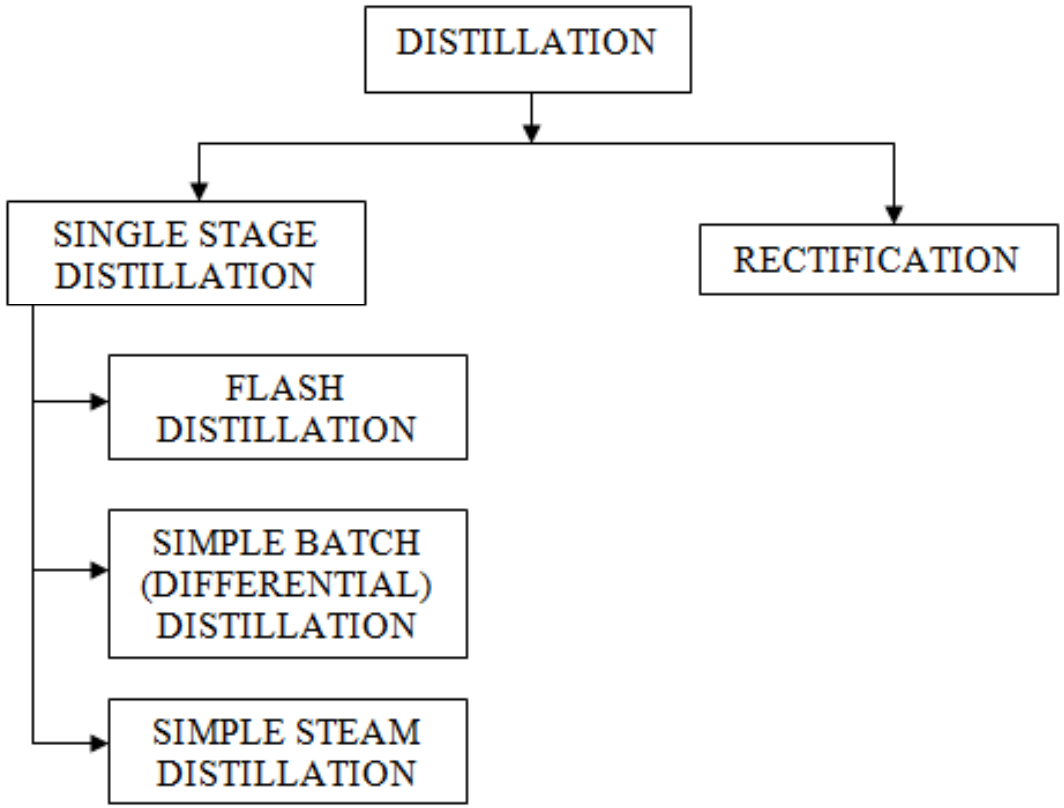
# Distillation

- **Distillation** is a separation process based on differences in volatilities among components of a liquid mixture; the greater the relative volatilities, the easier the separations.

- Distillation depends upon the distribution of these components between a vapor phase and a liquid phase.
- All components of the mixture are present in both phases.

- Distillation is widely used in chemical industry and its main application in food industry is in the production of **ethanol** an alcoholic beverages from fermented liquids.
- Some other food industry applications are the recovery, fractionation and concentration of **volatile aromas** as well as recovery of organic solvents in the production of edible oils by solvent extration and removal of undesirable odorous substances.

- Distillation methods can be categorized into two:
  - Single stage distillation
  - Distillation with reflux (fractional distillation or rectification)

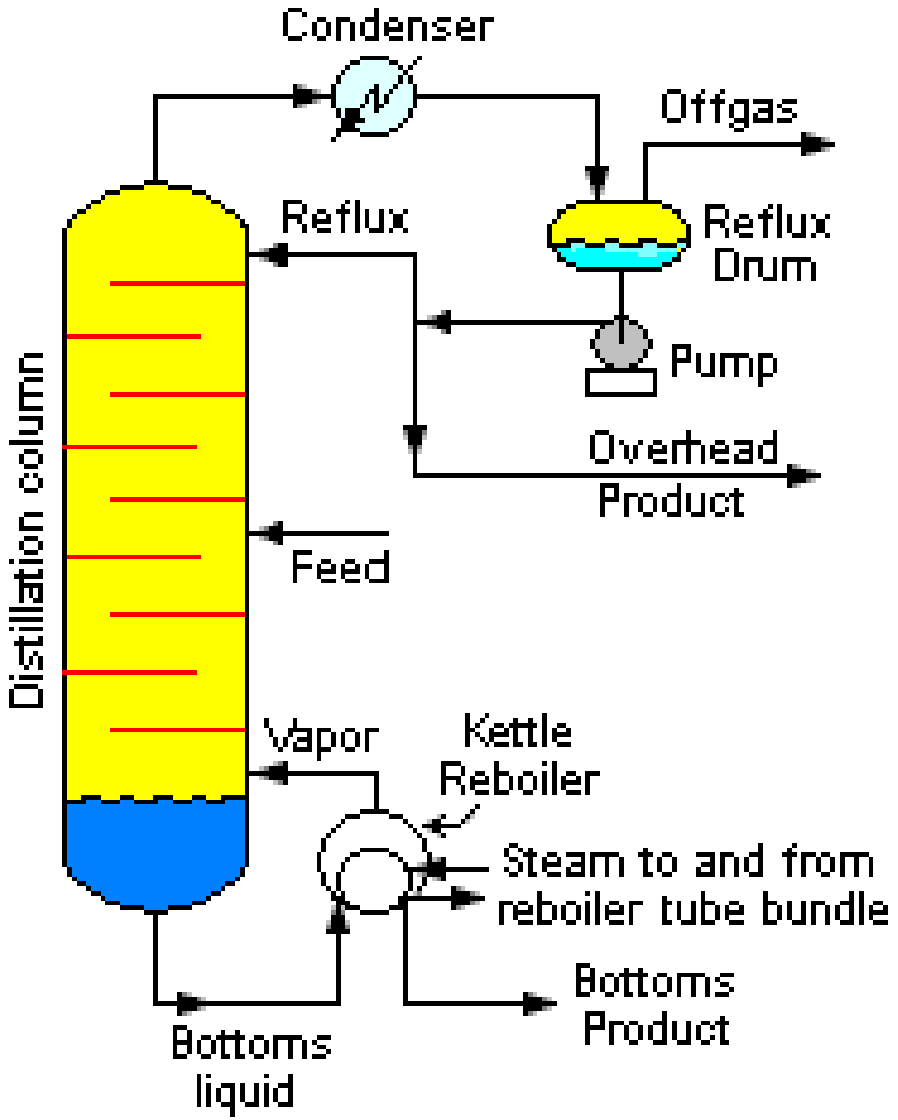

DISTILLATION
SINGLE STAGE DISTILLATION
RECTIFICATION
FLASH DISTILLATION
SIMPLE BATCH (DIFFERENTIAL) DISTILLATION
SIMPLE STEAM DISTILLATION

# Single Stage Distillation

- The vapor is produced by boiling the liquid mixture and recovered by condensing.
- The condensed liquid is not allowed to return to the distiller.

# Distillation with Reflux

- It is also referred as fractional distillation or rectification.
- Distillation with reflux includes a series of stages or trays where the vapor and liquid streams are contacted.
- The final vapor product coming overhead is condensed in a condenser and a portion of the condensate, which is also known as reflux, is returned back to the column.


Condenser
Offgas
Reflux
Reflux Drum
Pump
Overhead Product
Feed
Distillation column
Vapor
Kettle Reboiler
Steam to and from reboiler tube bundle
Bottoms Product
Bottoms liquid