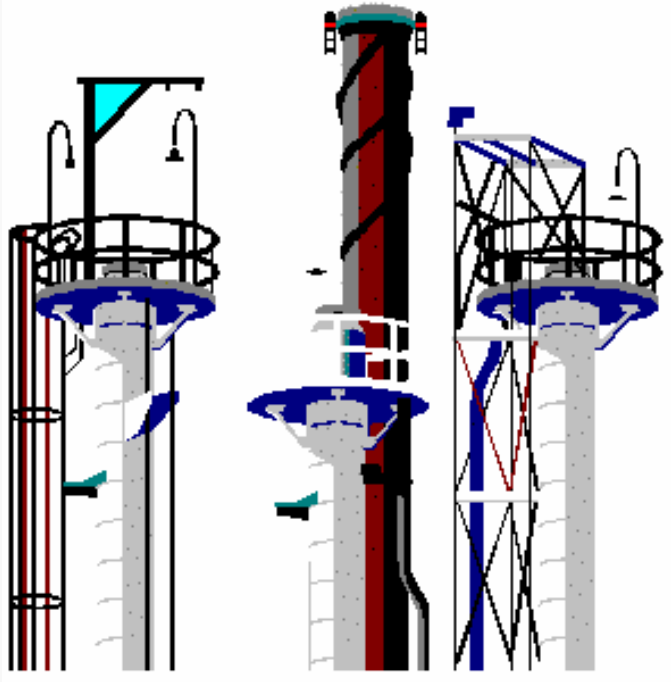
단위조작이란



이 광 남

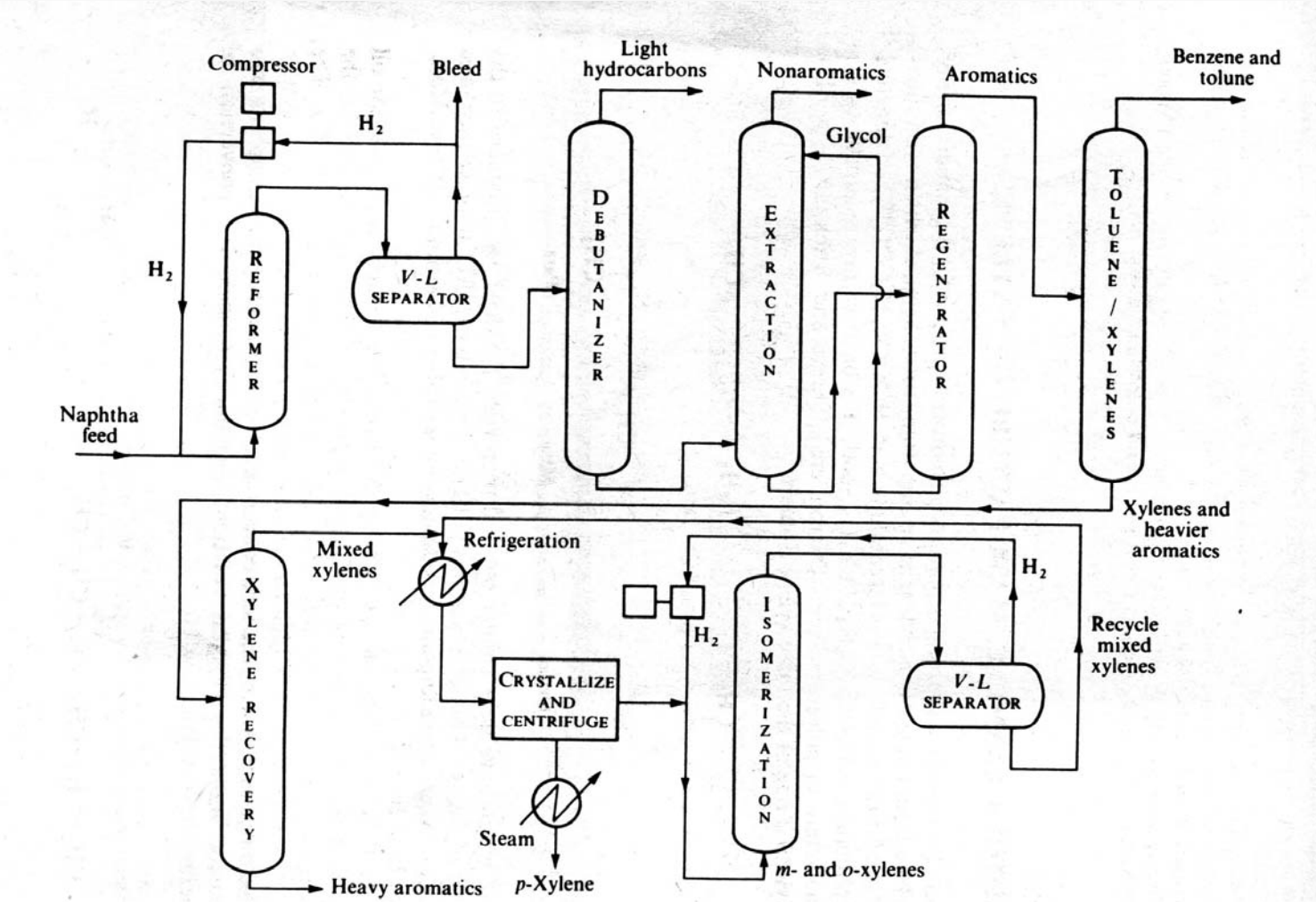
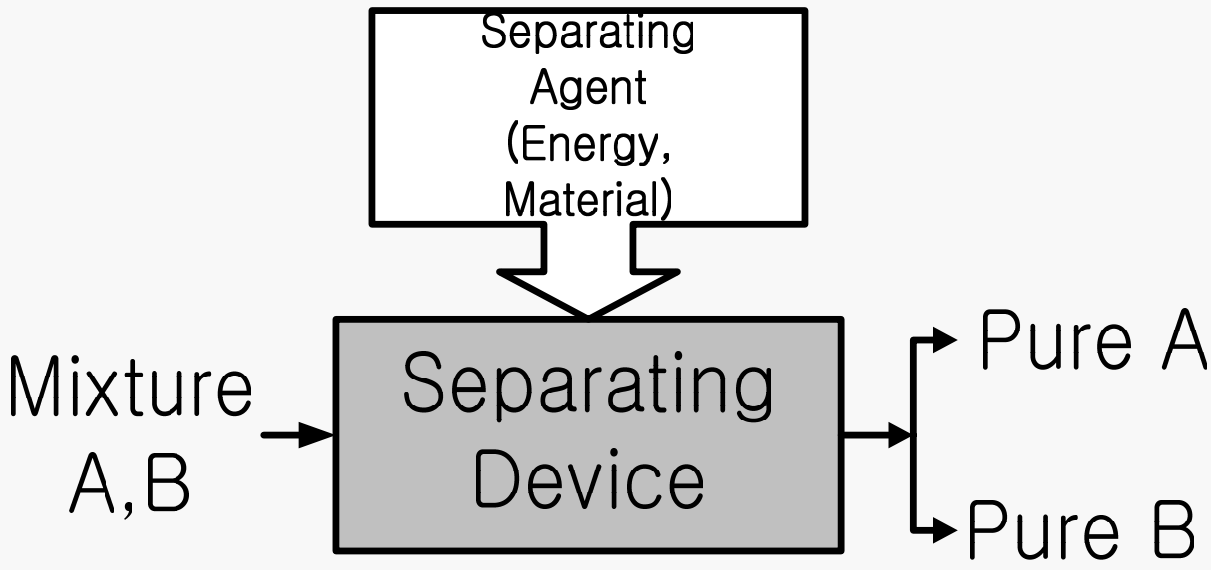


Figure 1-8 Production of *p*-xylene.

Separation


Separating
Agent
(Energy,
Material)
Mixture
A,B
Separating
Device
Pure A
Pure B

Category of separation processes

- **Mechanical (heterogeneous-feed)**
  vs diffusional (homogeneous-feed)
- **Equilibrium vs rate-governed process**
- **Energy-separating-agent**
  vs mass-separating-agent process

Diffusional Separation Process

- **Ordinary equilibrium processes, energy separating agent**

Name	Feed	Practical example
Evaporation	Liquid	Concentration of fruit juices
Distillation	Liquid and/or vapor	crude oil fraction
Crystallization	Liquid	sugar
Drying solids	Moist solid	Food dehydration
Freeze drying	Frozen water containing solids	Food dehydration

Ordinary equilibrium processes, mass separating agent

Name	Principle of separation	Practical example
Stripping	Difference in volatile	Recovery of light H.C from crude oil fraction
Absorption	Preferential solubilities	Removal of CO_2 and H_2S from natural gas by absorption into ethanolamine
Extraction	Different solubility of different species in the two liquid phases	

Leaching	Preferential solubility	Leaching of $CuSO_4$ from calcined ore
Adsorption	Difference in adsorption potentials	Drying gases by solid desiccants
Ion exchange	Law of mass action applied to available anions or cations	Water softening

Rate-governed processes

Name	Principle of separation	Practical example
Dialysis	Different rates of diffusional transport through membrane	Recovery of NaOH in rayon manufacture, artificial kidney
Ultrafilteration	Different permeabilities through membrane	Waste-water treatment, protein concentration
Reverse Osmosis	Different combined solubilities of species in membrane	Seawater desalination

Mechanical separation

Name	Principle of Separation	Practical Example
Centrifuge	Density difference	Recovery of insoluble reaction product
Cyclone	Density difference	Recovery of fludized catalyst fine
Filtration	Size of solid greater than pore size of filter medium	Recovery of slurried catalysts