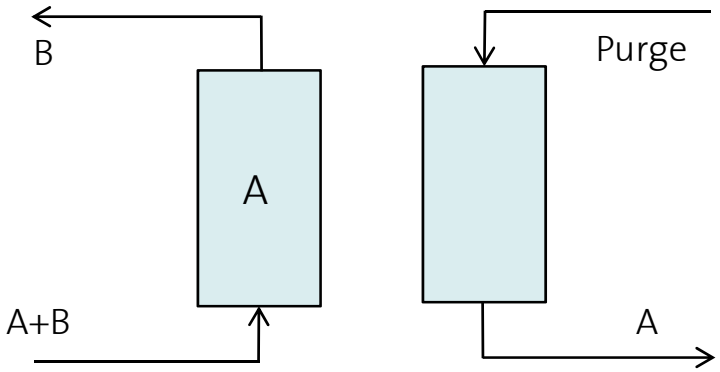
Gas separation - PSA

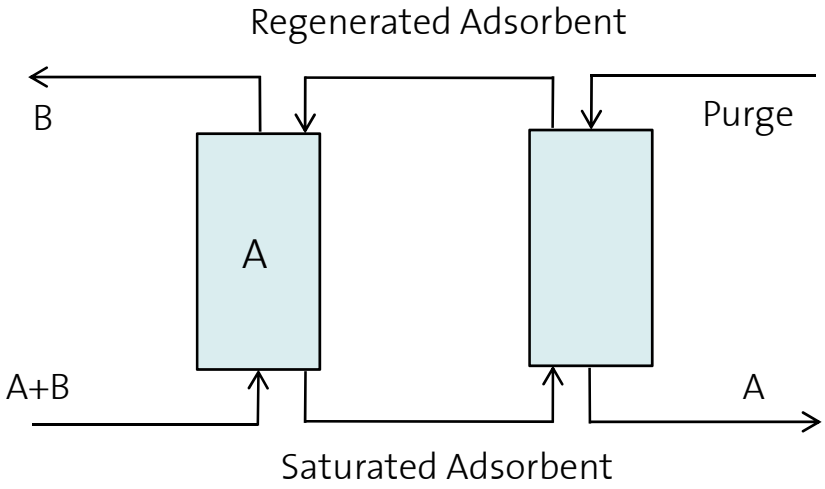
Adsorption separation processes

1. Classification: Process Configuration

a) Cyclic Process (Batch)



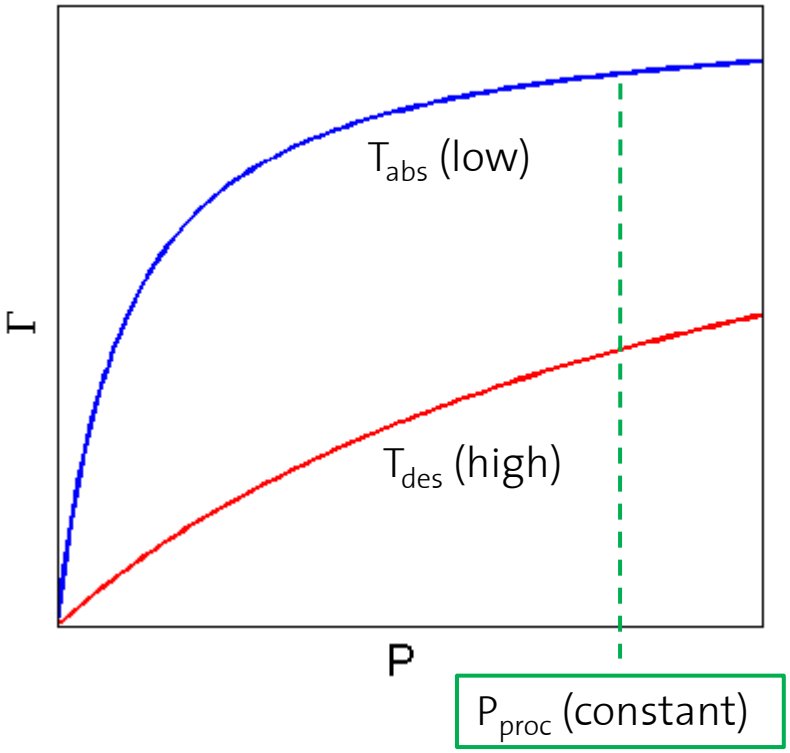
b) Countercurrent Process (Continuous)



Adsorption separation processes

2. Classification: regeneration procedures

a) Thermal swing adsorption (TSA)



⊕
- For strong adsorbed components
- Adsorbate can be recovered at high concentration

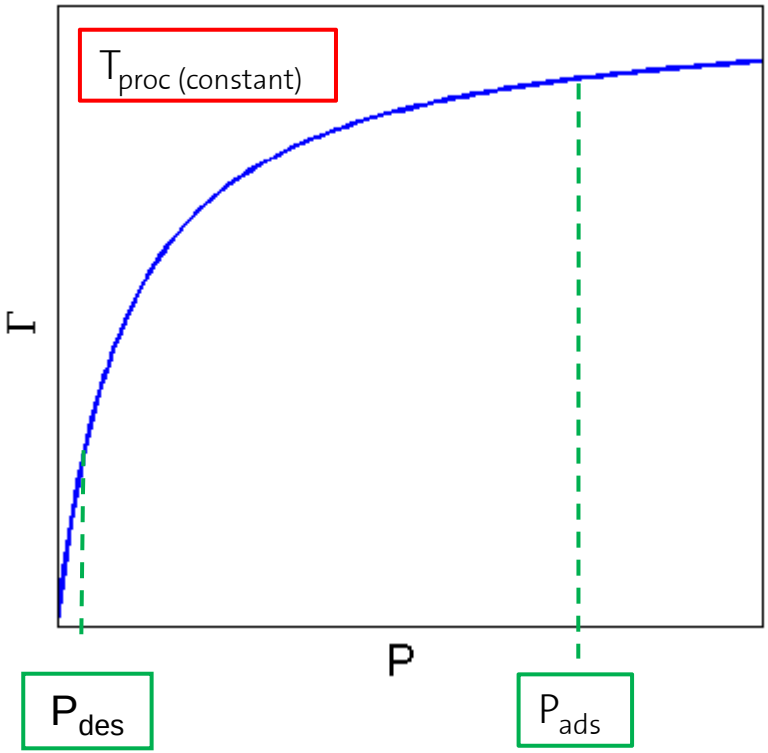
⊖
- No rapid cycles (thermal inertia)
- Thermal aging of the adsorbent

Examples: Gas drying or organic solvent drying

Adsorption separation processes

2. Classification: regeneration procedures

b) Pressure swing adsorption (PSA)



⊕
- Rapid cycles
- The weak adsorbents can be produced at high concentration

⊖
- Mechanical energy is expensive
- Vacuum may be needed

Examples: recovery and purification of H_2, air separation

Adsorption separation processes

2. Classification: regeneration procedures

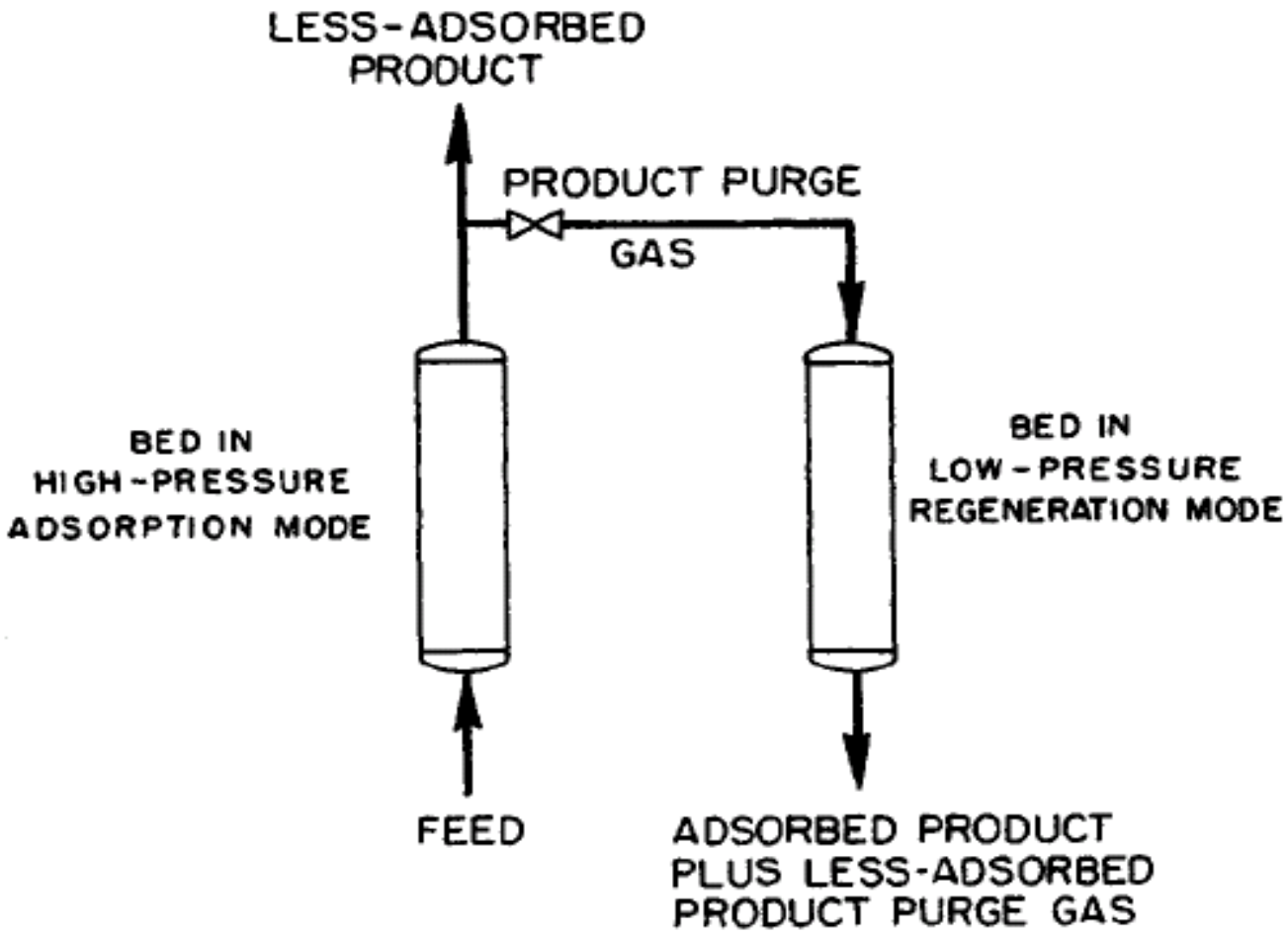
c) Purge gas stripping (non absorbable desorbent)

- Useful for weakly absorbable species (gas or liquid)
- Adsorbate obtained at low concentration
- Solvent recovery needed

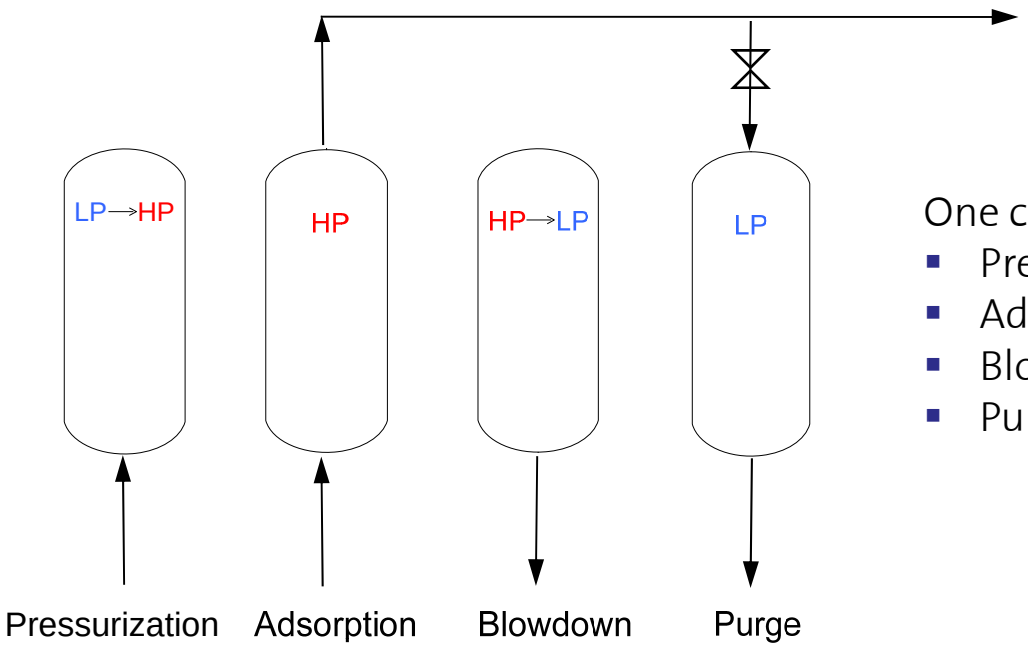
d) Displacement desorption (absorbable desorbent)

- For strongly absorbable components
- Adsorbate obtained at high concentration
- Solvent recovery needed

Pressure swing adsorption

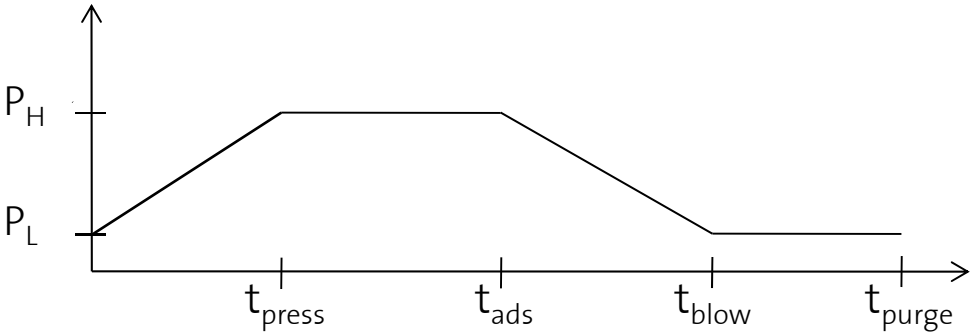


PSA (pressure swing adsortion)



One column is running in four different modes:

- Pressurization
- Adsorbtion (product is produced)
- Blowdown
- Purge



Pressure profile against time for the four different steps

Skarstrom Cycle