Basis of Sustainable Environmental Systems
HSLU, Semester 3

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Contents

Part I

TODO ops

i'll do it later don't worry

Part II

Separation techniques

1 A bit of chem again

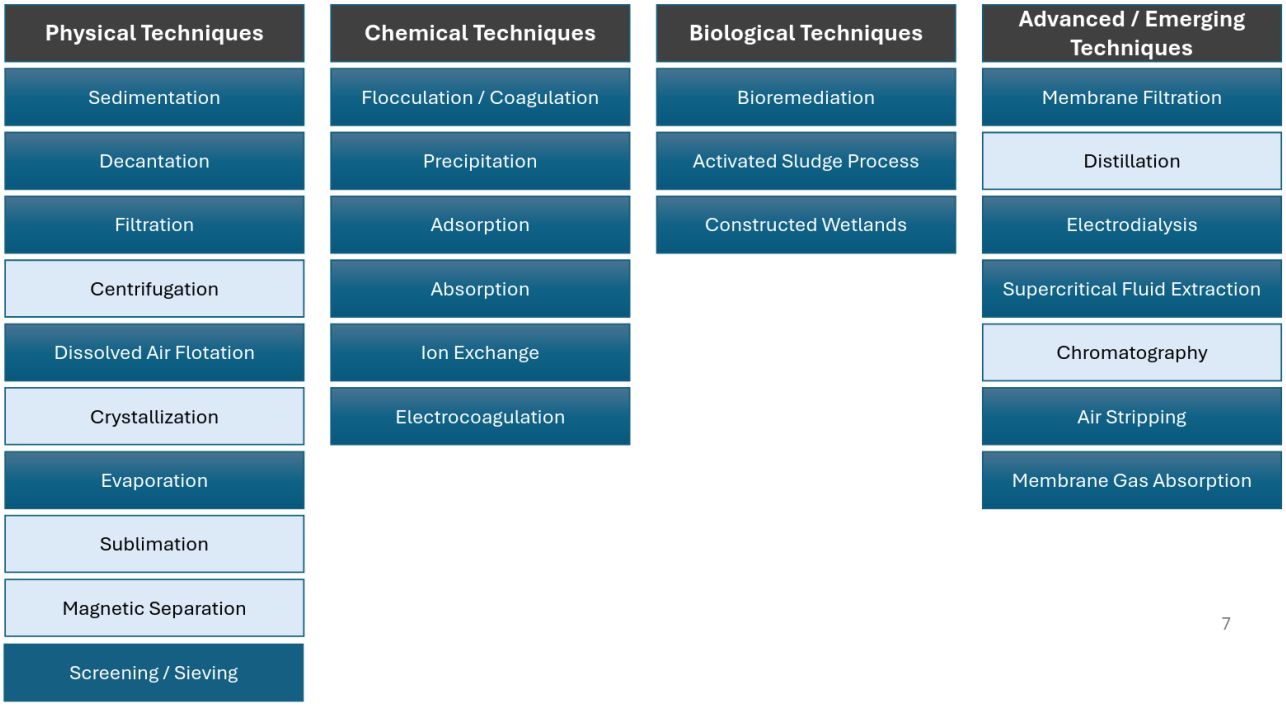
1.1 Solutions key terms

- **Solvent**: the substance that dissolves another substance
- **Solute**: the substance that is dissolved in a solvent
- **Solution**: it's a homogeneous mixture of two or more substances

What it is needed?

- Identify the substances to be separated from the mixture
- To collect useful substances free from impurities
- To remove unwanted particles

1.2 Classification of techniques



Separation techniques overview

2 Physical separation

2.1 Sedimentation

2.2 Decantation

2.3 Filtration

2.3.1 Sand filtration

2.3.2 Reverse osmosis

2.4 Centrifugation

2.5 Dissolved Air Flotation (DAF)

2.6 Magnetic separation

2.7 Screening and Sieving

3 Chemical separation

3.1 Flocculation

3.1.1 Flocculant

3.1.2 Coagulation

3.2 Electrocoagulation

3.3 Precipitation

3.4 Adsorbtion

3.4.1 Activated carbon

3.5 Absorption

3.5.1 Wet scrubber

3.6 Ion exchange

3.7 Crystallization

3.8 Evaporation

3.9 Sublimation

4 Advanced/Emerging separation

4.1 Mebrane filtration

4.1.1 Micro osmosis

4.1.2 Nano osmosis

4.1.3 Ultra osmosis

4.1.4 Reverse osmosis

4.2 Electrodialysis

4.3 Extraction

4.3.1 Liquid-Liquid Extraction (LLE)

4.3.2 Soxhlet extraction

4.3.3 Supercritical Fluid Extraction

4.4 Air stripping

Same as Wet Scrubber, but with water

4.5 Electrostatic precipitator (ESP)

5 Biological separation

5.1 Bioremediation

- Miicroorganisms degrade hazardous substances
- Useful for oil spills, soil remediation

5.2 Activated Sludge Process

- Aerobic digestion of organic matter
- Common in sewage treatment
- A parameter to monitor is the BOD (Biochemical Oxygen Demand) and COD (Chemical Oxygen Demand)
- Nitrification and Denitrification

5.3 Constructed Wetlands

- Mimics natural wetlands to treat wastewater
- Sustainable and low-maintenance
- Three types
- It takes 1-4 weeks to treat the water

Part III

Ecological sanitation

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6 Some principles of Sanitation

7 Objectives of ecological sanitation

- Provide affordable, hygenically safe, and desirable sanitary facilites
- Reduce the health risks related to sanitation, contaminated water an waste
- Prevent the pollution of surface and groundwater; precenti the degradation of soil fertility
- Optimise the management of nutrients and water resources

8 Principle of treatments and recycling

9 Wastewater management

9.1 Issues with current wastewater management (Linear End-of-Pipe Technology)

9.1.1 Poor treatment or uncontrolled discharge

9.1.2 High water use

9.1.3 Costly systems

9.1.4 Unequal service

9.1.5 Resource loss

9.1.6 Sewage sludge issues

9.2 Benefits of Material Flow Cycle (Instead of Disposal)

9.2.1 Better health

9.2.2 Resource recovery

9.2.3 Soil and crop benefits

9.2.4 Resource efficiency

9.2.5 Smarter systems

9.2.6 Holistic approach

10 Separation of substances