

GK-Ind-notes-27march

(The terms marked in in red are in your course. Last week I sent Filtration and centrifugation, this week I am sending Solvent extraction, and ultrafiltration)

Downstream processing operations

Downstream processing operations is divided into four groups which are applied in order to bring a product from its natural state as a component of a tissue, cell or fermentation broth through progressive improvements in purity and concentration.

1. **Removal of insolubles** is the first step and involves the separation of cells, cell debris or other particulate matter from fermentation broth.

Typical operations to achieve this are **filtration**, **centrifugation**, sedimentation, precipitation, flocculation, electro-precipitation, and gravity settling.

2. **Product isolation** is the removal of those components whose properties vary considerably from that of the desired product. For most products, water is the chief impurity and isolation steps are designed to remove most of it, reducing the volume of material to be handled and concentrating the product. **Solvent extraction**, adsorption, **ultrafiltration**, and **precipitation** are some of the unit operations involved.

3. **Product purification** is done to separate those contaminants that resemble the product very closely in physical and chemical properties. Consequently steps in this stage are expensive to carry out and require sensitive and sophisticated equipment.

Examples reversed phase chromatography, ion-exchange chromatography, crystallization and fractional precipitation.

4. **Product polishing** describes the final processing steps which end with packaging of the product in a form that is stable, easily transportable and convenient.

Crystallization, desiccation, **lyophilization** and **spray drying** are typical unit operations.

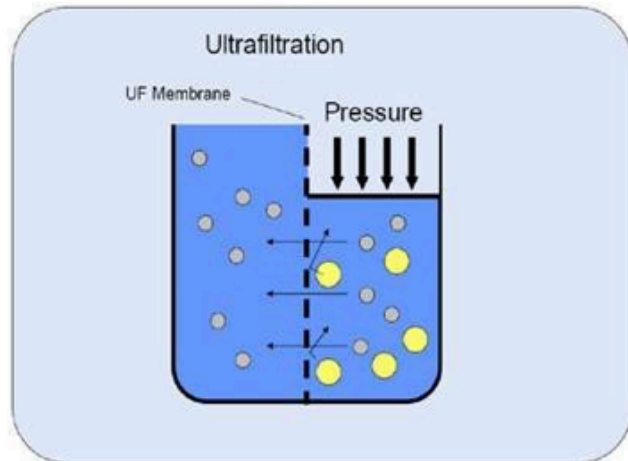
Product Isolation

- Removal of those components whose properties vary markedly from that of the desired product.
- Water is the chief impurity
 - a) Isolation steps are designed to remove it (i.e.dialysis)
 - b) Reducing the volume
 - c) Concentrating the product.
 - d) Solvent extraction, adsorption, ultrafiltration, and precipitation are some of the unit operations involved.

Solvent extraction

- It is a separation process that takes the advantage of the relative solubilities of solute in immiscible solvents.
- Solute is dissolved more readily and becomes more concentrated in the solvent in which it has a higher solubility.
- A partial separation occurs when a number of solutes have different relative solubilities in the two solvents used.
- Solvent should be non toxic, selective, inexpensive and immiscible with broth and should have a high distribution coefficient for the product.

Ultrafiltration



It is basically a pressure-driven separation process.

The operating pressure is usually between 0.1 and 1 MPa.

Ultrafiltration

- UF is governed by a screening principle and dependent on particle size.
- UF membranes have a pore size between 1 nm and 100 nm, thus allowing retention of compounds with a molecular weight of 300 to 500 000 Dalton.
- Typically, the process is suitable for retaining biomolecules, bacteria, viruses, polymers, colloidal particles and sugar molecules.

Ultrafiltration

