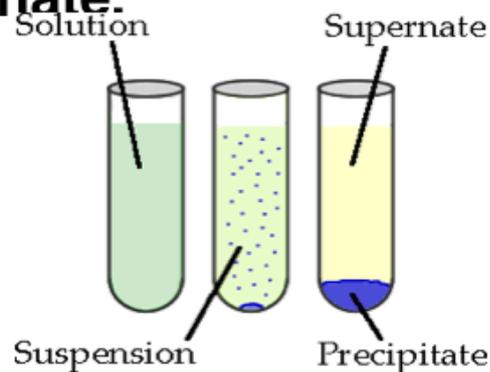


Last week I sent few downstream processes i.e product isolation, solvent extraction and Ultrafiltration. This week I am sending the remaining processes i.e precipitation, spray drying and lyophilisation.

Precipitation

- Formation of a solid in a solution during a chemical reaction.
- Solid formed is called the **precipitate** and the liquid remaining above the solid is called the **supernate**.



Precipitation

- Salts such as ammonium & sodium sulphate are used for proteins to precipitate.
- Organic solvents methanol used to precipitate dextrans.
- Chilled ethanol and acetone used for protein precipitation.
- Non ionic polymer such as polyethylene glycol used in precipitation.

Precipitation:

Precipitation is the most commonly used technique in industry for the concentration of macromolecules such as proteins and polysaccharides. Further, precipitation technique can also be employed for the removal of certain unwanted byproducts e.g. nucleic acids, pigments.

Neutral salts, organic solvents, high molecular weight polymers (ionic or non-ionic), besides alteration in temperature and pH are used in precipitation. Neutral salts:

The most commonly used salt is ammonium sulfate, since it is highly soluble, non-toxic to proteins and low-priced. Ammonium sulfate increases hydrophobic interactions between protein molecules that result in their precipitation. The precipitation of proteins is dependent on several factors such as protein concentration, pH and temperature.

Organic solvents:

Ethanol, acetone and propanol are the commonly used organic solvents for protein precipitation. Since proteins are denatured by organic solvents, the precipitation process has to be carried out below 0°C.

Non-ionic polymers:

Polyethylene glycol (PEG) is a high molecular weight non-ionic polymer that can precipitate proteins. It reduces the quantity of water available for protein solvation and precipitates protein. PEG does not denature proteins, besides being non-toxic.

Ionic polymers:

The charged polymers such as polyacrylic acid and polyethyleneimine are used. They form complexes with oppositely charged protein molecules that causes charge neutralisation and precipitation.

Increase in temperature:

The heat sensitive proteins can be precipitated by increasing the temperature.

Spray drying

Spray drying is used for drying large volumes of liquids. In spray drying, small droplets of liquid containing the product are passed through a nozzle directing it over a stream of hot gas. The water evaporates and the solid particles are left behind

Freeze-drying or lyophilization

Freeze-drying or lyophilization is the most preferred method for drying and formulation of a wide-range of products—pharmaceuticals, foodstuffs, diagnostics, bacteria, viruses. This is mainly because freeze-drying usually does not cause loss of biological activity of the desired product.

Lyophilization is based on the principle of sublimation of a liquid from a frozen state. In the actual technique, the liquid containing the product is frozen and then dried in a freeze-dryer under vacuum. The vacuum can now be released and the product containing vials can be sealed e.g., penicillin can be freeze dried directly.

lyophilization

- freezing the material
- reducing the surrounding pressure and adding enough heat to allow the frozen water in the material to sublime directly from the solid phase to gas.

Industrial and Environmental Microbiology Theory Assignment 1

Q1. What are downstream processes?

Q2. Explain any one such process in 2-3 lines.

Answer them handwritten on a page with your name and roll no. clearly written on top right of page. Mail It to me in two days (i.e by **6th April**, evening) on my email ID- gurjeet.kk@gmail.com

It is compulsory and very important. You may be marked for this assignment