Instrumental Technique:

Freeze Dryer

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Lyophilization or freeze drying is a process in which water is removed from a product after it is frozen and placed under a vacuum, allowing the ice to change directly from solid to vapor without passing through a liquid phase (sublimation).

Freeze Drying is the process of removing moisture from a frozen product using vacuum.

History

The process of freeze-drying was invented in 1906 by Arsène d'Arsonval and his assistant Frédéric Bordas at the laboratory of biophysics of Collège de France in Paris.
In 1911 Downey Harris and Shackle developed the freeze-drying method of preserving live rabies virus which eventually led to development of the first antirabies vaccine.
Freeze drying was first actively developed during WORLD WAR II transport of serum. The main aim was to store the products without refrigeration and to remove moisture from thermolabile compounds.
Shortly thereafter, the freeze-dry process was applied to penicillin and bone, and lyophilization became recognized as an important technique for preservation of biologicals.
Atlas in 1961 built 6 production freeze drying cabinet for Nestle group in Germany, Holland.

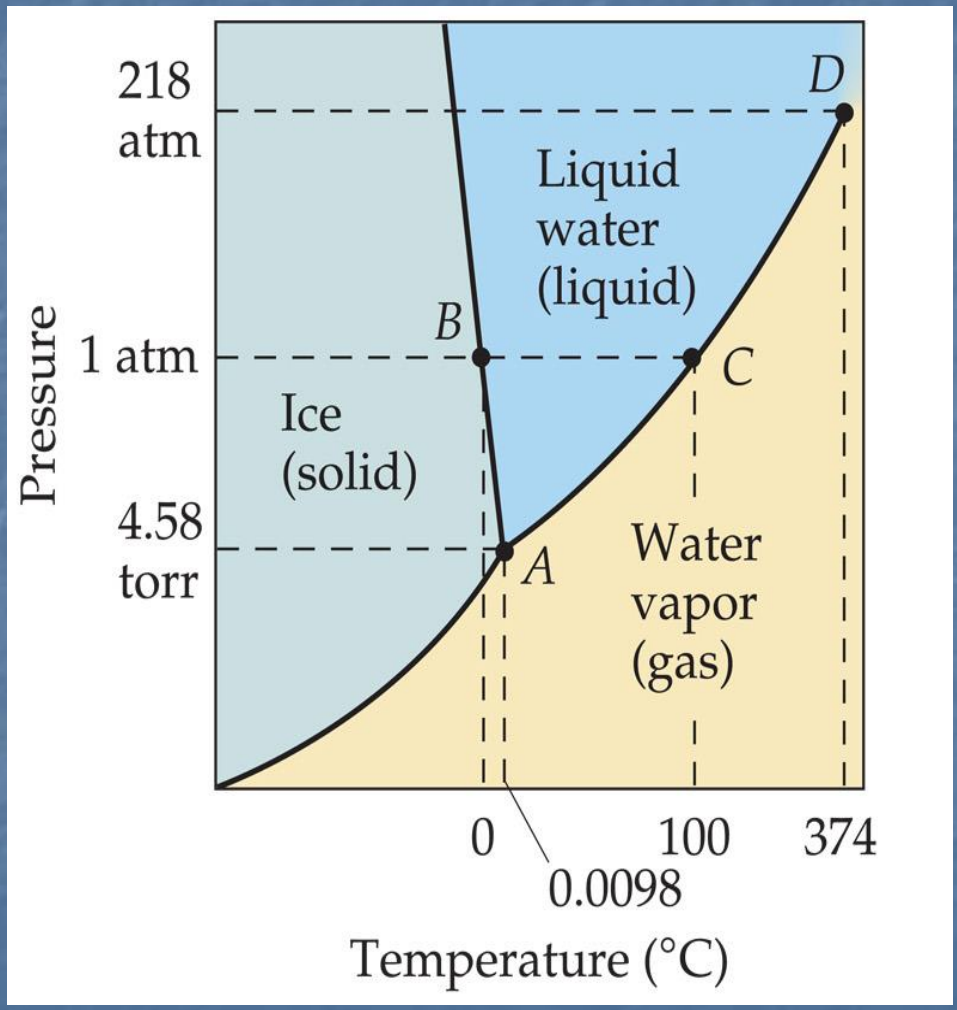
Theoretical Basis of Freeze Drying

- Lyophilization is carried out using a simple principle of physics sublimation. Sublimation is the transition of a substance from the solid to the vapour state, without first passing through an intermediate liquid phase.

- Lyophilization is performed at temperature and pressure conditions below the triple point, to enable sublimation of ice.

- The entire process is performed at low temperature and pressure by applying vacuum, hence is suited for drying of thermolabile compounds.

- The concentration gradient of water vapour between the drying front and condenser is the driving force for removal of water during lyophilization.



Basic components of a Freeze dryer

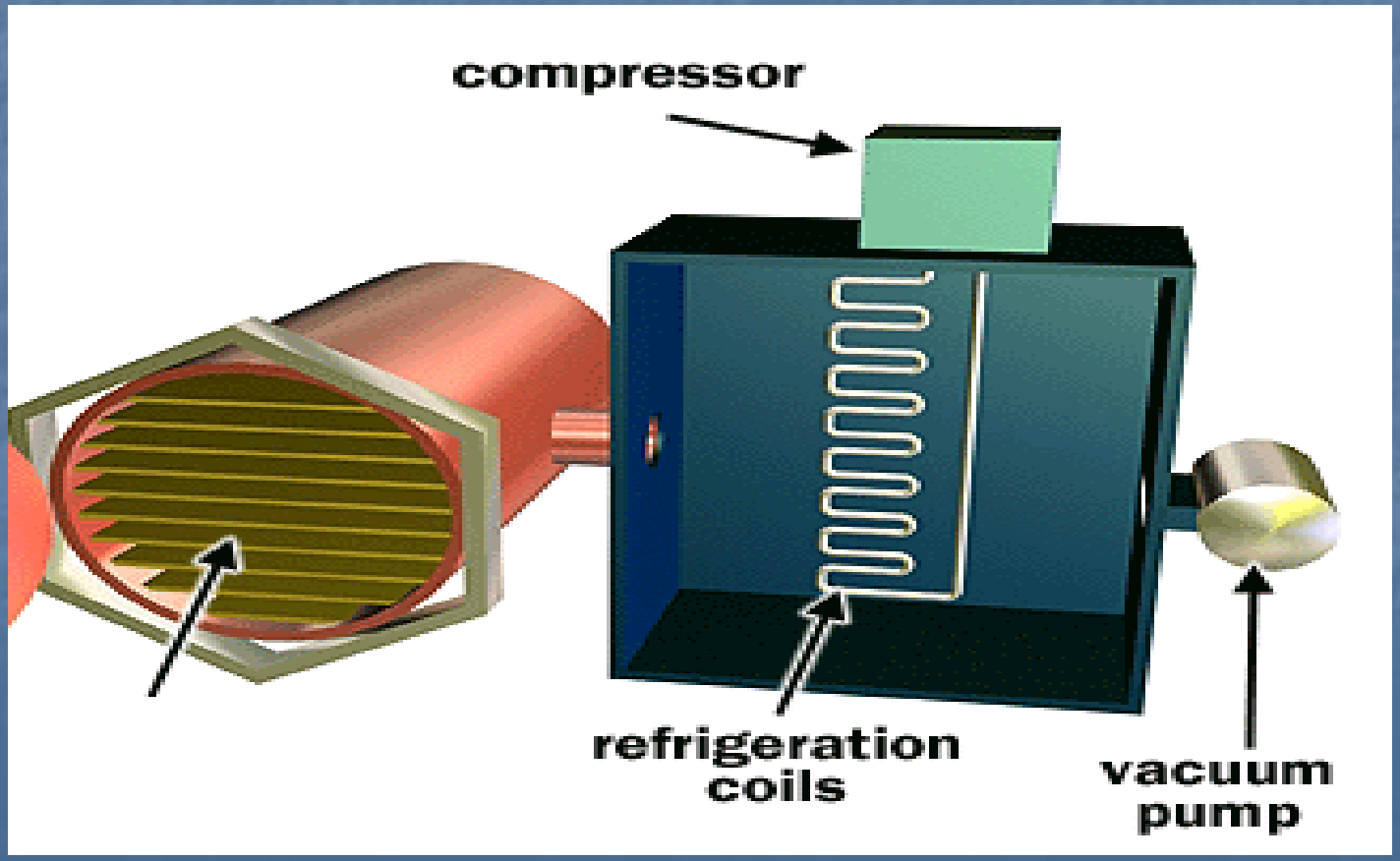
FREEZING STAGE

PRIMARY DRYING STAGE(Sublimation)

PACKING

Construction and main components of freeze dryer:

1. Vessel, shelves, trays and vapor condenser:
2. Refrigeration compressor
3. Vacuum pump



Applications:





- **Pharmaceutical and biotechnology**
- **Food and agriculture-based industries**
- **Technological industry**
- **Laboratory purpose**

Advantage of Freeze-drying Technology:

Longer preservation time:
Freeze dried food material has a longer preservation time than frozen food, canned food and oven drying
Freeze Drying preserves the integrity of the **product's biological and chemical structure and activity.**
Retain flavor, color, shape
No damage to the nutrition
Retain biological activity

Disadvantages:

One of the main disadvantages of freeze drying is the expense and time taken.


THANK
YOU