

Module 6 Freeze drying

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Freeze Drying

- The removal of water from a substance by direct sublimation from the frozen state to the vapour state is known as freeze drying. In this method, the water present in the product is not passed as liquid.
- Water vapour pressure gradient between the surroundings and ice within the material is maintained to cause sublimation.
- The direct sublimation of ice thermodynamically takes place below the “triple point” of water. The triple point of water lies at 0 °C and 4.59 mm of mercury, at this point the three phases of water viz. solid ice, liquid water and water vapour coexist at equilibrium.
- Below this point, the water vapour pressure of liquid water is more than ice. This results in direct sublimation.

In a freeze drying systems, dehydration takes place in three stages. First, the water of product is removed by formation of ice crystals.

These ice crystals later on removed from the body of material by sublimation. After removal of all the ice, the food may contain small amount of water which may be removed by evaporation in the freeze dryer.

In freeze drying system, the size and shape of original food product can be retained and the shrinkage, which is a problem with other drying system is negligible in freeze drying.

Also, the migration of soluble solids is limited. The losses due to the heat damage is minimized in freeze drying system. Freeze drying usually provides good retention of trace volatile flavour and aroma compounds present in the food.

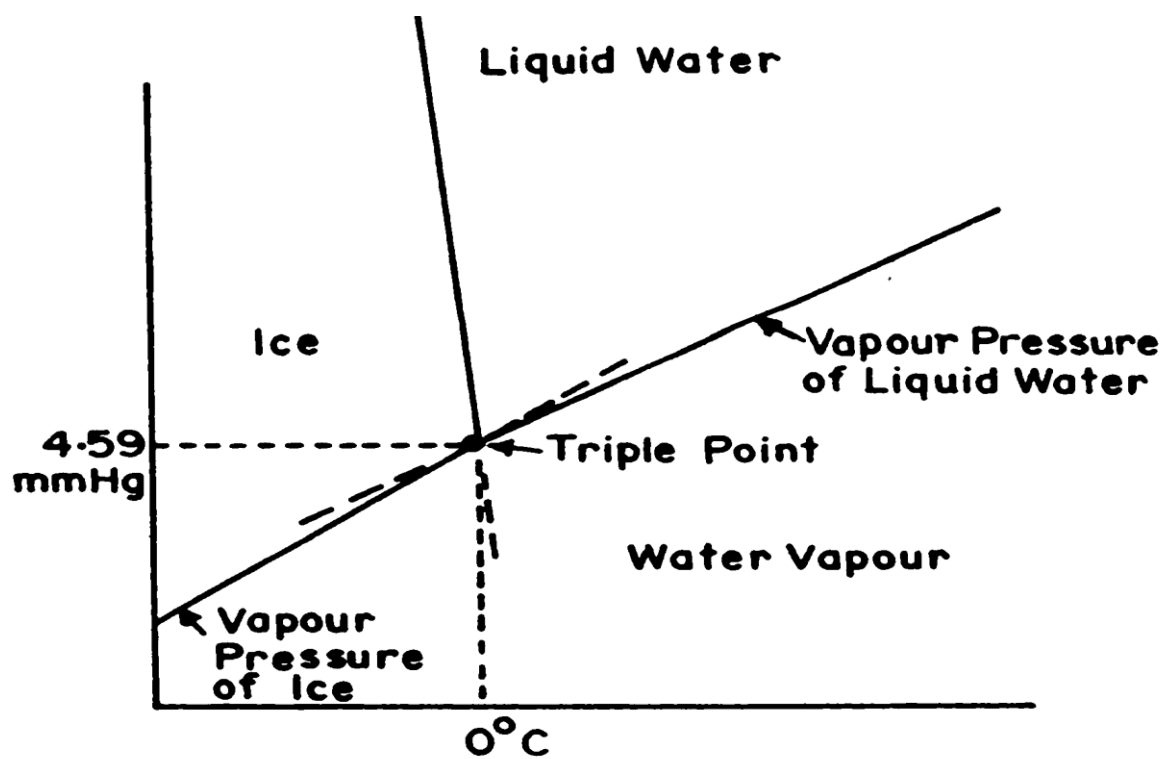


Fig. Water-liquid-solid phase diagram

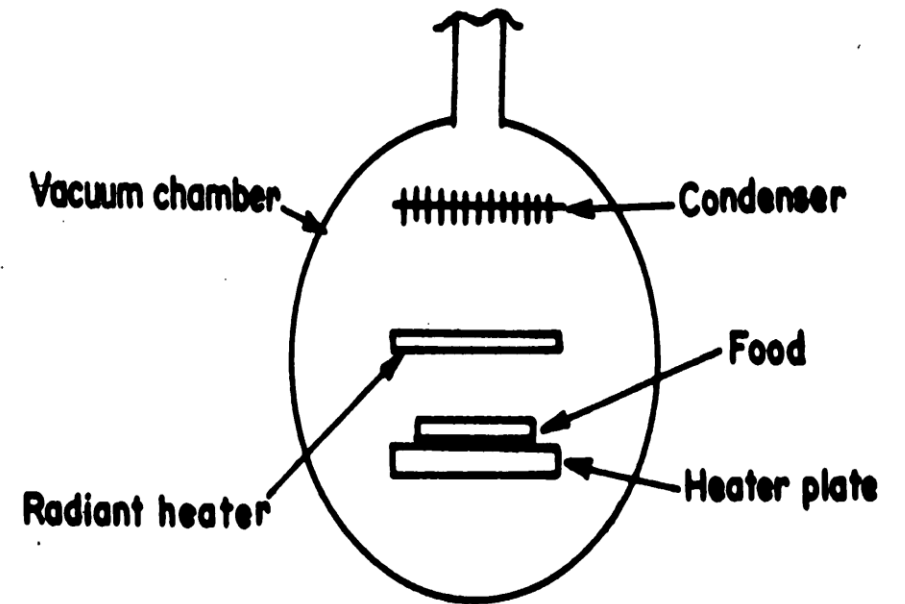


Fig. Schematic diagram of a vacuum freeze drying system

- The operation of freeze drying is carried out at low pressure, usually at 50 N/m^2 . The heat is supplied either by radiation or conduction from hot surfaces. The sublimated moisture condenses on the refrigerated coil located at other end of dryer.
- In conventional freeze dryers, condenser is provided to remove the water vapour formed during the process and a heating system to provide the necessary latent heat of sublimation to the frozen product.

Thank you