



FACULTY OF ENGINEERING & TECHNOLOGY

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2. Preservation of food by FREEZING

Freezing is the unit operation in which the temperature of a food is reduced below its freezing point and a proportion of the water undergoes a change in state to form ice crystals. Freezing process is a combination of the beneficial effects of low temperature at which micro-organisms cannot grow, chemical changes are reduced and cellular metabolic reactions are delayed.

Theory of freezing

- Sensible heat is first removed to lower the temperature of food to the freezing point.
- Heat produced by respiration in case of fresh foods (fruits and vegetables) is also removed.
- Then latent heat of crystallisation is removed to form ice crystals.
- The latent heat of crystallisation of other components of food (e.g., fats) is also removed.

Freezing techniques

- Plate Freezing: Product is pressed between hollow metal plates, either horizontally or vertically with a refrigerant circulating inside plates.

- Immersion Freezing: Food can be frozen rapidly by direct immersion in liquid such as brine, syrup, glycerol, etc. at low temperature (-18 °C).
- Cabinet Freezing: Cold air is circulated in a cabinet where product is placed on a tray.
- Air Blast Freezing: Refers to vigorous circulation of cold air in order to freeze the product. Air temperature is approx.-18 to -34 °C.
- Fluidized-Bed Freezing: Air is forced upward through perforated belt to partially lift or suspend particles.
- Tunnel Freezing: Product on trays are placed in racks or trolleys and frozen with cold air circulation inside the tunnel.

Novel methods of freezing

- High Pressure Freezing: Use of high pressure promotes uniform and rapid ice nucleation thus produces smaller crystals.
- Dehydrofreezing: Food is dehydrated to a desirable moisture and then frozen. It has the advantage of less damage to plant texture.

Changes during freezing

- Loss in texture is the main problem that occur during freezing. Water in inter cellular spaces of fruits and vegetables freezes and ice-crystals are formed which cause adjacent cell walls to rupture.
- Freezing causes negligible change to pigments, flavours or nutritionally important components, although these may be lost in preparation procedures.
- Freezing causes death of 10% to 60% of the microbe population and the %age gradually increases during frozen storage.

Advantages of Freezing

- Many foods can be frozen.
- Good natural color, flavor and nutritive value can be retained.
- Texture usually better than for other methods of food preservation.
- Foods can be frozen in less time than they can be dried or canned.
- Simple procedures.
- Adds convenience to food preparation.

Disadvantages of Freezing

- Texture of some foods is undesirable because of changes due to the freezing process.
- Initial investment and cost of maintaining a freezer is high.
- Storage space is limited by how much the freezer will hold.