Methods of Preservation
Low Temperature
Causes of Food Spoilage

• Spoilage of foods results in physical and chemical changes that may render the food inedible or hazardous to eat

• Causes of food spoilage:
  – Growth of microorganisms
  – Action of enzymes that normally occur in the food
  – Non-enzymatic reactions such as oxidation, damage from insects, rodents, mechanical damages
Spoilage by microorganisms

- Molds commonly occurring on jams, jellies, meats, milk, protein foods, fruits and vegetables, require less moisture than yeasts and bacteria
- *Aspergillus flavus*, growing on cereals, and peanuts have been found to produce toxins that cause illness and death in animals
- Yeasts ferment fruits, fruit juices, syrups, honey, molasses, ketchup and sauces and are considered undesirable
- Foods of low acid content are difficult to preserve because bacteria and their spores are very resistant to destruction
Methods of Food Preservation

• All methods are generally based on the principle of preventing or retarding the causes of spoilage

• No method of food preservation will improve the original quality of a food product

• Principles of food preservation:
  – By removing, hindering the growth of organisms - low temperature, heat, radiation, filtration
  – Destruction or inactivation of food enzymes by blanching or delay of chemical reactions
Preservation by low temperature

• Cold temperatures chiefly inhibits growth of microorganisms and increases the concentration of dissolved substances thereby reducing available water to bacteria

• Retains nutritional value and their natural colour, flavour, and texture

• Sub-zero levels cause metabolic injury, denaturation, and flocculation of cell proteins

• In vegetables, enzyme action may still produce undesirable effects on flavour and texture, hence they must be destroyed by heating
Methods of Freezing

• Refrigeration – storage at temperatures (0-5°C or below)
• Temporary food preservation method that will slow down the growth of microbes
• Causes dehydration of stored foods because of moisture condensation and the limitation is overcome by controlling humidity and selecting suitable packaging techniques
Methods of Freezing

• Slow-freezing process is also known as sharp freezing
  - Foods are placed in refrigerated temperatures (-4 to -29°C) for 3 to 72 hrs, for fruits and vegetables (-15 to -21 °C)

• In Quick-freezing (-32 to -40 °C) foods are rapidly frozen so that fine crystals are formed and fine crystals that are formed have lesser effect on breaking up plant and animal cells
Methods of Freezing

• Dehydro freezing of fruits and vegetables consists of drying the food to about 50% of its original weight and volume and then freezing the food to preserve it.

• Vegetables are blanched before freezing wherein enzymes are inactivated making them more compact by removing air from the tissues thus preventing rancidity, and loss of chlorophyll and carotene from greens.
Methods of Freezing

• Immersion freezing – foods are immersed in solutions of salt and ice for several hours like brine, refrigerants are directly sprayed

• Plate freezing - food (ideal for large blocks of fish) is packed tight to prevent air gaps between flat, hollow refrigerated metal plates, not suitable for irregular shaped items

• Blast Freezing – Food is subjected to steady stream of cold air (-40°C or lower) in a tunnel, suitable for irregular shaped items
Methods of Freezing

- Fluidized bed freezing – vertical jets of refrigerated air are blown up through the product, used for peas, beans
- Scrapped heat exchangers – products such as ice cream are frozen reducing ice crystal formation, producing a smooth product
- Cryogenic freezing – liquid nitrogen (-196°C) or carbon dioxide(-78 °C) is sprayed directly on soft fruit and prawns
Freezing of Foods

• Fruits are not blanched as it gives cooked flavour and soft texture, bananas suffer chilling injury at less than 12 °C

• Meat and poultry are frozen by wrapping resulting in improved tenderness

• Degree of unsaturation of fat in pork, fish, and poultry are responsible for rancidity

• As the fat of meat becomes rancid in freezer storage, the colour of myoglobin fades
Nutritive value of frozen foods

- Some loss of water soluble vitamins because of blanching and subsequent chilling
- Loss of ascorbic acid occurs during storage if the temperature is above -18°C
- Storage temperature of -18°C is usually recommended for frozen foods