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Methods of Preservation

Low Temperature



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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



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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



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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



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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



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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



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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



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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



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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



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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



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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



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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