

Course- SOS In Microbiology

Semester- M.Sc IV sem

Paper-402

Lecture – I unit -2nd topic

Topic – Principles of food preservation and preservation by use of low temperature

FOOD PRESERVATION

➤ It may be defined as the “**Process by which food items are prevented from getting spoilt for a long period of time**”.

Or

Process to stop or greatly slow down spoilage of food (loss of quality, edibility, or nutritive value) caused or accelerated by microorganism.

Need for food preservation

1. To take care of the excess produce.
2. To make transportation and storage of food easier.
3. To make food available to those areas where it can not be grown.

Principle Of Food Preservation

The principles of food preservations are:

1) Prevention or delay of microbial decomposition

- By keeping out microorganisms (asepsis)
- By removal of microorganisms (e.g., by filterartion)
- By hindering the growth and activity of microorganisms (e.g. by low temperatures, drying, anaerobic conditions, or chemicals)
- By killing the microorganisms (e.g. by heat or radiation)

2) Prevention or delay of self decomposition of the food

- By destruction or inactivation of food enzymes (by blanching)
- By prevention or delay of chemical reactions (By using antioxidant)

3)Prevention of damage because of insects, animals, mechanical causes etc.

Methods of Food Preservation

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graph TD; A[Methods of Food Preservation] --> B[Physical Method]; A --> C[Chemical Method];
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Physical Method

- **Asepsis**
- **Removal of microorganism (Filtration)**
- **Use of low temperature (Cooling, refrigeration)**
- **Use of high temperature (Pasteurisation, cooking)**
- **Use of radiation (U.V., γ , etc)**
- **Drying**
- **Use of high pressure**
- **Maintenance of anaerobic conditions**

Chemical Method

- **Use of chemical preservatives (Benzoates, sorbates, sugar salt, ethylene oxide, antimicrobials etc)**

Prevention or delaying of microbial decomposition

➤ **Asepsis- i.e., by keeping out microorganism as a preservative factor**

e.g., protective covering of fruit and vegetables, Packaging of foods , heat process along with the sealed container in canning industry prevents or delayed microbial decomposition or contamination

➤ **Removal of microorganism**

▪ **can be achieved by means of filtration, centrifugation, washing or trimming.**

• **Filtration is the only successful method for complete removal of microbes from liquid material (like fruit juices, beer, soft drinks , water)**

• **Washing raw foods removes most of the soil microorganism from the surface**

• **Trimming away spoiled portions of a food or discarding spoiled samples**

➤ Maintenance of anaerobic conditions

- A complete fill, evacuation of the unfilled space or replacement of the air by carbon dioxide, or by an inert gas such as nitrogen will bring about anaerobic conditions.
- Heat resistant aerobic spore formers may survive in canned food but unable to germinate or grow in absence of oxygen

Preservation by use of Low temperature

Principle

- Use of low temperature **retard chemical reactions and action of food enzymes and to slow down or stop the growth and activity of microorganisms in food.**
- The lower the temperature , the slower will be chemical reactions, enzyme action, and microbial growth thus prevent food spoilage.
- Each microorganism present has an optimal temperature for growth and a minimal temperature below which it cannot multiply. As the temperature drops from this optimal temperature toward the minimal, the rate of growth of the organism decreases and is slowest at the minimal temperature. Cooler temperatures will prevent growth, but slow metabolic activity may continue. The slowing of microbial activity with decreased temperatures is the principal behind refrigeration and freezing preservation.

Preservation methods that use low temperature

1. Cold storage/Chilling

- It is a modern food preservation method based on the fact that dangerous foodborne illness bacteria do not grow (or grow very slowly) at refrigeration temperatures (0-5°C or below).
- In general, it is considered as a temporary food preservation method because it will slow down the growth of microbes (food spoilage microbes: bacteria and fungi) but doesn't stop it completely as freezing does. Hence, refrigeration only keeps food for days rather than the months that freezing does. Practically, the life of many foods may be extended by storage at temperatures below 4°C.
- Most perishable foods like fresh fruits and vegetables, eggs, fish, dairy products, meats etc. held in chilling storage for a limited time with little changes from their original conditions

2. 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 a state to form ice crystals.
- It is one of the easiest, least time-consuming and most convenient methods of food preservation.
- Freezing is very good at retaining the nutritional value and their natural color, flavor and texture better than when other methods of food preservation are used.
- Microbial growth is prevented entirely and action of food enzymes is greatly reduced.
- It is suggested that before freezing the fresh vegetables, must be blanched/ Scalded (exposure to brief heat treatment) first to stop the enzymatic activity (that can cause alterations in their nutritional values)

Freezing techniques

1. Sharp/Slow Freezing-

- Freezing in air with only natural air circulation or best with electric fans.
- The temperature is usually -23°C or lower but may vary from -15 to -29°C
- May take from 3 to 72 hrs.

2. Quick Freezing-

- Freezing in short time usually takes 30 min or less time.
- Accomplished by one of the 3 methods
 - a) Direct immersion of the food in refrigerant
 - b) Indirect contact with refrigerant
 - c) Air blast freezing where frigid air at -17.8 to -34.4°C is blown across the material being frozen.

3. **Dehydrofreezing-** Food is dehydrated to a desirable moisture and then frozen. It has the advantage of less damage to plant texture.

4. **High pressure freezing-** Use of high pressure promotes uniform and rapid ice nucleation thus produces smaller crystals.

Changes during freezing

- Loss in texture
- Damage to food due to ice crystals formation which causes adjacent cell walls to rupture.
- Freezing causes death of 10- 60% of the microbial population and the percentage gradually increases during frozen storage.
- Loss of natural pigments and flavours
- Oxidative rancidity and loss of vitamin C in fruits.

Advantages

- Many foods can be frozen
- Good natural colour, flavor and nutritive value can be retained
- Texture usually better than for other methods of food preservation.
- Takes less time in case of freezing
- Simple procedures
- Adds convenience to food preparation

THANKS