

Principles of food preservation

Unit – I
Chapter - 2

Introduction

- **Food is defined as any material consisting essentially of protein, carbohydrate and fat used in the body of an organism to sustain growth, repair and vital processes and to furnish energy.**
- **As food contains various essential nutrients they are prone to contamination by various microorganisms.**

Contamination may be –

- 1. Natural contamination – natural contamination occurs when microorganisms attached themselves to foods. For instance, fruits are often contaminated with yeast because yeast ferments the carbohydrates in fruits.**
- 2. Artificial contamination – artificial contamination occurs when food is handled or processed such as when fecal bacteria enters food through improper handling procedures.**

Food spoilage

- **In food, several kinds of chemical changes occur once the food is harvested. Some changes may be considered desirable whereas other render food unfit for consumption**

The major classes of food change include –

- 1. Enzymatic processes – the flesh of the animal undergoes proteolysis by its own enzymes following its death but plants after harvest undergo other type of change. E.g. in harvested corn the sugar rapidly converts to starch.**
- 2. Chemical reactions with the environments – the most common abiotic chemical reactions involve oxidation by air. E.g. lipid autoxidation generates rancid odours.**
- 3. Microbiological processes – microbes when contaminated the food generates a wide range of chemical products.**

- **So, the Food spoilage actually refers to the microbial changes that render a product unfit or unpalatable for consumption**
- **Most foodstuffs serve as good media for the growth of many different microorganisms. Once the microorganism grows, they will produce changes in appearance, flavour, odour and other qualities of food**

The degradation process may be –

- 1. Putrefaction : Protein foods + proteolytic microbes amino acids + amines + ammonia + hydrogen sulphide**
- 2. Fermentation : Carbohydrate foods + carbohydrate fermenting microbes acids + alcohol + gases**
- 3. Rancidity : Fatty foods + lipolytic microbes fatty acids + glycerol Different foods spoils in different ways depending on their nutrient content, microbial species and environmental factors such as temperature.**

Food preservation

- **Food preservation is the process of treating and handling food to stop or slow down spoilage caused or accelerated by microorganisms**
- **Preservation usually involved preventing the growth of bacteria, fungi and other microorganisms as well as retarding the oxidation of fats which cause rancidity**

Principles of food preservation

1. Prevention or delay of microbial decomposition

- By keeping out microorganisms (asepsis)
- By removal of microorganisms
- By hindering the growth and activity of microorganisms (e.g. by low temperature, 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)

Methods of food preservation

1. Physical means of preservation includes –

- **Dehydration and freeze-drying** – as we all know that removal of water prevents microbial growth. So it is removed either by application of heat or by freezing under vacuum known as freeze-drying or lyophilisation. One of the disadvantage of drying is that some nutrients are broken down.
- **Refrigeration and freezing** – refrigeration temperature which is usually between -2°C to 16°C slows microbial growth. Freezing halts the growth of most microbes but preexisting contaminant strains often survive to grow again when the food is thawed.
- **Controlled or modified atmosphere** – food can also be packed or stored under vacuum with decreased oxygen or increased carbon dioxide. Controlled atmosphere limit abiotic oxidation as well as microbial growth.

- **Pasteurization** – pasteurization is usually carried out at 63°C for 30 minutes followed by quick cooling to 4°C. Pasteurization is effective in extending the shelf life of liquid foods.
- **Canning** – canning is carried out for the long term storage of food. For this food is cooked under pressure to attain a temperature high enough to destroy endospores. Canning effectively eliminates microbial contaminants. One of the disadvantages of canning is that it incurs some loss of food value as well as loss of desirable food texture and taste.
- **Ionizing radiation** – food irradiation effectively sterilizes many kinds of food for long term storage. Irradiation has also proved highly effective at eliminating pathogens that would cause serious illness.

2. Chemical methods of food preservation

- **Acids** – although by microbial fermentation foods can be preserved by acidification, an alternative approach is to add acids directly to the food. Organic acids that are commonly used to preserve foods are the benzoic acid, sorbic acid and propionic acid. These acids are usually added to the food as salts i.e. sodium benzoate, potassium sorbate and sodium propionate. This acids acts by crossing the cell membranes in the protonated form thereby releasing their protons at a higher intracellular pH and it is for this reason, they work best in foods that already have moderate acidity.
- **Esters** – esters of organic acids shows antimicrobial activity. E.g. fatty acid esters and benzoic acid esters. They are used to preserve processed cheese and vegetables.

- **Other organic compounds – numerous organic compounds (e.g. eugenol from cinnamon and cloves) shows potent antimicrobial activity.**
- **Inorganic compounds – salts such as phosphates, nitrites and sulphites are some of the inorganic food preservative. Nitrites and sulphites inhibit aerobic respiration of bacteria and their effectiveness is enhanced at low pH. However, these substances may show harmful effects on humans because nitrites can be converted to toxic nitrosamines and sulphites can cause allergic reactions to some peoples.**

Points To Remember

- **Any chemical change that renders food unfit for consumption is termed as food spoilage**
- **Food is spoiled through the degradation of enzymes within the food, through spontaneous chemical reactions and through microbial metabolism**
- **Food borne pathogens are spread during harvesting, processing and share consumption of food**
- **Hence food needs to be preserved by the application of various methods to prevent from certain microbial contaminants**