Chapter 4 Food Preservation Methods

Learning Objectives

This chapter will enable the students to

- Know the importance of food preservation
- Enhance their knowledge of different preservation techniques
- Know the difference between traditional techniques and modern industrial techniques
- Understand the steps to be taken before freezing vegetables, fruits, meat and poultry
- Know the different methods of food preservation
  - *Using low and high temperature*
  - *Use of chemical preservatives and high osmotic pressure*
  - *Dehydration*
  - *Irradiation*
  - *Vacuum packaging*

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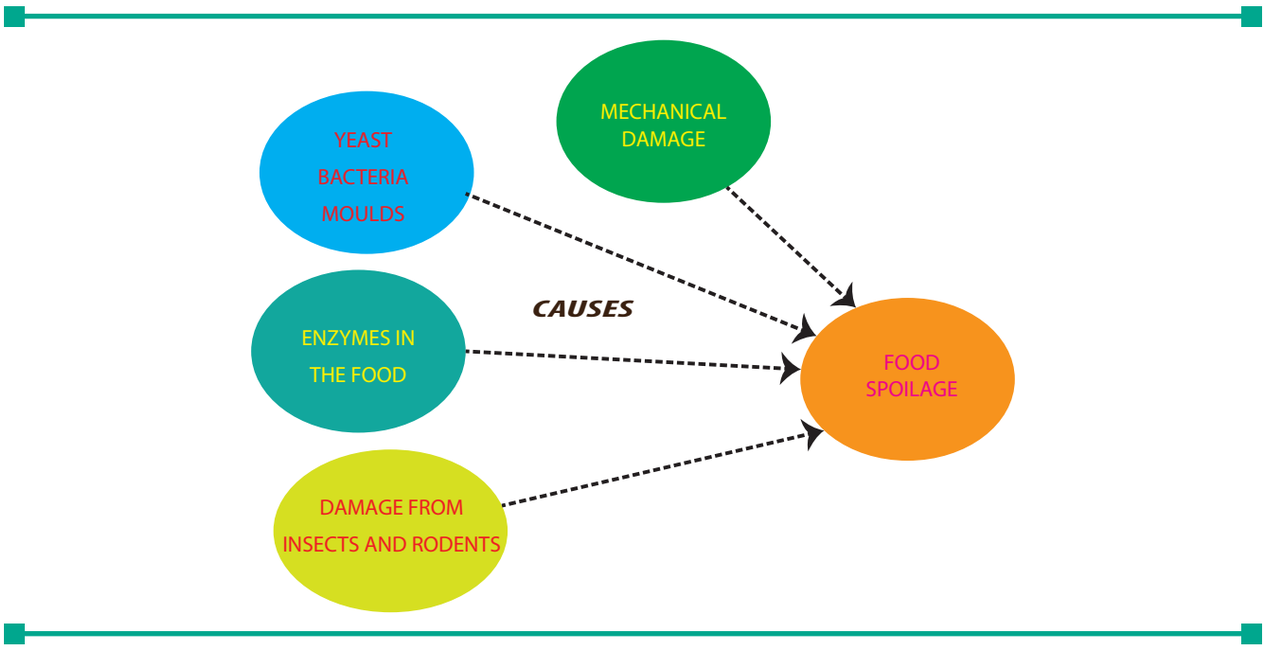
4.1 INTRODUCTION

Millions of fruits and vegetables are produced each year and they are lost due to poor processing and preservation. Fresh fruits are abundant during the season and are not available during off season. Due to this the food has to be stored until the next season. Fish and meat too have to be preserved as all that is killed or caught cannot be eaten at one time. Bacteria, fungi and yeasts tend to decay the food and render it unfit to eat. Hence all fresh foods have to be preserved if it is to be used after a period of time.

Besides when food spoils, they undergo physical and chemical changes that results in the food becoming inedible or hazardous to eat. The chief *causes of food spoilage* are;

- *The growth of microorganisms like bacteria, yeast and moulds.*
- *The action of enzymes that normally occur in the food.*
- *Other causes of spoilage are non enzymatic reactions in food such as oxidation and mechanical damage such as bruising and damage from rodents and insects.*



▲ Fig. 1 Causes of food spoilage

In order to prevent food spoilage and ensure food security and availability, various food preservation techniques have been used over the several years. The earliest steps in *food preservation* are *drying* of grains and nuts. Later *salting, smoking and drying* were applied to preserve the food.

4.1.1 Definition of Food Preservation

Food preservation is known as *"the science which deals with the process of prevention of decay or spoilage of food thus allowing it to be stored in a fit condition for future use".*

Preservation also can be defined *as "the state in which any food may be retained over a period of time without being contaminated by pathogenic organisms or chemicals, without losing optimum qualities of colour, texture, flavour and nutritive value".*

Importance of food preservation

Food production and supply does not always tally with the demand or needs of the people. In some places, there is *surplus production* of food product, whereas in some other place there is *inadequate supply*. It is therefore important to improve and expand *facilities for storage* and preservation of food to ensure its availability and acceptability at all times.

Preservation ensures:

- *Increase in shelf life of foods.*
- *Availability of seasonal foods throughout the year.*
- *Stability in prices of food as there will not be a deficit in supply.*
- *Good quality*
- *Edibility – texture and flavour*
- *Retention of nutritive value*
- *Retention of original colour of food.*

For the process of preservation, a preservative (e.g. salt, sugar, vinegar) is needed.

DO YOU KNOW?

A preservative is a substance that is added to food to inhibit and retard the growth of microorganisms and helps in the process of preservation.

Principles of Food Preservation

1. ***Prevention or delay of microbial decomposition.***
   a. By keeping out microorganisms and preventing contamination from pathogens. It involves applying the strictest rules to minimize the risk of infection *(asepsis)*.
   b. Removal of microorganism through usage of membrane which retains microorganisms *(filtration)*.
   c. By hindering the growth and activity of microorganisms *(refrigeration, dehydration, addition of chemical preservatives)*.
   d. By killing microorganisms *(boiling, irradiation)*.
2. ***Prevention or delay of self decomposition of food***
   a. By destruction or inactivation of enzymes *(blanching)*.
   b. By prevention or delay of chemical reactions *(anti oxidants)*.
3. ***Prevention of damage caused by mechanical causes, insects and rodents.***

4.2 PRESERVATION METHODS

Many foods cannot be stored as such and need to undergo a treatment or a technique which helps to prevent spoilage. The techniques adopted to preserve the foods are grouped into ***traditional techniques and modern industrial techniques.*** *Traditional techniques* include curing, freezing, boiling, heating, sugaring, pickling, canning, smoking, salting and fermentation. *Modern industrial technique* involve pasteurization, vacuum packing, artificial food additives and irradiation.

In this chapter, preservation techniques are discussed under the following headings. They are use of low temperature, use of high temperature, dehydration, use of chemical preservatives and preservation by high osmotic pressure.

Activity 1

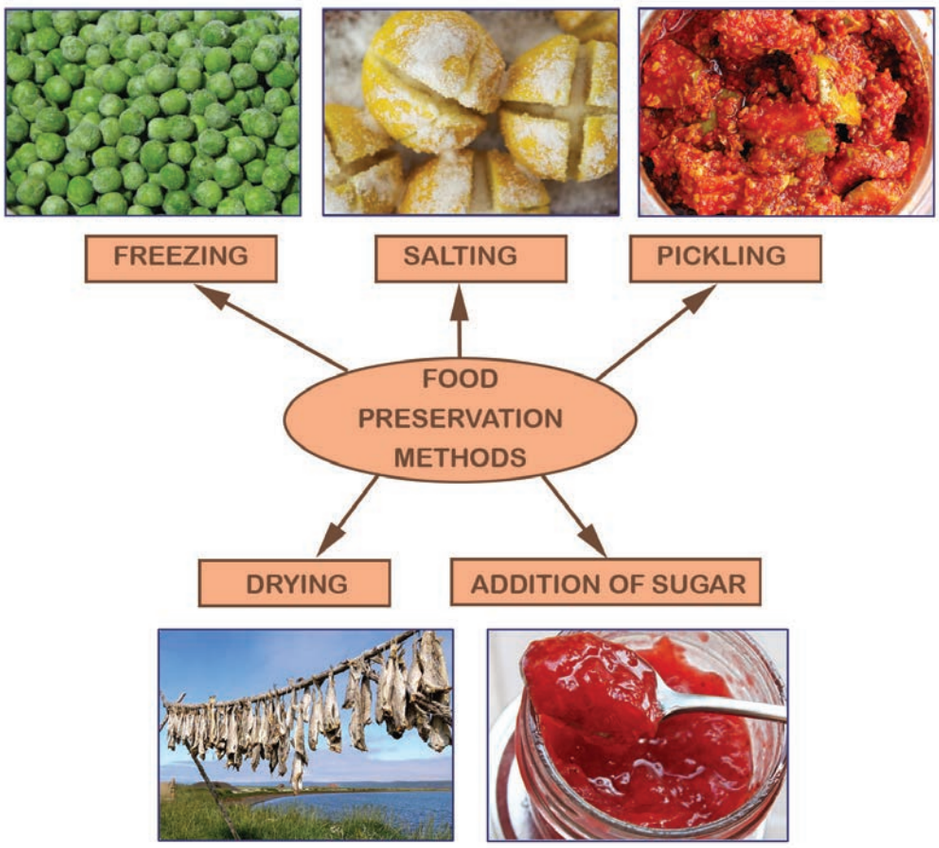
Boil sliced potatoes in water for three minutes. Observe the changes that take place in the texture, colour and appearance.

4.2.1 Preservation of Foods with Low Temperature

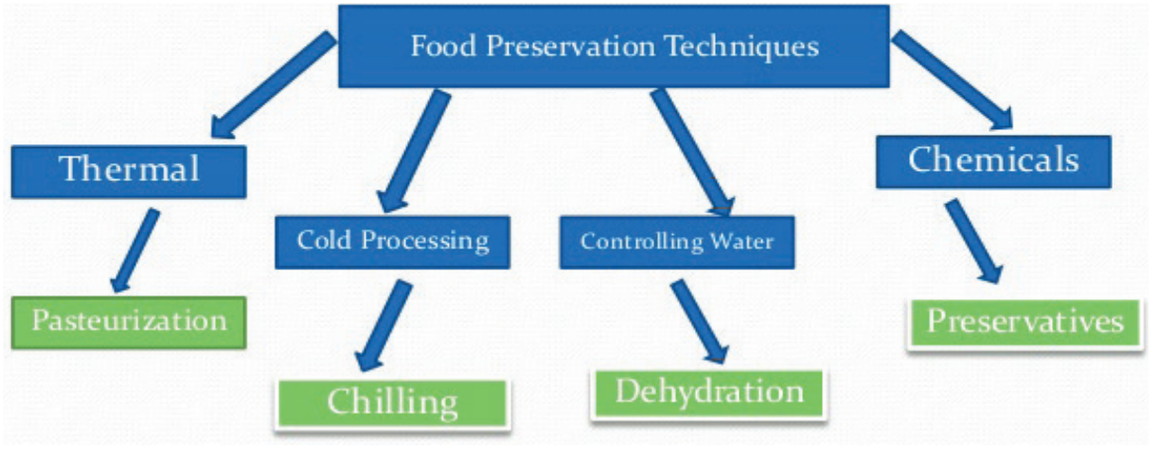
Use of low temperature reduces the microbial activity and enzyme activity thus prolongs shelf life of foods. Two different temperatures are employed in low temperature namely *chilling temperature and freezer temperature.*

4.2.1.1 Chill Storage

Chill temperature is just above the refrigerated temperature. In chilling fish, the temperature is reduced to freezing point of water. Chill temperature delays both bio-chemical and bacteriological changes. The deteriorative changes are retarded when low temperature is maintained. Hence the shelf life of food is improved and this ensures preserving natural and functional properties of food. Storage at *−1°C and −4 °C* can provide stability in the presence of food preservation.



▲ Fig. 2 Methods of food preservation



▲ Fig. 3 Techniques of food preservation

Food stored in the refrigerator

Fact

Ice and snow was used to preserve food in ancient times, now 85 per cent of all foods are refrigerated.

Table 1 Comparison Data of Shelf Life of Frozen and Refrigerated Foods

Vegetables/ Meat/Dairy/ Fruits	Refrigeration	Freezing
Pears	5 Days	One year
Butter	1–2 months	9 months
Milk	8–20 days	3 months
Lean fish	1–2 days	6–10 months
Fatty fish	1–2 days	2–3 months
Poultry	1–2 days	6–9 months
Bread	1–2 weeks	2–3 months
Flour	1 year	1–2 years
Corn	1–2 days	8 months
Green peas	1–2 days	8 months
Spinach	5–7 days	8 months

Source: foodclubkitchen.com

4.2.1.2 Freezing

Freezing is a means of preserving food through *the application and maintenance of extreme cold temperature (–4°C to –40°C).* It is *effective* because most of the water of the food tissue is changed from *the liquid to the solid state*. This change in the physical state of water retards enzymatic action and stops microbial growth, the cause of food spoilage, thus preserving food. Many foods can be *frozen for twelve months or more* without major changes in size, shape, texture, colour and flavour.

- **Slow freezing process**

It is also known as *sharp freezing*. In this method, the food is frozen under temperatures ranging from *–4°C to –29°C.*

Frozen grapes

Normal grapes

Tips for Preservation

In vegetables, enzyme action may produce undesirable effects on flavour and texture during freezing. So the enzymes must be destroyed by heating before the vegetables are frozen.

Freezing may *require three to seventy-two hours* under such conditions. *Home freezing* is done by this method.

- **Quick freezing process**

The temperatures used in the *quick freezing process* range from *–32°C to –40°C.* It freezes food so rapidly that fine crystals are formed. The time taken for quick freezing is significantly lower than that of slow freezing. In quick freezing, *large quantities of food* can be frozen in a short period of time. The use of very low temperature for both freezing and holding frozen products adds to the cost but of *desirable for* many products in terms of *retention of palatability* and *nutritive value.*

- **Dehydro freezing**

Dehydro freezing of fruits and vegetables is the drying of the food to about 50 percent of its original weight and volume and then freezing the food to preserve it. The quality of dehydro frozen fruits and vegetables is equal to that of fruits and vegetables which are frozen without preliminary drying. The cost is marginally less because of weight and volume savings in packing, freezing, storing and shipping.

DO YOU KNOW?

Cryogenic liquids are liquefied gases used for freezing due to its low boiling point. The commonly used cryogenic liquids are liquid nitrogen, liquid carbon-dioxide and Freon.

Points to be Considered Before Freezing Food

Vegetables:

Blanching (dipping the products in boiling water for two to three minutes) vegetables before freezing reduces the number of microorganisms, removes some air from the tissues, makes them more compact and enhances their colour. Its most important function is to *inactivate enzymes* otherwise that would cause deterioration in palatability, colour and ascorbic acid content during storage.

Fruits:

The enzymes of fruits can be inactivated by *blanching* but it *is not done* as it gives the *fruit a cooked flavour and soft texture.* Rather fruits are cut directly into sugar syrup or sugar to prevent oxidation. Sugar not only increases the sweetness but helps to retain volatile aroma.

Meat and poultry:

Meat and poultry require only *wrapping for freezing.* After slaughtering the animal, the pork, meat and poultry is chilled promptly to avoid spoilage. The tendency of the fat of the pork and poultry to become rancid during storage in a freezer is aggravated by storage before freezing.

4.2.2 Preservation by High Temperature

The temperature and time used in heat processing a food depends upon the effects of heat on food and the other preservative methods employed.

4.2.2.1 Pasteurization

Pasteurization is a heat treatment that kills part but not all the micro organisms present and involves the application of *temperatures below 100°C.* The heating, may be by means of steam, hot water, dry heat or electric currents and the products are cooled immediately after the heat treatment. *Milk is usually pasteurized.*

Pasteurized products are not sterile. They contain vegetative organisms and spores which are still capable of growth. Hence *many pasteurized foods* must be stored *under refrigeration*. Pasteurized milk can be stored for over a week under refrigeration while pasteurized milk stored at room temperature will spoil within a day.

Table 2 The Time and Temperature for the Pasteurization of Various Food Products

Food	Temperature (°C)	Duration
Milk	62.8	30 mts.
	71.7	15 sec.
Ice cream mix	71.1	30 mts.
	82.2	60–20 secs.
Grape wine	82–85	1 min.
Dried fruits	65.6–85	30–90 mts.
Bottled grape juice	76.7	30–90 mts.
Carbonated juices	65.5	30 mts.

Source: Food Science III Edition, New Age International publishers Srilalshmi. B. (2006), Chennai

4.2.2.2 Blanching

Blanching is a heat treatment like pasteurization. It is done *by dipping the products in boiling water for two to three minutes at 180°F to 190°F.* Blanching focuses on *deaerating* the product and *inactivating degradative enzymes* before further processing. Blanching is an *important step in freezing food*, as frozen foods can develop off flavour, vitamin losses and colour changes while in storage.

Blanching

- *Prevents bacterial growth.*
- *Fixes the natural colour of vegetables – holds the colour.*
- *Shrinks the product, better for filling the container.*

Blanching of tomatoes

Activity 2

1. Cut apple/banana. Expose them for 5 minutes in the air. Observe what happens.
2. Squeeze a few drops of lemon juice on a slice of apple. Does the colour change?

4.2.2.3 Canning

Canning involves the application of temperatures to food that is high enough to destroy essentially all micro organisms present. It also involves *airtight sealing* in

sterilized containers to prevent recontamination. The degree of heat and the length of time of heating vary with the type of food and the kinds of micro organisms. Large quantities of food are canned for preservation. In developed countries, canned foods form a major part of the diet of the people. *Items* often canned are *meats and meat products, fruits and vegetables, fish products, soups, etc.*

The process of canning involves the following steps:

- *Receiving, cleaning, grading and inspecting of raw commodity.*
- *Blanching to inactivate enzymes.*
- *Placing in the container with added brine or syrup and deaeration of the product.*
- *The next process is exhausting. Exhausting is done to expel the air and gas from the can so that its internal pressure, after heating and cooling, is the same as the atmospheric pressure.*
- *After exhausting, the filled cans are permanently sealed mechanically.*
- *The sealed containers are subjected to high temperatures, to destroy the most heat resistant organisms.*
- *After this, the cans are cooled by water in a cooling canal to about 38°C, before storage.*
- *The final step is casing and storing the cans.*

▲ Fig. 4 Home scale canning

4.2.3 Preservation by Dehydration

Dehydration is *the extraction of moisture* from food products like fruits, vegetables, herbs and meat. It inhibits the growth of microorganisms and *imparts a long storage life*. This is a modern development of smoking and drying. Some *changes* that occur during the process of dehydration are:

- *Chemical changes*
- *Browning and flavour changes*
- *Denaturation of proteins*
- *Concentration on the surface of the food (case hardening)*

Dehydration can be done by *drying and salting*. Evaporation is quickened with the addition of moderate heat which is sometimes provided *by natural sunlight*. The ultraviolet rays from the sun serve to *kill microbes*. Modern methods of dehydration use circulating air that is heated just enough to promote dehydration without cooking the food. Food preservation by drying is one of the oldest methods used by human beings. Drying is one of the methods used for dehydration.

4.2.3.1 Drying

Drying is the method nature resorts to preserve foods. Natural drying was adopted by early man to dry fruits, fish and meat by exposing them to the sun.

Dried tomatoes

Sun drying is used in many parts of the world for preserving certain foods, such as fruits and nuts. However, this method can be used only if the *climatic conditions are hot* with low humidity. In many cases foods are pretreated before drying to make the structure more porous and to facilitate transfer of moisture, thereby speeding the drying rate. Food porosity increases the chance of quick solubility on reconstitution, but is at a disadvantage due to increased bulk and shorter storage stability. *Vegetables like beans, peas, potatoes, cauliflower, ladies finger, garlic, onion and all leafy vegetables can be sundried.*

Changes during drying

- Shrinkage occurs on the surface first and then proceeds to the inner layers. With quick high temperature drying of food, the surface becomes dry and rigid long before the center dries out.
- Dried food pieces may also contain cracks and pores of various diameters. The shrinking and pore clogging by the solutes is known as core hardening. It can be minimized by gradual drying with low surface temperature.
- Foods that lack good structure and are high in sugar content, give an impression of retaining moisture even after the drying process. Fruits like grapes and figs have high sugar content and lack good structure, hence appearing moist even after dehydration.
- Complete prevention of these changes is impossible. They can be minimized by using appropriate technology.

Dry figs are richer in fiber. A ¼ – cup serving of dried figs is nutritionally comparable to a serving of two large fresh figs, providing about same amount of calories, fibres and potassium.

Methods of Drying

A number of drying methods are available; some are suitable for liquids, others for solid foods or mixtures containing food pieces. The common drier types used for liquid and solid foods may be categorized as the air-convection drier, drum or roller drier and vacuum drier.

4.2.3.2 Types of Driers

- **Air-Convection drier** – In the air-convection drier, hot air supplies the heat for evaporation. Though there are different types of air-convection driers, they all have an insulated enclosure, a means of circulating air through the enclosure and a means of heating this air.

  If liquid, the food may be sprayed or poured into pans or on belts. Food in the form of a fine spray or mist is

introduced into a tower or chamber along with heated air. The small droplets come into contact with the hot air, blast off their moisture, become small particles and drop to the bottom where they are removed. This method can produce a high quality product even with heat sensitive products like milk, eggs and coffee.

- **Drum or Roller drier** – Liquid foods, purees and mashes are dried by this method. The food to be dried is applied, as a continuous thin layer, on to the surface of a revolving drum or between a pair of drums moving in opposite directions heated by steam. The dried layer of food is scraped by a scraper blade positioned at a point on the drum. Foods that are sticky cannot be scraped when it is hot. Such a sticky food becomes brittle when cooled, which facilitates scraping. For heat resistant food products, drum drying is one of the inexpensive dehydration methods.
- **Vacuum driers** – This method is quiet expensive but gives good quality foods. It consists of a vacuum chamber that can withstand air pressure and contains shelves to hold food. The shelves are heated. The food gets heated by conduction and radiated heat. Liquid foods dehydrated by vacuum drying have a puffed structure and are easily dissolved in water. There is minimum flavour change and heat damage because low temperature is used in this method.

Dried foods are very convenient as they are light weight, take up little storage space and can be stored for long periods as emergency foods.

4.2.4 Smoking of Foods

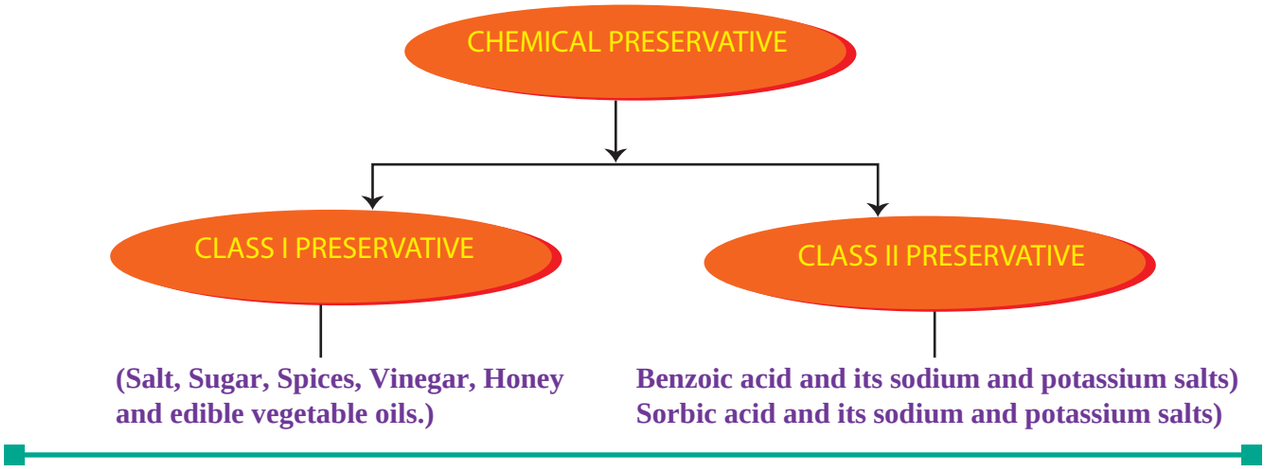
Smoking is mostly done to preserve the meat. This process helps to develop flavours in it. Wood smoke contains small amounts of formaldehyde, higher aldehydes, formic acid, acetic acid and resins. These compounds have antiseptic properties and destroy microorganisms present. The temperature and period of smoking vary with the type of meat. In sausages, the smoking is done for a few hours after smoking the material is packed in polythene bags and kept at refrigerated conditions.

4.2.5 Preservation by Chemical Preservatives

Preservatives are chemical agents which serve to retard, hinder or mask undesirable change in food. Preservatives help in retaining the original quality of food and delaying their spoilage.

Preservatives are classified into class I and class II preservative. Class I preservatives are available at home. Class II preservatives are prepared in the industries.

- Sulphur dioxide is the only permitted preservative used in the form of sulphites.
- In India, sodium benzoate, sulphites and sorbic acids are permitted preservatives used in fruits and vegetables.
- Dried fruits are treated with sulphur dioxide to conserve the colour and to prevent the growth of microorganisms.
- Sodium benzoate is preferred to benzoic acid because of its solubility and used in tomato ketchups, sauces, jams, jellies, pickles and fruit juices.



- Sorbic acid and its salts are effective against yeasts and moulds but less effective against bacteria. They are good preservatives for foods with high fat content e.g., low fat spreads and processed cheese.

Sulphite Fact

It is an effective and economical additive. Sulphites decolourise the anthocyanin pigment present in food; hence it is not used in grape crush and squashes. Instead sodium benzoate is used which retains the colour.

Household preservatives – vinegar (acetic acid) and ascorbic acid (in lemon) are used for preservation.

4.2.6 Preservation by High Osmotic Pressure

The principle of osmosis is used to preserve jams, jellies and pickles. In this process, water tends to draw out from microbes (*plasmolysis)* and makes it dehydrated, thus killing them. But yeasts and moulds are relatively resistant to high osmotic pressure. Hence, preserved foods like pickles tend to spoil if not stored properly.

Mango jam

4.2.6.1 High Concentration of Sugar

Sugar is used to preserve fruits. Preserving fruits in honey to avoid spoilage is a well known practice. Nowadays jams and jellies prepared from fruits have a high concentration of sugar and it acts as a preservative. Pectin, acid and sugar are essential to prepare jam. Jam or jelly are prepared by adding commercially prepared pectin and

it also reduces the cooking time. Jellies are clear substances made of fruit juice or the extract of a fruit.

Sugar acts in the following ways:

- Sugar draws the water out of food therefore making it unavailable for microorganisms.
- As a result of water loss, microbial metabolism is stopped.
- Hence, the growth of microorganisms is stopped

Preparation of jelly:

- Under-ripe fruits are used, because the pectin content is high and good acidity is essential for a good jelly.
- Pieces of fruit are completely immersed in water and cooked for 10–20 minutes. Hard fruits like guavas need to be cooked for 45 minutes.
- After the fruit is cooked, it is strained without disturbing the fruit pieces.
- The fruit extracts contain pectin which determines the addition of sugar. When the level of pectin is high, it needs more sugar but requires less boiling time.
- Rapid boiling facilitates rapid evaporation, which avoids strong flavour and darkened colour.
- Then the jelly is poured in bottles or moulds, and allowed to set without any disturbance.

CASE STUDY

Case study 1

After a grand marriage function, 50 bananas, 5 kgs of tomatoes and 3 kgs of lime were left unused. Suggest ways to preserve these food items.

Preparation of jam:

- Fruits like apples are cooked with skin and made into pulp with the strainer for making jam
- Equal quantities of sugar and pulp are taken to make jam.
- After it is cooked, it is transferred to a sterilized bottle and allowed to cool.

Test for doneness for jam

Sheet test – the mixture is allowed to drip from a large cool spoon. If the syrup forms a sheet instead of two separate drops, the jam is done.

Bubble test – when the end point reaches, big bubbles can be seen throughout the jam.

Plate test – set a plate in the freezer for some time. Put the jam and tilt the plate slowly. The jam should come down as a whole mass forming "U" shape. Water should not separate out.

Fork test – dip the fork into the jam or jelly. Jam of correct consistency forms a sheet between the needles of the fork.

Honey

Honey is a natural preservative in its original state and was one of the earliest preservatives used by ancient civilizations. It has a high concentration of sugar that draws out the water out of yeast or bacteria cells which contaminate the food.

4.2.6.2 High Concentration of Salt

Foods are also preserved by the principle of osmotic pressure in salting and pickling. Most commonly used preservative is sodium chloride. Required quantity may be added to slow down or prevent the growth of microorganisms or enough to permit lactic acid fermentation to take place.

Salted mangoes and cucumber

Activity 3

Cut a lemon into two. On one half, add some salt and leave the other as it is. Leave it aside for a week. Note the changes.

Sodium chloride preserves the food by the following principles:

- It causes the high osmotic pressure and hence plasmolysis occurs.
- It dehydrates foods by drawing out and tying up moisture, as it dehydrates microbial cell.
- It ionizes to yield the chlorine ion which is harmful to organisms.
- It reduces the solubility of oxygen in the moisture.
- It sensitizes the cell against carbon dioxide.
- It interferes with the action of proteolytic enzymes.

Pickling:

In pickling, food is placed in edible liquids like brine, vinegar or vegetable oil which inhibit or kill microorganisms. Sometimes, food is heated along with pickling agent so that it gets saturated with it.

Pickles may be broadly divided into three groups:

Sweet pickles e.g., tomato sweet pickle, mango sweet pickle.

Sour pickles e.g., mango pickle, lime pickle.

Fermented pickles e.g., cucumber pickle, cabbage pickle, chilli pickle, meat and sausages.

The important preservative agents in pickles are salt, vinegar, sugar, oil, spices and condiments. Each has a specific role in preservation.

Mango pickle

Lemon pickle

CASE STUDY

Case study 2

During harvest festival season, tomatoes are available in abundance. How can we make use of this?

Salt:

Salt is employed to control microbial population in foods such as butter, cheese, cabbage, olives, cucumbers, meats, fish and bread. There are four methods of salt curing; dry salting (fish), brimming (vadu manga), low salt fermentation (chilli pickle, sauerkraut from cabbage) and pickling (lime pickle). Sodium chloride or common salt is used primarily as a preservative and flavouring agent.

Vinegar:

Vinegar is a natural preservative. Vinegar is made from a two step process. The first process involves the carbohydrate being converted into alcohol by fermentation. The second step is its conversion to an acetic acid. The acetic acid in vinegar kills microbes and stops food spoilage. Pickling is a common method of using vinegar as a preservative. It is also used to improve the flavour of foods.

Spices and condiments:

These have *bacteriostatic* effect (slowing the growth and multiplication of microbes). The essential oil of spices is inhibitor of microorganism. The inhibitory effects of the spices differ with the kind of spice and the microorganisms being tested. Mustard flour and the volatile oil of mustard, for example, are very effective against *Saccharomyces cerevisiae*. In pickles like avakai and chilli pickle, mustard flour helps in the prevention of the growth of spoilage organisms in the food.

Turmeric powder, tamarind, chilli powder, asafoetida, fenugreek seed, cinnamon and cloves are usually *bacteriostatic*. Ground pepper corn and all spices are less inhibitory than cinnamon and cloves. Extracts of these plants have been shown to be inhibitory to *Bacillus subtilis* and *E. coli*. Allicin is the active principle in onions and garlic that kills bacteria and acts against fungi.

Bacteriostatic effect – prevents the growth of bacteria (i.e., it keeps them in the stationary phase of growth)
Bactericidal effect – means that it kills bacteria (cidal-killing)

Oil:

In addition to salt and several spices, oils are used in making pickles. Spice mixtures and oil are added to the fruit or vegetable. It is allowed to ferment for a month or so. The fermentation process renders fruits soft and the fruit take on the additional aroma and flavour of the spices. Aerobic bacteria and mould growth are prevented by covering the top with oil. Properly prepared and stored pickles can last upto a year or more without spoilage.

Spoiled pickle

DO YOU KNOW?

Any part of pickle which sticks out of oil gets acted by yeast decreasing the acid level. Once this acid level goes down, the bacteria starts acting on the pickle, making it slimy and slippery. This is how **pickles get spoilt**.

Latest techniques in food preservation

4.2.7 Food Irradiation

Food irradiation is a process of food preservation in which food is exposed to ionizing energy – *radio isotope cobalt 60 and cesium-137*. The electromagnetic *radiation suppresses* the growth of most *microorganisms*.

Hospitalized patients, who have compromised immune systems and *astronauts in space*, consume irradiated foods. More than forty years of scientific research show that this process is safe. The radiant energy kills the bacteria in the food, but it does not touch the food directly.

The uses of food irradiation are:

- *To avoid the use of harmful chemical compounds* in insect disinfestations of stored products and microbial decontamination of spices.
- *To extend the shelf life* of meat, poultry and sea foods by killing microorganisms which cause spoilage.
- *To replace the chemicals* used for slowing sprouting in tubers and bulbs and delay ripening of fruits.

4.2.8 Vacuum Packing

Vacuum packing is a process that removes air from the package prior to sealing. This method involves placing items in *a plastic film package, removing air from inside, and sealing the package*. This technology is *widely used* all over the world in the *packaging of milk and milk products, juice etc.*

Facts!

China is the largest apple producing country in the world.

In banana cultivation, Tamil Nadu tops the other states in India.

SUMMARY

- Millions of fruits and vegetables are produced each year and they are lost due to poor processing and preservation.
- Hence all fresh foods have to be preserved to avoid spoilage.
- Preservation ensures increase in shelf life of foods, the quality, the edibility, retention of nutritive value and retention of original colour of food
- The principles of food preservation techniques are prevention or delay of microbial decomposition, prevention and delay of self-decomposition of food, and prevention of damage caused by mechanical causes, insects and rodents.
- Preservation methods include traditional techniques and modern industrial techniques.
- In traditional techniques curing, freezing, boiling, pickling and salting, etc., helps to preserve the food for future use.
- Advanced techniques like vacuum packing, irradiation improves the quality and shelf life of the food.

GLOSSARY

Shelf life (வாழ்நாள் நீடித்தல்) - The period of food stuff to withstand without spoilage

Spores (இனப்பெருக்கத்திற்கு உதவும் நுண்துகள்கள்) - useful for reproduction

Aroma (நறுமணம்) - a pleasant smell

Rancidity (எண்ணெய் சிக்கல் வாடை) - development of off- flavour in fatty foods

Contamination (மாசடைதல்)- Spoilage caused by environmental factors like water, dust, air, smoke.

Plasmolysis (கிருமிகளிலிருந்து ஈரப்பதத்தை நீக்குதல்)- Removal of water from the micro organisms

Decay (படிப்படியாக அழிவுறுதல்) - be slowly destroyed

Hazardous (தீங்கு விளைவிக்கக் கூடிய / ஆபத்தான) - dangerous

Edible (உண்ணத்தக்க) - good or safe to eat

Food spoilage (உணவு கெடுதல்) - the condition where food loses its original freshness

Food security (அனைவருக்கும் உணவு கிடைப்பதை உறுதி செய்தல்) - ensuring availability of food to everyone

Microbial decomposition (நுண்ணுயிரிகளின் செயல்பாட்டினால் உணவு மெல்ல மெல்ல அழுகல் நிலையை அடைதல்) - food is spoiled slowly by the action of microbes

Questions

I. Choose the correct answer

1. Food processing helps to increase the food _____
   a. shelf-life c. colour
   b. spoilage d. Taste

2. One of the oldest method in preserving food is _____
   a. refrigeration
   b. sun drying
   c. pasteurization
   d. Irradiation

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3. Plasmolysis is removal of _____
   a. moisture from micro-organism
   b. nutrients from food
   c. fibre from foods
   d. enzymes from food

4. Brine solution is made from _____
   a. salt c. acid
   b. sugar d. alkali

5. Canning involves application of ____
   a. cold temperature
   b. high temperature
   c. freezing temperature
   d. mild temperature

6. Smoking is generally done to preserve _____

a. meat
b. cereals
c. pulses
d. milk

7. Frozen foods are stored for _____

a. 3 months
b. 6months
c. 9 months
d. 12 months or more

8. Milk is pasteurized at _____ temperature for 30 minutes.

a. 62.6^0C
b. 62.7^0C
c. 62.8^0C
d. 62.9^0C

9. Preservation helps to maintain the optimum qualities of food in terms of _____

a. colour
b. texture
c. flavour
d. all the above

10. Removal of microorganisms through usage of membrane is called _____

a. filtration
b. asepsis
c. boiling
d. irradiation

II. Very short answer (2 marks)

1. Why is sodium benzoate used in the place of benzoic acid in jam and jelly preparation?
2. How does addition of sugar act as a preservative? Write two foods where sugar is used as a preservative.
3. Write few examples for pasteurized food. Give the temperature and time used for the same.
4. Heat treatment is given before freezing the food. Why?
5. Write any two methods where osmotic pressure is used to preserve food and how?
6. Freezing helps in preserving the food. Do you agree with the statement? If yes, How?
7. Enumerate the changes that occur in drying process.

III. Answer briefly (3 marks)

1. What is pasteurization? Pasteurization ensures complete safety of the food. Justify the statement.
2. How addition of sodium chloride acts on food to preserve it?
3. Explain the role of chemical preservatives in preserving fruits and vegetables.
4. Use of sugar helps to preserve the food. Prove it with suitable example.
5. List the causes of food spoilage.
6. Write a note on different types of freezing.

IV. Write in detail (5 marks)

1. Low temperature can be used to preserve the food. Suggest a method and explain.
2. When you are preparing jam, knowing about the end point is very important. Enumerate the methods that will help you identify the end point and explain.
3. Canning plays an important role in food preservation. Justify and Explain the procedure for canning vegetables.
4. Freezing is one way of preserving the food. Explain the points to be considered while preserving fruits, vegetables, meat and poultry by freezing.
5. Explain any two types of driers

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