

Title: BASIC PRINCIPLE OF FOOD PRESERVATION

Dear Students, in to-day's lecture, we will discuss about "BASIC PRINCIPLE OF FOOD PRESERVATION" special reference to **causes of food spoilage, preservation methods , drying, smoking, fermentation, ect..** The following points are high lighted,

1. CAUSES OF FOOD SPOILAGE:
2. PRESERVATION METHODS
3. PRESERVATION BY HEATING FOOD
4. ADDING PRESERVATIVE.
5. CONCLUSION

Introduction:

Food Preservation, the term food preservation refers to any one of a number of techniques used to prevent food from spoiling. The following are the general methods of food preservation:

- application of heat, such as canning and preserving, pasteurization, evaporation, sun-drying, dehydration and smoking,
- application of cold, as ill cold storage, refrigeration and freezing,
- the use of chemical substances such as salt, sugar, vinegar, benzoic and lactic acids,
- fermentation, examples being acetic, lactic, alcoholic, etc.,
- such mechanical means as vacuum, filtration and clarification processes, devices or agents for preventing chemical deterioration or bacteriological spoilage (the use of oil, paraffin and water glass are included here),
- Combinations of two or more of the above.

1:CAUSES OF FOOD SPOILAGE:

food spoilage refers to undesirable changes occurring in food due to the action of microorganisms, insects and enzymes, food spoils due to deteriorative changes that occur in it which makes it inedible or harmful. Food changes from the time of harvest catch or slaughter. These changes may result in making the foods unfit for human beings. There are several causes of food spoilage these are

1. **The presence of microorganisms and its growth brings about undesirable changes.** Microorganisms are very minute and cannot be seen with the naked eye, bacteria, yeasts and moulds are the main microorganisms that grow and multiply in the food and spoil it. The activity of these microorganisms is dependent on many factors, such as air, moisture , temperature and concentration of salt, sugar and acids
2. **Unhygienic and improper handling of food:** proper handling of food is very important. Damaged foods spoil faster because their protective coverings are no more intact. The microorganisms enter through the cuts and spoil the food. Microorganism also enter the food when it comes in contact with dirty hands, pots and pans
3. **Action of enzymes present in the food:** enzymes are chemical substance found in all plants and animals. The changes in foods during storage can be produced both by enzymes from microorganisms that contaminate the food. A good example is the ripening of banana in which the enzymes present in the fruit hasten the ripening process. Beyond a certain stage the enzymes can render the fruits soft and unfit to eat. If there is a brownish spot in the fruits yeast could grow and produce enzymes which spoils the fruits all enzymes are inactivated by temperature above 80°C

2:Preservation methods

The various food preserving methods are all designed to reduce or eliminate one or the other (or both) of these causative agents.

For example, a simple and common method of preserving food is by heating it to some minimum temperature. This process prevents or retards spoilage because high temperatures kill or inactivate most kinds of pathogens. The addition of compounds known as BHA (butylated hydroxyanisole) and BHT (butylated hydroxytoluene) to foods also prevents spoilage in another different way. These compounds are known to act as antioxidants, preventing chemical reactions which cause the oxidation of food resulting in its spoilage.

The search for methods of food preservation can be traced to the dawn of human civilization. People who lived through harsh winter seasons found it essential to find some means of insuring a food supply during the time when no fresh fruits or vegetables were available. Evidence for the use of **dehydration** (drying) as a method of food preservation goes back at least 5,000 years. Among the most primitive forms of food preservation that are still in use today are such methods as **smoking, drying, salting, freezing, pasteurization , canning** and **fermenting**.

Early humans probably discovered by accident that certain foods exposed to smoke seem to last longer than those that are not. Meats, fish, fowl, and cheese were among such foods. It appears that compounds present in wood smoke have antimicrobial actions that prevent the growth of organisms causing spoilage. Today, the process of smoking has become a sophisticated food preservation method with both hot and cold forms in use.

3:PRESERVATION BY HEATING FOOD

HEATING FOOD

Heating food is an effective way of preserving it because the great majority of harmful pathogens are killed at temperatures close to the boiling point of water. In this

respect, heating foods is a form of food preservation comparable to that of freezing but much superior to it in its effectiveness. A preliminary step in many other forms of food preservation, especially forms that make use of packaging, is to heat the foods to temperatures sufficiently high to destroy pathogens. In many cases, foods are actually cooked prior to their being packaged and stored. In other cases, cooking is neither appropriate nor necessary.

PASTEURIZATION

The most familiar example of the latter situation is **pasteurization**. During the 1860s, the French bacteriologist Louis Pasteur discovered that pathogens in foods could be destroyed by heating those foods to a certain minimum temperature. The process was particularly appealing for the preservation of milk since preserving milk by boiling is not a practical approach. Conventional methods of pasteurization called for the heating of milk to a temperature between 63 and 65°C for a period of about 30 minutes, and then cooling it to room temperature. In a more recent revision of that process, milk can also be "**flash-pasteurized**" by raising its temperature to about 71°C for a minimum of 15 seconds, with equally successful results. A process known as **ultra-high-pasteurization** uses even higher temperatures, of the order of 90–130°C, for periods of a second or more.

CANNING

One of the most common methods for preserving foods today is to enclose them in a sterile container. The term canning refers to this method although the specific container can be glass, plastic, or some other material as well as a metal can, from which the procedure originally obtained its name. The basic principle behind canning is that a food is sterilized, usually by heating, and then placed within an air-tight container. In the absence of air, no new pathogens can gain access to the sterilized food. In most canning operations, the food to be packaged is first prepared in some way—cleaned, peeled, sliced, chopped, or treated in some other way—and then placed directly into the

container. The container is then placed in hot water or some other environment where its temperature is raised above the boiling point of water for some period of time. This heating process achieves two goals at once. First, it kills the vast majority of pathogens that may be present in the container. Second, it forces out most of the air above the food in the container. The commercial packaging of foods frequently makes use of tin, aluminum, or other kinds of metallic cans. The technology for this kind of canning was first developed in the mid- 1800s, when individual workers hand-sealed cans after foods had been cooked within them. At this stage, a single worker could seldom produce more than 100 canisters (from which the word can later came) of food a day. With the development of far more efficient canning machines in the late nineteenth century, the mass production of canned foods became a reality. Modern machines are capable of moving a minimum of 1,000 cans per minute through the sealing operation.

SMOKING

Hot smoking is used primarily with fresh or frozen foods, while **cold smoking** is used most often with salted products. The most advantageous conditions for each kind of smoking, such as air velocity, relative humidity, length of exposure, and salt content are now generally understood and applied during the smoking process. Nowadays, many alternative forms of preservation are available that smoking no longer holds the position of importance it once did with ancient peoples. More frequently, the process is used to add interesting and distinctive flavours to foods.

DRYING

Because most disease-causing organisms require a moist environment in which to survive and multiply, drying is a natural technique for preventing spoilage. Leaving foods out in the sun and wind to dry out is probably one of the earliest forms of food preservation. Evidence of the drying of meats, fish, fruits, and vegetables also go back to the earliest recorded human history. At some point, humans learned that the drying process could be hastened and improved by various mechanical techniques. For

example, the Arabs learned early on that apricots could be preserved almost indefinitely by macerating them, boiling them, and then leaving them to dry on broad sheets. The product of this technique, quamaradeen, is still made by the same process in modern Muslim countries.

Today, a host of dehydrating techniques are known and used depending on the properties of the food which is being preserved. Modern drying techniques make use of fans and heaters in controlled environments. Controlled temperature air drying is especially popular for the preservation of grains such as maize, barley, and bulgur.

Vacuum Drying

Vacuum drying is a form of preservation in which a food is placed in a large container from which air is removed. Water vapor pressure within the food is greater than that outside of it, and water evaporates more quickly from the food than in a normal atmosphere. Vacuum drying is biologically desirable since some enzymes that cause oxidation of foods become active during normal air drying. These enzymes do not appear to be as active under vacuum drying conditions, however. Two of the special advantages of vacuum drying are that the process is more efficient at removing water from a food product, and it takes place more quickly than air drying.

Spray Drying

Spray drying is the process during which concentrated solution of coffee in water is sprayed through a disk with many small holes in it. The surface area of the original coffee grounds is increased many times, making dehydration of the dry product much more efficient.

FREEZE-DRYING

Freeze-drying is a method of preservation that makes use of the physical principle known as sublimation, the process by which a solid passes directly to the gaseous phase without first melting. Freeze-drying is a desirable way of preserving food because at low temperatures (commonly around -10°C to -25°C) chemical reactions take place very slowly and pathogens have difficulty surviving. The food to be preserved by this method is first frozen and then placed into a vacuum chamber. Water

in the food freezes and then sublimates, leaving the moisture content in the final product of as low as 0.5%.

FREEZING

Freezing is an effective form of food preservation because the pathogens that cause food spoilage are killed or do not grow very rapidly at reduced temperatures. The process is less effective in food preservation than are thermal techniques such as boiling because pathogens are more likely to be able to survive cold temperatures than hot temperatures. One of the problems surrounding the use of freezing as a method of food preservation is the danger that pathogens deactivated (but not killed) by the process will once again become active when the frozen food thaws. Because of differences in cellular composition, foods actually begin to freeze at different temperatures ranging from about -0.6°C for some kinds of fish to -7°C for some kinds of fruits.

The rate at which food is frozen is also a factor, primarily because of aesthetic reasons. The more slowly food is frozen, the larger the ice crystals that are formed. Large ice crystals have the tendency to cause rupture of cells and the destruction of texture in meats, fish, vegetables, and fruits. In order to deal with this problem, the technique of quick-freezing has been developed. In quick-freezing, a food is cooled to or below its freezing point as quickly as possible. The product thus obtained, when thawed, tends to have a firm, more natural texture than is the case with most slow-frozen foods.

FERMENTATION

Fermentation is a naturally occurring chemical reaction by which a natural food is converted into another form by pathogens. It is a process in which food spoils, but results in the formation of an edible product. Perhaps the best example of such a food is cheese. Fresh milk does not remain in edible condition for a very long period of time. Its pH is such that harmful pathogens begin to grow in it very rapidly. Early humans discovered, however, that the spoilage of milk can be controlled in such a way as to

produce a new product, cheese. Bread is another food product made by the process of fermentation. Flour, water, sugar, milk, and other raw materials are mixed together with yeasts and then baked. The addition of yeasts brings about the fermentation of sugars present in the mixture, resulting in the formation of a product that will remain edible much longer than will the original raw materials used in the bread-making process.

4: ADDING PRESERVATIVES

The majority of food preservation operations used today also employ some kind of chemical additive to reduce spoilage. Some familiar examples of the former class of food additives are sodium benzoate and benzoic acid; calcium, sodium propionate, and propionic acid; calcium, potassium, sodium sorbate, and sorbic acid; and sodium and potassium sulfite. Examples of the latter class of additives include calcium, sodium ascorbate, and ascorbic acid (vitamin C); butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT); lecithin; and sodium and potassium sulfite and sulfur dioxide. A special class of additives that reduce oxidation is known as the **sequestrants**. **Sequestrants** are compounds that "capture" metallic ions, such as those of copper, iron, and nickel, and remove them from contact with foods. The removal of these ions helps preserve foods because in their free state they increase the rate at which oxidation of foods takes place. Some examples of sequestrants used as food preservatives are ethylenediamine-tetraacetic acid (EDTA), citric acid, sorbitol, and tartaric acid.

. SALTING

The precise mechanism by which salting preserves food is not entirely understood. It is known that salt binds with water molecules and thus acts as a dehydrating agent in foods. A high level of salinity may also impair the conditions under which pathogens can survive. The value of adding salt to foods for preservation has been well known for centuries. Sugar appears to have effects similar to those of salt

in preventing spoilage of food. The use of either compound (and of certain other natural materials) is known as curing. A desirable side effect of using salt or sugar as a food preservative is, of course, the pleasant flavour each compound adds to the final product. Curing can be accomplished in a variety of ways. Meats can be submerged in a salt solution known as brine, or the salt can be rubbed on the meat by hand. The injection of salt solutions into meats has also become popular. Curing is used with certain fruits and vegetables, such as cabbage (in the making of sauerkraut), cucumbers (in the making of pickles), and olives. It is probably most popular, however, in the preservation of meats and fish.

SUGAR

sugar is used as a preservative, these are jams, jellies, squashes. Like in pickle, chatni, etc., sugar is added to these foods not only for taste but also as a preservative. The proportion of sugar has to be correct to protect them from spoiling. The sugar dissolves in the water avail. This results in less water being available for the growth of micro-organisms. Hence the food becomes safe.

ACIDS

These are lemon juice, vinegar, citric acid, etc. Vinegar is used to preserve onions, tomato ketchup; lemon juice is used in pickles; citric acid is used in squashes. Acids increase the acidic content of food items, thus preventing the activity and growth of micro-organisms.

OILS AND SPICES

Oils and spices are used as preservatives in pickles. mustard powder is one of them. It prevents the growth of micro organisms, thus preventing spoilage, oil is poured to cover the mango, lemon or other vegetables which are being pickled. The oil acts as a protective covers to prevents contact of micro-organisms with the food, and prevents contact of air with food, hence the micro organisms cannot grow and spoil the food

5: Conclusion

The spoilage of food may be caused during mechanical handling, processing, packaging, storing and transportation. Appropriate care has to be exercised to prevent

deterioration of quality of food. Several methods are available for preservation of food based on the above principles, the method include:

- Preventing the accessibility of food to microorganism by asepsis and packaging
- Hindering the growth and activity of microorganism by use of preservatives
- Killing the microorganism by use of high temperature and ionizing radiation
- Inactivation of endogenous enzymes by moderate heating
- Inhibition of chemical reaction through the use of chemical additives

Food preservation as it is practiced in the industry always involves the use of combination of methods for achieving maximum effectiveness. Asepsis or preventing the accessibility of food to microorganisms is well exemplified in nature, the protective covering in natural foods such as skins on fruits and vegetables, shells on eggs and nuts and skins and membranes on livestock and fish prevent the attack by microorganisms and maintain the living tissues in healthy condition. Microbial attack is facilitated only after the death of the animal or when the skin is physically damaged. Packaging of foods and food products in a variety of materials such as metal cans, plastic films pouches, bags or boxes, paper bags or cartons and glass bottles provide effective protection against microbial attack. Filtration or centrifugation is adopted to physically remove microorganisms particularly in liquid foods such as milk, soft drinks, fruits juices and alcoholic beverages such as wine and beer.

Food preservation has become an increasingly important component of the food industry as fewer people eat foods produced on their own lands, and as consumers expect to be able to purchase and consume foods that are out of season.