FOOD PROCESS ENGINEERING.-I

FOR

DIPLOMA STUDENTS

Prepared By : Mrs.Sriya suman Patro(Lect. FT)

What is Food Preservation? / define food preservation

Food preservation is the process of preventing food spoilage, food poisoning, or microbial contamination.

Food preservation is one way to prevent food from microbial growth. We cover the food with lids after it is prepared to protect it from insects and flies. We are protecting the food from any possible infection by insects. This is temporary. Food preservation is used to preserve food for a longer period of time.

Here are some important goals of food preservation.

- To prevent microbial contamination.
- To kill pathogens.
- To minimize food poisoning and food spoilage.

Methods of Food Preservation

These are the main methods for food preservation:

- Asepsis is the prevention of microorganisms.
- Elimination of microorganisms
- Maintain anaerobic conditions in sealed and evacuated containers.
- High temperatures are not recommended.
- Low temperatures are recommended.
- Drying: This includes the binding up of water with hydrophilic colloids or solutes.
- Chemical preservatives can be either added or developed by microorganisms.
- Irradiation.
- Microorganisms can be mechanically destroyed, such as by grinding or high pressures. (Not used in industry).
- Combinations of more than one of the methods. A single method is rarely effective. Usually, several methods are combined. Cans are preserved, for example, by heating them in a sealed, evacuated can. Preservatives that are used together have a lower need for intensity than those required to preserve food by just one agency. For sterilization, benzoate and sorbate are used in fruit juices with less heat. Each ingredient can be added at a lower level to catsup, pickles or relishes if it contains sugar, vinegar, and salt. Foods that have been previously sterilized by gamma radiation or

antibiotic tylosin need less heat to sterilize than those not treated. In the following chapters, you will find many more examples.

Principles of food preservation – What are the principles of food preservation?

During performing the preservation of foods by the different methods, the following principles are

applied:

1. Preventing or delaying microbial degradation
    1. By keeping microorganisms out (asepsis).
    2. Filtration to remove microorganisms
    3. You can stop the growth or activity of microorganisms by using low temperatures, drying, anaerobic conditions, or chemicals.
    4. You can also kill them by heat or radiation
2. Preventing or delaying the self-decomposition
    1. Food enzymes can be destroyed or inactivated, e.g. by blanching
3. Prevention of damage caused by insects, animals, or mechanical causes.

Most microorganisms can be controlled using methods that are resistant to chemical reactions or enzymatic activity in food. Autodecomposition can be continued by using low temperatures and drying methods unless you take special precautions. Most vegetables are heated to activate their enzymes before they are frozen.

1. Food preservation by Delay of Microbial Decomposition

Many common methods of food preservation depend not on the destruction or removal of Most common methods for food preservation do not depend on the destruction of microorganisms, but rather on delay in the initiation and hindrance to it once it has started.

Food preservation, i.e. prevention of spoilage, is especially important. This can be achieved by extending the lag phase as much as possible and the phase of acceleration as much as you can. You can do this in many ways.

- To introduce as few spoilage organisms (i.e., to reduce the amount of contamination) as possible. The lag phase will be longer if there are fewer organisms.

- Avoid the addition of active growing organisms (from logarithmic growth). These organisms could be found in unclean containers, equipment, and utensils, which come into contact with food.
- One or more adverse environmental conditions, such as unfavorable food, humidity, temperature, pH, O-R potential, and presence of inhibitors. The more adverse the conditions, the lengthier the delay of the initiation of growth.

The generation time of organisms can be calculated from the growth curve. This is the time between the formation of a cell in a mother cell and the division of that cell into two new cells. The logarithmic growth phase will have the shortest generation time. However, it will vary depending on the environment during growth (e.g., type of food, temperature, O Rpotential, available moisture and presence of inhibitors). As conditions become more favorable, the generation time decreases and becomes longer. Any environmental change that extends the generation time will also increase the food's shelf life. For example, a drop in temperature will increase the generation time and thus the keeping time. If we start with one cell and it divides every 30 minutes, there will be approximately I million cells within 10 hours. However, only 1,000 cells can be created if the generation takes 60 minutes and 32 cells if it takes 120 minutes. This highlights the importance of not contaminating food with microorganisms in the logarithmic growth phase. When their generation time is shorter, multiplication will occur at its fastest rate.

2. Food preservation by Prevention of Microbial Decomposition

- Food spoilage organisms must be killed or removed to prevent microbial decomposition.
- However, stopping microorganism multiplication does not prevent their decomposition. Viable organisms and their enzymes can still be active.
- In most cases, it is easier to kill microorganisms with smaller numbers than with larger ones. This reaffirms the importance and danger of contamination.
- It is especially important to introduce or build up microorganisms that are resistant to the lethal agent, such as heat-resistant bacteria spores, when food is to be heated.
- In their logarithmic growth phase, vegetative cells of organisms are less resistant to lethal agents. However, they are more resistant during their later lag or maximal stationary growth phase.

3. Food preservation by Asepsis

- Healthy plants and animals have healthy inner tissues that are usually free of microorganisms. If they do exist, it is unlikely that they will cause spoilage.
- Microbial decomposition can be delayed or prevented if there is a protective coating around the food.
- These coverings include the shells and skins of nuts, fruits, and vegetable skins, husks, and ear corn husks, eggs shells and skin, and membranes, and fats on meat and fish.
- Only when the protective layer has been removed or the decomposition has spread to the outer surface, inner tissues can be subject to microorganisms' decomposition.
- Food industries are paying more attention to preventing food contamination, starting from the raw material and ending with the final product.
- Food technologists are concerned about the "bioburden" or microorganisms in food. They consider both types and numbers. These types are crucial because they can include spoilage organisms, desirable microorganisms in food fermentations, and even pathogenic microorganisms.
- The counts of microorganisms are significant because the more spoilage organisms there are, the more probable food spoilage will be, the more challenging will be the protection of food, and the more probably will be the existence of pathogens.
- Bioburden can be caused by contamination, growth, or both.
- Many types of food are judged by their microorganisms.
- Here are some examples that illustrate the importance of aseptic techniques in the food industry.
    - Asepsis is used extensively to package foods. You can choose from loose wrapping or wrapping that prevents contamination, or a sealed can of canned foods. If tightened, it protects the contents from microorganisms.
    - The dairy industry strives to avoid contamination by microorganisms in the production and processing of milk for market and other purposes. The quality of milk is determined by its bacterial content.
    - The bioburden (or load) of microorganisms in the canning industry determines the temperature necessary to preserve a food. This is especially true if there are heat-resistant spoilage organisms such as

spore-forming thermophiles. After heat treatment, the sealed can stops recontamination.
- The meat-packing industry uses sanitary methods for handling, processing, and slaughtering meats to reduce their weight and improve the quality of meat and other meat products.
- Controlled food fermentation, such as cheese manufacturing, is more successful if there are fewer competing organisms.

4. Removal Of Microorganisms

Although it is generally not effective for food preservation, the removal of microorganisms can be beneficial under certain conditions. You can remove microorganisms by washing, filtration, centrifugation, clarification, washing, trimming, and/or sedimentation.

- **Filtration**: This is the only method that can completely remove organisms. Filtering the liquid through a sterilized "bacteriaproof", filter is done using sintered glass, diatomaceous Earth, unglazed porcelain, membrane pad, or another material. The liquid is then forced through the filter by either positive or negative pressure. This technique has been proven to work well with water, fruit juices, and soft drinks.
- **Washing raw foods:** While it can help preserve them, washing raw foods may prove to be hazardous under certain conditions. Washing cucumber heads and cabbage heads before they are fermented into sauerkraut or pickles removes most soil microorganisms. This increases the number of beneficial lactic acid bacteria and the overall flora. Fresh fruits and vegetables can be washed to remove soil organisms that might be resistant to heat during canning. It is essential to remove all organisms from food contact equipment. Then, germicidal treatment is performed on the apparatus. If the water is contaminated with spoilage organisms, or if it contains high levels of moisture, washing foods can be hazardous.
- **Trimming**: This is essential from a legal standpoint and can help in food preservation. Even though large quantities of spoilage organisms can be removed this way, it is possible for food to become contaminated. For the production of sauerkraut, it is recommended to trim the outer leaves from cabbage heads.

5. Maintenance Of Anaerobic Conditions

- Anaerobic conditions within the container may be a preservative factor for sealed and packaged foods.

- Anaerobic conditions can be achieved by a complete fill, the evacuation of any unfilled space (the head space inside a can), and the replacement of the air with carbon dioxide or an inert gas like nitrogen.
- Spores from some aerobic sporeformers may be resistant to heat. They can survive in canned foods, but they are unable to germinate in absence of oxygen.
- The production of carbon dioxide through fermentation and its accumulation at the surface will make the environment anaerobic and stop the growth of microbes.