Introduction to Food Science and Engineering

Food Spoilage

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Food spoilage

Food Fit For Consumption (Fitness of food):

Definition: A food product is fit for consumption if a discriminating consumer with knowledge of the details of its production eats it on seeing the material itself. Conversely, the food is considered spoiled and unfit for consumption when such a consumer refuses it as food.

- Thus, the definition of fitness of food seems to be based on the visual characteristics of the food and the personal judgment of consumers. **However, There are certain criteria universally accepted for assurance of fitness of a food which are as:**

a. The desired stage of development or maturity: fruits and vegetables should be at certain stages of maturity or ripeness. Poultry meat should be preferably from young birds.

b. Freedom from contamination: Food must be free from contamination by flies, rodents, or insects. Dirty equipment and diseased workers are not acceptable.

c. Freedom from unacceptable changes in food: Food should be free from undesirable chemical changes that occur due to environmental factors such as prolong exposure to air, or oxygen or fluctuations in temperature and humidity.

Causes Food spoilage

Causes of Food Spoilage:

Food is mostly subjected to Physical, Chemical and Biological changes and these cause the deterioration in the quality and ultimately the spoilage of food. In addition, 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.

The major causes of food spoilage include:

1. Activity and growth of microorganisms,
2. Activity of endogenous enzymes,
3. Chemical reactions of the constituents of food,
4. Invasion and spoilage by insects and rodents,
5. Environmental factors such as temperature, moisture, air and light, and
6. Time

Activity and Sources of Microorganisms

Activity of food spoiling microorganism: Microorganisms when come contract to fresh foods, they infect and spoil the foods through multiplying themselves.

Sources of food spoiling microorganism: Microorganisms that usually spoil foods are available in the following sources:

- In Soil, Water and Air.
- On the skins of cattle, fruits and vegetables.
- On the feathers of poultry.
- On the hulls of grains and shells of nuts.
- On the clothing and skin of handling personnel.
- On processing equipment.
- Within the intestines and body cavities of animal and human body.
- Most raw foods also contain a variety of bacteria, yeasts and molds.

Prevention of Activity of Microorganisms

Prevention of activity of microorganism:

Most of the preservative methods aim at controlling the growth and activity of spoilage and pathogenic microorganisms. This may be achieved:

1. by eliminating contaminated raw food materials.
2. by the use of high temperature (e.g. pasteurization), chemicals, or radiation to kill the organisms.
3. by storing the food at low temperatures (e.g. refrigeration),
4. By removing of moisture through evaporation or drying, and
5. by checking the hygienic conditions at different stages of food processing.

Action of Native Enzymes

The activity of the endogenous enzymes in plant and animal foods is often intensified after harvest or slaughter due to lack of control mechanism.

- For example, pepsin in a living animal helps in the digestion of protein but does not affect the intestine itself but when the animal is dead, pepsin does contribute to proteolysis (breakdown of proteins or peptides into amino acids) of the organs containing it.
- Similarly, uncontrolled ripening of vegetables and fruits results in their spoilage.

Prevention of activity of native enzymes: The native enzymes may be inactivated by heat (e.g. blancing), radiation or by the use of specific chemicals.

Insects, Parasite and rodents

- **Insects** destroy cereals, fruits and vegetables by consuming as well as by contaminating them. They also facilitate microbial attach on foods.
- **Parasites** enter the human body mostly through poultry which have been improperly cooked.
- **Rodents** apart from consuming considerable quantity of food also contaminate the food through their droppings, urine and filth. Rodents are also carriers of pathogenic bacteria.
- **Prevention:** Fumigation of stored plant foods with chemicals such as methyl bromide and ethylene oxide is carried out to control the insects.

Chemical Reaction

Chemical Reactions: The quality of foods deteriorate due to chemical reactions of the constituents of food.

- The unsaturated fatty acid components undergo oxidation due to exposure to atmospheric air giving rise to oxidative rancidity in fat rich foods.
- Free fatty acids may also be released due to hydrolytic reactions causing odor as well as undesirable changes in the texture of food.
- Losses of vitamins due to oxidation or light induced reactions also occur.
- **Prevention:** Heating foods at high temperature after harvesting or slaughtering destroy bacteria but enhances chemical reactions. So, reducing temperature in the best way to prevent chemical reaction. Thus, storing foods in cold storage or in refrigerator will reduce the chemical reactions.

Environmental Factors

Environmental factors which affect the quality of food include temperature, moisture, humidity, air and light.

Temperature: Excessive heat denatures proteins, break emulsions, destroys vitamins, enhances the rates of chemical as well as enzymatic reactions and dries out food by removing moisture. On the other hand excessive cold also spoil foods. The texture of fruits and vegetables allow to freeze and thaw is disrupted. Uncontrolled freezing also spoils liquid foods. Thus milk tends to curdle and loses protein due to denaturation and the emulsion breaks separating the fat.

Moisture and humidity: Surface moisture causes lumping and caking of granular foods. Condensation of moisture on the surface of the food facilitates the growth and activity of microorganisms. Even in moisture proof packages, fruits and vegetables give off moisture from respiration and transpiration sufficient to support the growth of microorganisms.

Environmental Factors (Contd.)

- **Air and oxygen:** Air and oxygen can have detrimental effect on vitamins A and C, food colour, flavour and other food constituents. Air facilitates oxidation reaction and it favours the growth of aerobic organisms particularly molds.
- **Light:** Light destroys riboflavin, vitamins A and C and also promotes light induced oxidation reactions affecting flavour and colour of foods. Light also causes destruction of proteins as in the case of milk.

Environmental Factors (Contd.)

Time: The quality of food remains at its peak for some time soon after its harvest or slaughter and thereafter as time progresses, the deterioration in the quality of the food also progresses.

There are two options for maintaining food quality:

1. Keep the food alive as long as possible, till required. Similarly, fruits and vegetables may not be plucked till required.
2. The harvested or slaughtered food must be cleaned and cooled immediately. This delays the onset of deterioration of food quality but does not prevent it.

The End