7 Food Spoilage

Contents

Most of the natural foods have a limited shelf life. Some foods such as fish, meat, milk, bread, tomatoes, etc have a short life span as they contain high amount of moisture. Other foods are kept for a considerably longer time (low moisture food) but may get decomposed eventually. Once food has been harvested, gathered or slaughtered, it starts to deteriorate until it becomes unfit for consumption. This deterioration is known as decay and leads to food spoilage.

Spoilage is the process in which original nutritional value, texture, flavour, etc. of food are damaged, such food ultimately becomes unacceptable for consumption. Hence, it is essential to process or preserve foods after harvesting or slaughtering to combat the problem of food spoilage.

Definition :

"Food spoilage is the process of change in physical, chemical, microbial and sensory properties of the food so that it becomes unfit for human consumption. Food spoilage is any undesirable change in food and such changes can be detected by smell, taste, touch or sight".

7.1 Classification of food on the basis of spoilage:

Food commodities can be classified into three groups on the basis of moisture content as perishable foods (high level of moisture), semi-perishable foods (medium level of moisture) and non-perishable foods (low moisture).

1. Perishable foods

Perishable foods are those likely to spoil, decay or rot quickly so that they become unsafe for consumption unless special preservation methods are used. Perishable commodities usually require some sort of refrigerated storage. Perishable foods include dairy products, eggs, meat, fish, poultry, fruits and vegetables, cooked foods and leftovers.

2. Semi-perishable foods

Semi-perishable foods are those that do not require refrigeration, having medium level of moisture but still have a limited shelf life. They include foods like potatoes, apples, onions, etc.

3. Non-perishable foods

Foods that do not spoil under normal storage conditions for a reasonably long time (contain low moisture) are known as non-perishable foods. These foods have long shelf life and don't require refrigeration. These items are usually kept under dry and cool storage conditions and are protected from moisture e.g. grains, flour, sugar, pulses, toast, biscuits, etc.

7.2 Signs of food spoilage:

Food deterioration is manifested by the reduction in aroma, flavour, texture and nutritional values of foods. Different types of undesirable changes may occur due to spoilage in food are listed as follows:

- **Change in colour:** The fruits like banana turn black after storing for a long period of time and reduce the acceptability of food. (black, soft and fermented)
- **Change in smell:** Rancid smell of spoiled oils, fatty food, bitter smell of curd or sour smell of starchy food. (rancid *samosa, potato wada, chakali, etc.)*
- **Change in consistency:** Curdling of milk, stickiness and undesirable viscosity in spoiled cooked *dal, curries* and vegetables (thread, foam, bubbles).
- **Change in texture:** Some vegetables like potato, brinjal, carrot, etc. undergo too much softening leading to rotting, changes in firmness. Lump formation take place in powdered materials (milk powder, wheat flour).
- **Change due to mechanical damage:** Mechanical damages such as eggs with broken shells, bruising of fruits and vegetables during harvesting, packaging transportation and handling, causes damage.

These gradual changes that cause deterioration and decay (rotting) in foods may occur due to certain organisms and chemicals present in the food and outside the food.

7.3 Factors affecting food spoilage:

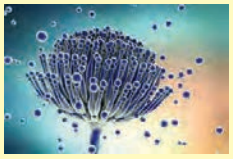
Food spoilage may occures mainly due to one or more of the following factors;

a. Microorganisms

The microorganisms that can cause food-borne illness are called pathogenic microorganisms. These microorganisms grow best at room temperatures, but most do not grow at refrigerator temperatures. Pathogenic microorganisms may grow in foods without any noticeable change in odour, appearance or taste. When food spoilage microorganisms are present, the food usually looks and/or smells

Table 7.1 : Different microorganism, their characteristics and food susceptible to it.

Micro-organism	Characteristics	Examples of Organisms	Commodities Susceptible to Spoilage
Bacteria  *(Pseudomonas)*	- Round, rod or spiral shaped - Grow under wide variety of conditions - Spore or Non-spore forming	*Staphylococcus aureus,* *Escherichia coli, Clostridium Botulinum* *Pseudomonas, Salmonella*	Meats, Milk, Eggs
Yeasts  *(Saccharomyces)*	- Uni-cellular fungi produced by budding - Produces bubbles on food surface	Zygosaccharomyces, *Saccharomyces, Candida*	Fresh and processed fruits, Vegetables, Dairy products, Fermented alcoholic beverages

Moulds  (*Aspergillus*)	- Multi-cellular, filamentous fungi - White cottony appearance - Some moulds produces mycotoxins - Spoilage occurs in field or storage	*Penicillium* *Alterneria species* *Aspergillus niger* *Aspergillus flavus*	Animal products (Meat, egg, fish) Fruits and Vegetables Cereals, nuts and their products

unpleasant. These microorganisms include bacteria, yeasts and moulds.

b. Enzymes

Enzymes are proteins in nature and they acts as biocatalyst in chemical reactions. They are responsible for spoilage in fruits and vegetables that causes changes in texture, color and flavour e.g., softening of banana tissues, browning of cut apple.

c. Air

Oxidation is a chemical process that produces undesirable changes in colour, flavour, texture and nutritional content of food. e.g. rancidity, discoloration of light-colored fruits and loss of vitamin C.

d. Light

Light exposure could result in loss of colour and vitamin. Light also may be responsible for the oxidation of fats.

e. Insects and rodents

These creatures require food to survive, therefore they damage packed and stored food making it more vulnerable to further deterioration.

f. Physical damage

Bruises, cuts and cracks on raw produce (fruits and vegetables) cause due to mishandling where microorganisms can grow easily and leads to spoilage. Dented cans, improper and broken packages provide places for microorganisms, air, light and creatures to enter into it easily.

g. Temperature

At higher temperatures food will get deteriorated at faster rate. Microorganisms, will grow rapidly at room temperature. At this temperature the growth of microorganisms, chemical reactions, biochemical reactions, metabolic reactions (ripening, respiration and transpiration) increases the rate of spoilage.

Do You Know?

Water is an essential component of all foods, even dry foods items like flour also contains water. Water or moisture greatly affects the keeping qualities of food. Moisture can absorb on the surface of a product and can cause many food defects like moulding, sogginess, caking and lumping of dry products. Water in foods can be controlled by drying, freezing, concentration, packaging, etc.

h. Time

Microorganisms require optimum time and favourable atmosphere to grow and multiply. Under favourable conditions such as temperature, moisture, pH, gas, concentration, microorganisms grow rapidly and thereby cause food spoilage and illness.

7.4 Prevention of food spoilage:

Various methods can be used to prevent, delay or otherwise reduce food spoilage.

- A food rotation system uses the first in first out method (FIFO), which ensures that the first item purchased is the first item consumed.
- Manipulation of factors controlling the conditions required for microbial growth and enzyme action viz. temperature,

moisture, air and pH other than the food itself can help to prevent food spoilage.

- The key for preventing food spoilage is to store food at proper conditions.
- Enzymes and microorganisms get inactivated by heat and chemical treatment.
- Using modern techniques of preventing food spoilage such as canning, pasteurization, irradiation, aseptic packaging, modified atmospheric packaging, vacuum packaging, nitrogen flushing, high pressure processing etc.

Activity

Keep some fresh food items such as tomatoes, mangoes, oranges, banana, etc. on the kitchen shelf for about three to five days and then observe what happens to them. List and describe the signs of deterioration on each food item.

Discussion: You will realize that their appearance, smell, texture and taste might have changed. Some of them will be covered with a whitish and blackish substance. All these signs will indicate that these foods are not wholesome since they are contaminated.

Points to remember

- Food spoilage is a naturally occurring process in which food deteriorates to the point at which the food becomes unfit for consumption.
- Food gets spoiled due to physical, chemical and microbial degradation resulting in development of off-flavours or the textural changes leading to rejection of food.
- Food spoilage can be prevented by using various food preservation techniques.

Exercise

Q.1 (a) Select the most appropriate option:

i. The microorganisms that can cause food-borne illness are known as _____ microorganisms.
(Pathogenic, Non-pathogenic, Aerobic)

ii. _____ is the process of change in the physical and chemical properties of the food so that it becomes unfit for consumption.
(Food spoilage, Food processing, Food preservation)

iii. A food rotation system _____ ensures that the first item purchased is the first item consumed.
(FIFA, FIFB, FIFO)

iv. Food spoilage related to white cottony appearance on food products is due to _____.
(Bacteria, Mould, Yeast)

(b) Match the following:

A	B
i. Perishable	a. Round, rod and spiral shape
ii. Semi-perishable	b. Unicellular fungi
iii. Non-perishable	c. Multicellular
iv. Bacteria	d. Meat and Fish
v. Yeast	e. Apple
vi. Moulds	f. Grains
	g. Oxidation

(c) State whether the following statements are true or false:

i. Most of the natural food have a limited shelflife.

ii. The microorganism that can cause food born illness are called non-pathogenic microorganisms.

iii. Enzymes are not bio-calalyst.

iv. Meat is a non-perishable product.

Q.2 Answer in brief

i. Give examples of Perishable foods.

ii. Give examples of Non-perishable foods.

Q.3 Short answer questions

(a) Define the term

i. Food spoilage

ii. Perishable foods

iii. Semi-perishable foods

iv. Rancidity

(b) Enlist factors affecting food spoilage.

Q.4 Long answer questions

i. Describe food spoilage and explain the causes of food spoilage.

ii. How can we prevent food spoilage?

iii. Discuss the signs of food spoilage.

❖ Project :

Identify reasons and characteristics of food spoilage in five food commodities.