

**Paper No.: 03**

**Paper Title: FOOD MICROBIOLOGY**

**Module-22 : Fruits and Vegetable Spoilage**



# INTRODUCTION

- ❑ Fruits and vegetables are rich source of energy, body-building nutrients, vitamins and minerals.
- ❑ Protected mechanically by the pectins which constitute a protective gum between the cells and gives firmness.
- ❑ Spoilage in fruits and vegetable starts with the hydrolysis of the pectin. Once the pectinases have damage the structure of the fruit/vegetable, other organisms start to contribute to the soft rot.
- ❑ Majority of the microorganisms in vegetables are saprophytes, such as lactic acid bacteria, *coryniforms*, *coliforms*, *micrococci*, spore-formers, and *pseudomonas*, which may be from the air, soil, and water.
- ❑ The fungus namely *Aureobasidium*, *Fusarium*, and *Alternaria*, are also commonly present but lower in number as compare to bacteria.

# BASIC TYPES OF SPOILAGE

## ❑ On the basis of appearance:

- Microbial growth
- Change in food colour

## ❑ Textural change

- Slime formation
- Tissue softening

## ❑ Changes in taste and odor

- Development of nitrogenous compounds
- Organic acids
- Sulfides



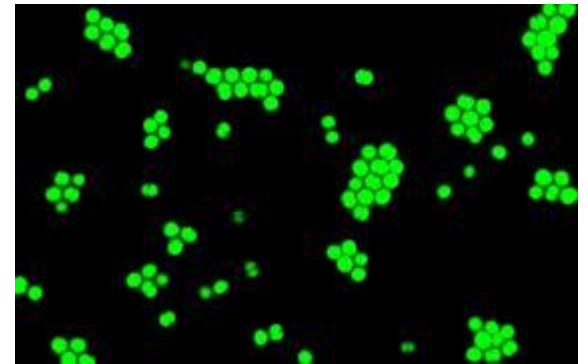
# CAUSATIVE MICROBES

## ❑ Saprophytic microorganisms :-

- *P. fluorescens*
- *E. agglomerans*
- *E. herbicola*

## ❑ Pectinolytic microorganisms :-

- *P. fluorescens*



- *P. paucimobilis*
- *P. viridiflava*
- *P. luteola*
- *Xanthomonas maltophila*
- *Flavobacterium* spp.

❑ **Food borne pathogens :-**

- *Listeria monocytogenes*
- *Salmonella poona*
- *Shigella* spp.
- *S. aureus*



➤ *C. botulinum*

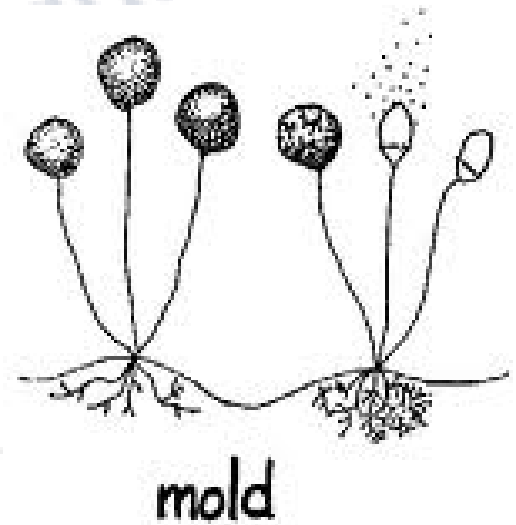
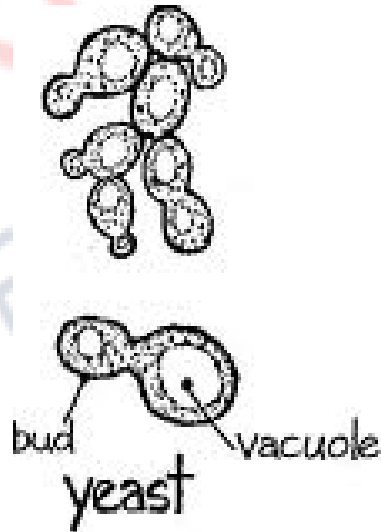
❑ **Yeast and molds :-**

➤ *Basidiophora*

➤ *Peronospora*

➤ *Phytophthora*

➤ *Plasmopara*





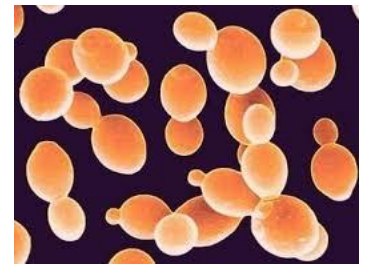
# FACTORS AFFECTING MICROBIAL GROWTH

## □ In Fruits :-

- Due to ripening cell wall weakens and the amounts of antifungal chemicals in fruits decreases.
- Physical damage during harvesting causes breaks in outer protective layers of fruits that spoilage organisms can exploit.



- High levels of sugar and a low pH in fruits juices generally favours growth of yeasts, moulds and acid-tolerant bacteria.
- *Saccharomyces* and *Zygosaccharomyces* are resistant to thermal processing and are found in some spoiled juices.





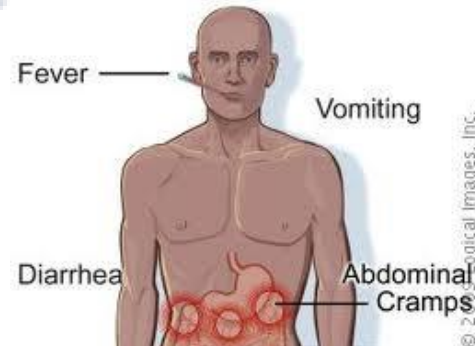
## □ In Vegetables :-

- Bacterial spoilage start with softening of tissues as pectins are degraded and the whole vegetable finally become slimy mass.
- The higher moisture content of vegetables as compared to grains allows different fungi to proliferate, but some species of *Aspergillus* attack onions.



# DISEASES CAUSED

- **Salmonellosis** :- This disease is caused by *Salmonella spp.*. Salmonellosis can be caused due to contaminated fruits and vegetables like bean sprouts, tomatoes, melons, unpasteurised orange juice.



- **Shigellosis** :- Caused due to *Shigella*. This disease is caused due to Lettuce, vegetable salad, potato salad containing spring onion, sliced raw papaya, watermelon.

□ **Campylobacter enteritis :-**

*Campylobacter jejuni* is the major causative agent . Person suffering from this disease develops fever, abdominal cramps, nausea, vomiting and watery diarrhoea.

- **Yersiniosis :-** *Yersinia enterocolitica* is the causative organism of Yersiniosis. Incidence of *Yersinia* is higher on root and leafy vegetables than on tomatoes or cucumbers



- **Listeriosis :-** Caused by *Listeria monocytogenes* . It can grow on endive, lettuce, tomatoes asparagus, broccoli, cauliflower and cabbage.



- **Botulism :-** *Clostridium botulinum* is the causative organism. It causes fatal paralysis of muscles. It is caused due to botulinum toxin.



- **Norwalk-like gastroenteritis** :- Caused due to norwalk like viruses. Illness is characterized by acute onset of nausea, vomiting, abdominal cramps, and diarrhoea.



# PRESERVATION METHODS

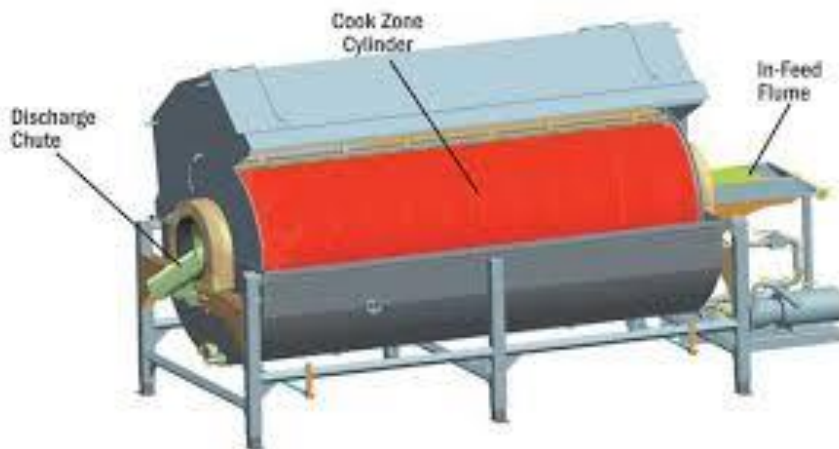
## □ Use of acidulants :

- **Lactic acid** :- Due to production of this acid pH decreases to levels unfavourable for growth of spoilage organisms such as putrefactive anaerobes and butyric-acid-producing bacteria.
- **Acetic Acid** :- A common preservative, acetic acid inhibit the growth of many species of bacteria, yeasts and to a lesser extent moulds.



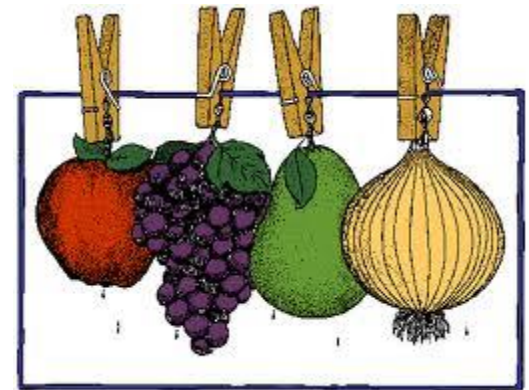


- **Other Acidulants :-** Ascorbic acid , malic, tartaric acid are commonly used preservatives. Citric acid is naturally prevalent in citrus fruits. But, it is a less effective antimicrobial agent as compared to other acids.
- ❑ **Scalding or blanching in hot water :-** Blanching of fruits, fresh vegetables and root vegetable pieces carried out by immersed in a bath containing hot water (or boiling water) for 1-10 minutes at 91-99°C.



## □ Drying fruits and vegetables :

- **Natural sun drying :-** . The temperature should remain around  $29.4^{\circ}\text{C}$ , and the level of humidity should be less than 60%.
- **Drying with a food dehydrator**
- **Oven drying :-** Oven drying of food carried out at  $60^{\circ}\text{C}$ .



## □ Pasteurizing sun dried fruits :

- To pasteurize with heat, place dried food evenly in shallow trays no more than 1 inch in depth. Fruits should be heated at 71.1°C for 30 minutes.
- To pasteurize with cold, fruits can be placed in the freezer at 0°C for 48 hours.



## □ **Conditioning dried fruits :**

- Conditioning is the process of evenly distributing moisture present in the dried fruit to prevent mold growth.
- Condition dried fruit by placing it in a plastic or glass container, sealing, and storing for 7 days to 10 days.



## ❑ Freezing :

- Freezing is a quick, convenient, and popular way to preserve fruits and vegetables.
- Store frozen foods at 0°C or lower.

## ❑ Use of ozone :

- Fruit stored can be stored at low levels of ozone for up to eight days.
- Different fruits have different ozone tolerance



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