

Microorganisms and Food Preservation



Understanding Microorganisms

Microorganisms, or microbes, are tiny living organisms invisible to the naked eye, found in air, water, plants, and animals. They thrive in extreme environments, from freezing temperatures to hot springs and deserts. They can be unicellular or multicellular and are classified into five main types:

- ➔ Bacteria
- ➔ Fungi
- ➔ Protozoa
- ➔ Algae

Bacteria: Bacteria are unicellular microorganisms. Examples include:

- ➔ *Lactobacillus*: Converts milk into curd.
- ➔ *Rhizobium*: Fixes atmospheric nitrogen in soil.

Viruses: Viruses are smaller than bacteria and require a host to reproduce. Common viral diseases include polio, chickenpox, influenza, and the common cold.

Beneficial Microorganisms

- ➔ **Curd Formation:** *Lactobacillus* ferments milk into curd.
- ➔ **Soil Fertility:** *Rhizobium* enriches soil by nitrogen fixation.
- ➔ **Decomposition & Nutrient Recycling:** Bacteria and fungi break down dead matter, enriching soil.
- ➔ **Bread & Bakery Products:** Yeast releases carbon dioxide, causing dough to rise.
- ➔ **Industrial Uses:** Yeast ferments sugars into alcohol for producing beer, wine, and vinegar.
- ➔ **Medicinal Applications:** Antibiotics like penicillin, streptomycin, and erythromycin treat bacterial infections.
- ➔ **Vaccines:** Weakened or dead microbes in vaccines stimulate immunity against diseases like tuberculosis, cholera, and hepatitis.

Harmful Microorganisms

Pathogens cause diseases in humans, animals, and plants. They spread through air, water, food, or direct contact.

- ➔ **Communicable Diseases:** Tuberculosis, chickenpox, cholera, and common cold spread via air, water, and contact.
- ➔ **Disease Carriers:**
 - Houseflies and mosquitoes spread infections.
 - *Anopheles* mosquito transmits malaria (*Plasmodium* protozoan).
 - *Aedes* mosquito spreads dengue (viral disease).
- ➔ **Microbial Diseases in Animals:**
 - Foot and mouth disease (viral)
 - Anthrax (bacterial)
- ➔ **Microbial Diseases in Plants:**
 - Citrus canker (bacterial)
 - Rust of wheat (fungal)
 - Yellow mosaic disease in ladyfinger (viral)
- ➔ **Food Poisoning:** Toxins from microbes cause vomiting, diarrhea, and fever.

Food Preservation

To prevent microbial growth, common methods include:

- ➔ Sun drying, heating, cooling, and refrigeration
- ➔ Adding salt, sugar, mustard oil, or vinegar
- ➔ Using chemical preservatives (e.g., sodium benzoate)
- ➔ **Pasteurization:** Heating milk to 70°C for 15-30 seconds and rapid cooling to kill bacteria
- ➔ Storing food in airtight containers

Nitrogen Fixation & Cycle

Although nitrogen makes up 78% of the atmosphere, it is unusable in its natural form.

- ➔ *Rhizobium* and blue-green algae convert nitrogen into a usable form.
- ➔ Lightning also aids nitrogen fixation.
- ➔ The nitrogen cycle includes:
 - Nitrogen fixation by bacteria and algae.
 - Plant absorption for growth.
 - Transfer through the food chain.
 - Decomposition returning nitrogen to the soil.
 - Denitrification converting compounds back to atmospheric nitrogen, maintaining balance.