

Microbes

- Microbes are diverse – protozoa, bacteria, fungi and microscopic plants viruses, viroids and also prions (proteinacious infectious agents)
- Microbes like bacteria and fungi can be grown in nutrient media to form colonies which can be seen in naked eyes.
- Some microbes cause diseases and some are useful for human being.

Lactic acid Bacteria

- Grows in milk and converts it to curd.
- Produces acid that coagulates and partially digests milk proteins.
- LAB improves nutritional quality of milk by increasing vitamin B₁₂
- LAB plays very important role in checking disease causing microbes.

Other microbes

- Dough, used to make *dosa* and *idli* is also fermented by bacteria.
- The puffed-up appearance of dough is due to the production of CO₂.
- Baker's yeast (***Saccharomyces cerevisiae***) is used to making bread.
- 'Toddy' a traditional drink is made by fermentation of sap from palms.

Other microbes

- Large holes in 'Swiss cheese' are due to production of large amount of CO₂ by a bacterium named ***Propionibacterium sharmanii***.
- The '**Roquefort cheese**' is ripened by specific fungi, which gives specific flavor.

MICROBES IN INDUSTRIAL PRODUCTS

- Beverages and antibiotics are some examples.
- Microbes are grown in very large vessels called **fermenters**.

Fermented Beverages

- **Yeasts** for production of wine, beer, whisky, brandy or rum.
- ***Saccharomyces cerevisiae*** commonly called '**brewer's yeast**' used for fermenting malted cereals and fruit juices to produce **ethanol**.
- **Wine and beer** are produced **without distillation**.
- **Whisky, brandy and rum** are produced by **distillation** of the fermented broth.

Antibiotics

- **Antibiotics** are the chemical substances which are produced by some microbes and can kill or retard the growth of other microbes.
- The first antibiotic discovered is the penicillin, from a mould (fungus) ***Penicillium notatum***.
- Antibiotics have greatly improved our capacity to treat deadly diseases such as plague, whooping cough. Diphtheria and leprosy.

Acid producing microbes

- *Aspegillus niger* (a fungus)
produces **citric acid**.
- *Acetobacter aceti* (a bacterium)
produce **acetic acid**.
- *Clostridium butylicum* (a bacterium)
produce **butyric acid**.
- *Lactobacillus* (a bacterium)
produces **lactic acid**.

Enzyme producing microbes

- **Lipases** used in detergent
- **Pectinase, proteases and cellulases**, make bottled fruit juices clearer.
- **Streptokinase** produced by **Streptococcus** used as a 'clot buster',

Other useful microbes

- ***Saccharomyces cerevisiae*** (yeast) used for production of **ethanol**.
- **Cyclosporin-A** produced by a fungus called ***Trichoderma polysporum*** used as **immunosuppressive agent** in organ transplantation.
- **Statins** produced by ***Monascus purpureus*** used as blood cholesterol lowering agents.

Sewage

- The waste water generated in cities and town containing human excreta. This municipal waste is called sewage.

Primary treatment

- Involves the physical removal of particles – through filtration and sedimentation.
- Initially **floating debris** is removed by **sequential filtration**.
- The **grit** (soil and small pebbles) are removed by **sedimentation**.
- All solids that settle form the **primary sludge**, and the supernatant forms the effluents.
- The effluents are taken for secondary treatment.

Secondary treatment or Biological treatment

- The primary effluent is passed into aeration tanks which allows vigorous growth of useful aerobic microbes into **flocs**.
- This significantly reduces the **BOD (biochemical oxygen demand)** of the effluent.
- Once the BOD is reduced, the effluent is then passed into the settling tank where the bacterial 'flocs' are allowed to sediment. This sediment is called **activated sludge**.
- Small part of activated sludge is pumped back to aeration tank to serve as the inoculums.

Anaerobic treatment

- The remaining sludge is pumped into **anaerobic sludge digester** where there are other bacteria which grow anaerobically, digest the bacteria and fungi in the sludge.
- During this digestion bacteria produce **biogas**, (mixture of methane, hydrogen sulphide and carbon dioxide)
- The effluent from the secondary treatment plant is released into natural water body like rivers and streams.

