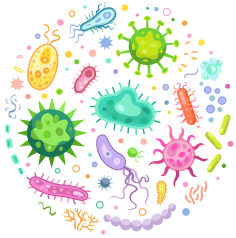
Microbes

Microbes are organisms which cannot be seen by naked eye found in soil, water, air and inside the bodies of living organisms, thermal vents deep in soil, under snow as well as in acidic environment.



Diversity

Microbes are of various varieties

- Protozoa
- Bacteria
- Fungi
- Plant viruses
- Viroids
- Prions

8. MICROBES IN HUMAN WELFARE

MICROBES IN HOUSEHOLD PRODUCT

Curd: Lactobacillus /LAB

Bread: *Saccharomyces cerevisiae*

Swiss Cheese: *Propionibacterium sharmanii*

Toddy: Microbes ferment sap from plant

MICROBES IN INDUSTRIAL PRODUCT

Enzyme

Pectinase and Proteases
Used to clarify bottled juice

Lipases
- Used in detergent formulation.
- Removes oily stains from laundry.

Streptokinase
- Produced by *Streptococcus*
- Used as clot buster

Anti-biotics

- *Penicillium notatum* as antibiotic

Bio-active Molecules

Cyclosporin's A
Produced fungus, *Trichoderma polysporum*.
Useful as immuno suppressive agent

Statins
Produced by yeast *Monascus purpures*.
Used as blood cholesterol lowering agent

Organic chemical

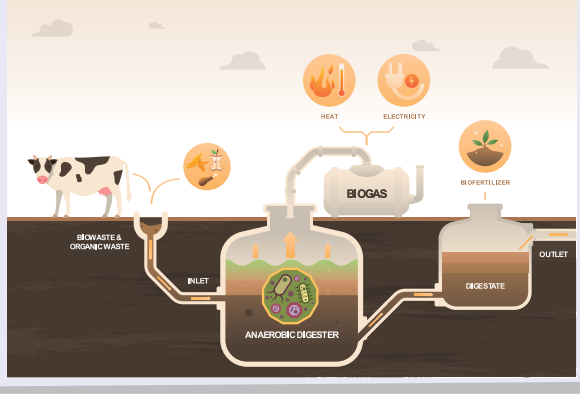
- *Aspergillus niger* form citric acid
- *Acetobacter aceti* form acetic acid
- *Clostridium butylicum* form Butyric acid
- Lacto bacillus form Lactic Acid
- *Saccharomyces cerevisiae* ethanol

Fermented Beverages

Saccharomyces cerevisiae - brewer's yeast, is used for fermenting malted cereals and fruit juices, to produce ethanol. Depending on the type of the raw material fermented and the type of processing different types of alcoholic drinks are obtained.

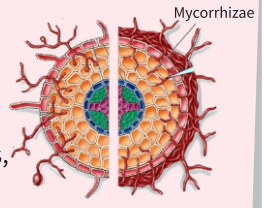
PRODUCTION OF BIOGAS

- Biogas is a mixture of gases (mainly methane).
- **Methanogens** grow anaerobically on cellulosic material and produce CH_4. Ex. *Methanobacterium*.
- The Dung of Cattle (gobar) is rich in these bacteria.
- Indian Agricultural Research Institute (IARI) and Khadi and Village Industries Commission (KVIC) Developed technology of biogas.



MICROBESING BIO-FERTILIZERS

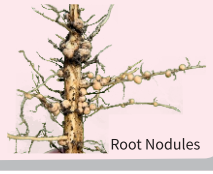
Biofertilisers are organisms that enrich the nutrient quality of the soil. The main sources of biofertilisers are bacteria, fungi and cyanobacteria.



- **Fungi** are also known to form symbiotic associations with plants (mycorrhiza). Many members of the genus Glomus form mycorrhiza.
- The fungal symbiont in these associations absorbs phosphorus from soil and passes it to the plant. Plants having such associations show other benefits also, such as resistance to root-borne pathogens, tolerance to salinity and drought, and an overall increase in plant growth and development.
- **Cyanobacteria** are autotrophic microbes widely distributed in aquatic and terrestrial environments many of which can fix atmospheric nitrogen, e.g. Anabaena, Nostoc, Oscillatoria, etc.
- In paddy fields, cyanobacteria serve as an important biofertiliser. Blue green algae also add organic matter to the soil and increase its fertility.


Anabaena

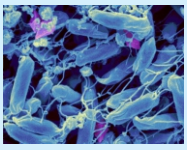
- **Rhizobium** is symbiotic bacteria in root Nodules of leguminous plant. Fix atmospheric N_2.
- Other bacteria can fix atmospheric nitrogen while free-living in the soil (examples Azospirillum and Azotobacter), thus enriching the nitrogen content of the soil.


Root Nodules

BIOCONTROL AGENTS

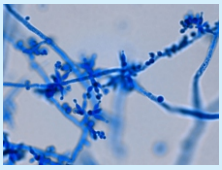
Bacillus thuringiensis (BT)

- Control butterfly caterpillar.
- Available in sachets as dried spores which is mixed with water and sprayed onto vulnerable plants such as brassicas and fruit trees, where these are eaten by the insect larvae.
- In the gut of the larvae, the toxin is released and the larvae get killed. The bacterial disease will kill caterpillars & leave other insects unharmed.



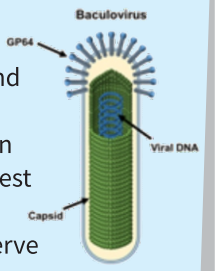
Trichoderma

- There are free living present in the root ecosystem.
- They Control several plant pathogen.

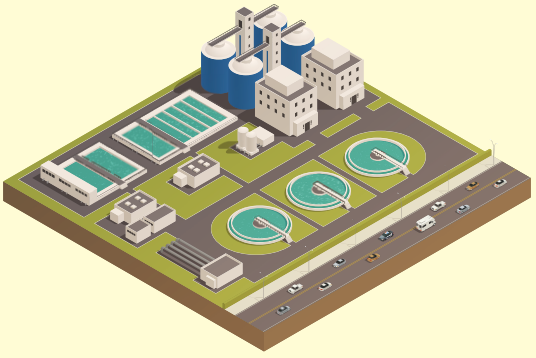


Baculoviruses

- Especially genus Nucleopoly hedrovirus
- Attacks insects and other arthropods
- This is desirable in IPM (Integrated pest management) program to conserve beneficial insects



SEWAGE TREATMENT


Sewage treatment Plant

Sewage treatment is carried out in two stages:

Primary treatment : These treatment steps basically involve physical removal of particles – large and small – from the sewage through filtration and sedimentation.

Secondary treatment or Biological treatment : The primary effluent is passed into large aeration tanks where it is constantly agitated mechanically and air is pumped into it. This allows vigorous growth of useful aerobic microbes into flocs (masses of bacteria associated with fungal filaments to form mesh like structures). While growing, these microbes consume the major part of the organic matter in the effluent. This significantly reduces the BOD (biochemical oxygen demand) of the effluent. Once the BOD of sewage or waste water is reduced significantly, the effluent is then passed into a settling tank where the bacterial 'flocs' are allowed to sediment. This sediment is called activated sludge.

The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters. Here, other kinds of bacteria, which grow anaerobically, digest the bacteria and the fungi in the sludge. During this digestion, bacteria produce a mixture of gases such as methane, hydrogen sulphide and carbon dioxide.