CHAPTER

6 Microbes in Human Welfare

- Microbes are present everywhere, even in the most harsh habitats.
- Several microbes are pathogenic to plants and animals, however, many of them are useful too.
- Microbes are diverse-protozoa, bacteria, fungi and microscopic animal and plant viruses, viroids and also prions are present everywhere even at thermal vents, snow layer and highly acidic environment.
- Many bacteria and fungi are utilised by us in preparation of several household products such as: cheese, curd, *dosa* and *idli*, toddy etc.
- For industrial production of a number of products, microbes are grown in large vessel called fermenters.
  - Yeast is used to make bread and beer.
  - Yeast ferments malted cereals and fruit juices to produce ethanol and many other alcoholic products.
- Wine and beer are produced without distillation whereas whisky, brandy and rum are produced by distillation of the fermented broth.
  - Antibiotics are one of the most important products from microbes for the benefit of mankind. Penicillin was the first antibiotic discovered by Alexander Fleming.
  - Microbes also produce a range of organic acids, enzymes, bioactive molecules etc. which are utilised in medicinal and other industries.
- Wine and beer are produced without distillation whereas whisky, brandy and rum are produced by distillation of the fermented broth.

Table 1: organic acids, enzymes of molecules obtained from the microbes

Microbe	Product	Function
Lactobacillus	Curd	Increase Vit B_{12} content
Bacteria	Dosa and Idli	Produce dough by evolving CO_2
Propionibacterium sharmanii	Swiss Cheese	Holes in cheese due to production of CO_2
Fungus	Roquefort Cheese	gives flavor
Penicillium notatum	Penicillin	Antibiotic
Aspergillus niger	Citric cid	—
Acetobacter aceti	Acetic acid	—
Clostridium butylicum	Butyric acid	—
Lactobacillus	Lactic acid	—
Streptococcus	Streptokinase	'clot buster' for removing clots from the blood vessels
Trichoderma polysporum.	Cyclosporin A	immunosuppressive agent in organ-transplant patients
Monascus purpureus	Statins	blood-cholesterol lowering agents

- Waste water is harmful because it contains pathogen-containing human excreta, hence, it can not be directly released into the water bodies.
  - Treatment of waste water is done by the heterotrophic microbes naturally present in the sewage.

Table 2: Events in waste water treatment

	Event	Characteristic	Followed by
Primary treatment	physical removal of particles – large and small – from the sewage through filtration and sedimentation	solids that settle form the primary sludge, and the supernatant forms the effluent	Supernatant taken for biological treatment

	Event	Characteristic	Followed by
Secondary Treatment	Aerobic treatment	growth of useful aerobic microbes into flocs, reduction of BOD	effluent sediments to form activated sludge, use as inoculum for aeration tank remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters.
	Anaerobic treatment	Anaerobic bacteria digest aerobic fungi and bacteria, produce biogas	effluent from the secondary treatment plant is generally released into natural water bodies like rivers and streams.

- Methanogens are also present in the rumen of cattle, and therefore, their dung can be used to produce Gobar gas.
- Biogas produced by microbes is used as a source of energy in rural areas.
- Continuous usage of chemical fertilisers and pesticides lead to environmental pollution.
- Organic farming aims to minimise environmental pollution by using biofertilisers and biocontrol agents.
- Several insects, bacteria, fungi and viruses act as biocontrol agents.
- A number of bacteria, cyanobacteria and fungi either in free-living or symbiotic state act as biofertilisers.

Table 3: Microbes as biocontrol agents and biofertilisers

Microbe	Function	Characteristic
Ladybird	Biocontrol	Against aphids
Dragonflies		Against mosquitoes
Bacillus thuringiensis		Against Insect larvae
Trichoderma		Against many root pathogens
Baculoviruses (Nucleopolyhedrovirus)		Against insects and other arthropods
Rhizobium, Azotobacter, Azospirillum	Biofertiliser	nitrogen fixation
Glomus		Forms mycorrhiza
Anabaena, Nostoc, Oscillatoria		add organic matter to the soil and increase its fertility