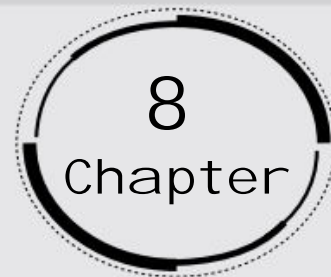


Microbes in Human Welfare



- 1. Bacteria cannot be seen with the naked eyes, but these can be seen with the help of a microscope. If you have to carry a sample from your home to your biology laboratory to demonstrate the presence of microbes under a microscope, which sample would you carry and why?**

Ans. A sample, Curd, can be used for the study of microbes. Numerous lactic acid bacteria (LAB) or Lactobacillus are present in Curd. Acids are produced by these bacteria that coagulate and digest milk proteins.

In the research laboratory, a tiny low drop of curd is carried because it contains multitudes of bacteria, which might be easily observed under a microscope which are of varied shapes and sizes.

- 2. Give examples to prove that microbes release gases during metabolism.**

Ans. For the release of gases during metabolism, the examples are:

- (a) A puffed appearance is seen in dough which is used for making idli and dosa. This is Due to the action of bacteria; carbon dioxide is released. This CO₂ released from the dough gets caught within the dough, hence giving it a puffed appearance.
- (b) During wastewater treatment, the digestion of sludge produces a bacteria which is a mixture of gases such as methane, hydrogen sulphide and carbon dioxide.

- 3. In which food would you find lactic acid bacteria? Mention some of their useful applications.**

Ans. Lactic acid bacteria is present in curd.

Their useful applications are as follows:

- (i) Formation of milk into curd is produced by this bacterium.
- (ii) Multiplication of the bacterium increases its number, which converts the milk into curd.
- (iii) The content of vitamin B12 increases in the curd.
- (iv) Presence of lactic acid bacteria in the stomach keeps a check on the disease-causing micro-organisms.

4. Name some traditional Indian foods made of wheat, rice and Bengal gram (or their products) which involve use of microbes.

Ans.

- (i) In the making dosa and idli, rice powder is fermented by bacteria and for creating bread (from wheat), yeast (Saccharomyces cerevisiae) is employed.
- (ii) Gutta (made from black gram) also uses bacteria.
- (iii) Microbes are accustomed to ferment fish, soya bean and bamboo shoots to create foods.

5. In which way have microbes played a major role in controlling diseases caused by harmful bacteria?

Ans.

- (i) Several microorganisms are used for preparing medicines. In order to kill other disease-causing microorganisms antibiotics were developed which are produced by certain microorganisms.
- (ii) Medicines are usually obtained from bacteria and fungi. Either they get killed or the growth gets stopped by disease-causing microorganisms.
- (iii) For the treatment of life-threatening diseases such as plague, whooping cough (kali khansi), diphtheria (galgotu) and leprosy (kusht rog) and for many other common infections different antibiotics were used which are Streptomycin, tetracycline, and penicillin are common ones .
- (iv) Growth of Staphylococci bacteria in the body was checked by chemical penicillin produced by Penicillium notatum, a fungus.
- (v) Bacteria were destroyed by weakening their cell walls by antibiotics. Due to this weakening, certain immune cells such as the white blood cells enter the bacterial cell and cause cell lysis. The process of destroying cells such as blood cells and bacteria is cell lysis.

6. Name any two species of fungus, which are used in the production of antibiotics.

Ans. Penicillium notatum (antibiotic- Penicillin) and Acremonium (previously known as Cephalosporium) (antibiotic- cephalosporin) are two species of fungus, which are used in the production of antibiotics.

7. What is sewage? In which way can sewage be harmful to us?

Ans. The municipal waste matter is the sewage which is carried away in sewers and drains.

It consists of both liquid and solid wastes, which is rich in organic matter and microbes. Most of these microbes are pathogenic and may cause several water-borne diseases. Sewage water is a major source of polluting drinking water. Hence, it is important that sewage water should be properly collected, treated, then disposed of.

8. What is the key difference between primary and secondary sewage treatment?

Ans. Removal of large and small particles from the sewage through filtration and sedimentation by physical means is Primary treatment. Whereas, secondary sewage treatment includes the biological digestion of organic matter by microbes. Primary treatment is affordable and relatively less complicated than secondary sewage which is a very costly and complicated process.

9. Do you think microbes can also be used as a source of energy? If yes, how?

Ans. Yes, microbes can be used as an energy source. Bacteria like Methane bacterium are employed for the generation of gobar gas or biogas.

- (i) In a biogas plant, the generation of biogas is an anaerobic process which consists of a concrete tank (10-15 feet deep) with sufficient outlets and inlets.
- (ii) Slurry is formed by the mixture of dung and water and is further thrown into the tank. The digester of the tank contains numerous anaerobic methane-producing bacteria, which produce biogas from the slurry.
- (iii) Biogas can be used as a source of energy after removal through the pipe, while the spent slurry is removed from the outlet and is used as a fertilizer.

10. Microbes can be used to decrease the use of chemical fertilizers and pesticides. Explain how this can be accomplished.

Ans. Organisms that enrich the nutrient quality of the soil are the microbes which can be employed as biofertilizers. Bacteria, fungi and cyanobacteria are the main sources of biofertilizers. By this, fertility of the soil is increased in many ways

- (i) Nodules on the roots of leguminous plants (a symbiotic association) that is formed by Rhizobium fixes the atmospheric nitrogen into organic form, which is used by the plant as a nutrient.
- (ii) Fixing atmospheric nitrogen by Azospirillum and Azotobacter, while living freely, and enhancing the nitrogen content of the soil.

- (iii) Symbiotic association is formed by the many members of the genus *Glomus* (fungi) with vascular host plants known as mycorrhiza that:
- (a) Helps within the absorption of phosphorus from soil and pass it to the plant.
 - (b) Resistance to root-borne pathogens are developed within the plants.
 - (c) Overall increase in plant growth and development can be done by increasing their tolerance to salinity and drought.
- (iv) Cyanobacteria autotrophic microbes, e.g., *Anabaena*, *Nostoc*, *Oscillatoria* can fix atmospheric nitrogen, in aquatic and terrestrial environments and also add organic matter to the soil and increase its fertility.

11. Three water samples namely river water, untreated sewage water and secondary effluent discharged from a sewage treatment plant were subjected to BOD test. The samples were labelled A, B and C; but the laboratory attendant did not note which was which. The BOD values of the three samples A, B and C were recorded as 20 mg/L, 8 mg/L and 400 mg/L, respectively. Which sample of the water is most polluted? Can you assign the correct label to each assuming the river water is relatively clean?

Ans. Sample A (BOD 20 mg/L) is secondary effluent discharged from a sewage treatment plant. Sample B (BOD 8 mg/L) is river water.
Sample C (BOD 400 mg/L) is the untreated sewage water.
As BOD is the direct measure of the organic matter present in water, higher the BOD, the more polluted the water.

12. Find out the name of the microbes from which Cyclosporin A (an immunosuppressive drug) and Statins (blood cholesterol lowering agents) are obtained

Ans.

- (i) Cyclosporin-A is obtained from the fungus *Trichoderma polysporum*.
- (ii) Statins are obtained from *Monascus purpureus*.

13. Find out the role of microbes in the following and discuss it with your teacher.

- (a) Single cell protein (SCP)
- (b) Soil

Ans.

- (a) Single Cell Protein (SCP) refers to harmless microbial cells that may be used as an alternate source of excellent protein. Just like mushrooms (a

fungus) is eaten by many individuals and yeast utilized by athletes as a protein source; similarly, other sorts of microbial cells can also be used as food rich in protein, minerals, fats, carbohydrates and vitamins. On an industrial scale, microbes like *Spirulina* and *Methylophilus methylotrophus* are grown on materials containing starch like waste, water from potato processing plants, straw, molasses, animal manure and even sewage. These single cell microbes may be used as a source.

(b) Soil: An important role is played by microbes in maintaining soil fertility. By the process of decomposition, they help in the formation of nutrient-rich humus. The ability to fix atmospheric nitrogen into usable form is done by many species of bacteria and cyanobacteria. A symbiotic bacteria found in the root nodules of leguminous plants is a *Rhizobium*. Free living nitrogen-fixing bacteria are *Azospirillum* and *Azotobacter*, whereas *Anabaena*, *Nostoc*, and *Oscillatoria* are examples of nitrogen-fixing cyanobacteria.

14. Arrange the following in the decreasing order (most important first) of their importance, for the welfare of human society. Give reasons for your answer.

Biogas, Citric acid, Penicillin and Curd

Ans. Penicillin > Biogas > Curd > Citric acid

An antibiotic that aid kill pathogens that cause infections and diseases and thus, it saves lives is Penicillin.

Biogas is a non-polluting decent fuel that is produced as a byproduct of sewage treatment. In the homes, it is used for cooking and lighting homes in rural areas.

Curd has excellent nutrient value, providing vitamin-B12 and replaces unfavourable bacteria of the stomach with helpful ones.

Citric acid is employed as a preservative of food.

15. How do biofertilizers enrich the fertility of the soil?

Ans. Fertility of the soil can be increased by the use of biofertilizers. Selection of beneficial microorganisms are involved that help in improving plant growth by providing plant nutrients. To mobilize the availability of nutrients by their biological activity, these are introduced to seeds, roots, or soil. Therefore, they are extremely beneficial in enhancing the soil with organic nutrients. The ability

to fix free atmospheric nitrogen is shown by many species of bacteria. A symbiotic bacteria found in the root nodules of leguminous plants is a *Rhizobium*. Free living nitrogen-fixing bacteria are *Azospirillum* and *Azotobacter*, whereas *Anabaena*, *Nostoc*, and *Oscillatoria* are examples of nitrogen-fixing cyanobacteria.

Bio-fertilizers are cost effective and eco-friendly.