



Chapter 10

Microbes in Human Welfare

1. Give the scientific name of the source organism from which the first antibiotic was produced.
Ans. *Penicillium notatum*
2. Mention the information that the health workers derive by measuring BOD of a water body.
Ans. (i) By measuring BOD of a water body, health workers find the amount of dissolved oxygen in water. The lesser the amount of dissolved oxygen, the more polluted the water body will be. (ii) It is also measure of organic matter present in water and uptake of O₂ by microbes.
3. Mention the importance of Lactic acid bacteria to humans other than setting milk into curd.
Ans. Lactic acid bacteria increase vitamin B12 absorption and also checks disease-causing microbes.
4. Mention a product of human welfare obtained with the help of each one of the following microbes: (a) LAB (b) *Saccharomyces cerevisiae* (c) *Propionibacterium sharmanii* (d) *Aspergillus niger*
Ans. (a) Convert milk to curd (b) Bread/alcoholic drinks (c) Swiss cheese (d) Citric acid
5. Name the bacterium responsible for the large holes seen in "Swiss Cheese". What are these holes due to?
Ans. *Propionibacterium sharmanii*. The holes are because of production of large amount of CO₂.
6. Name the microbes that help production of the following products commercially: (a) Statin (b) Citric acid (c) Penicillin (d) Butyric acid
Ans. (a) *Monascus purpureus* (b) *Aspergillus niger* (c) *Penicillium notatum* (d) *Clostridium butylicum*
7. Why are some molecules called bioactive molecules? Give two examples of such molecules.
Ans. Some molecules are called bioactive molecules, because microbes like bacteria or fungi are used in their production. e.g., Citric acid produced by *Aspergillus niger* Butyric acid produced by *Clostridium butylicum* Ethanol produced by *Saccharomyces cerevisiae* Streptokinase produced by *Streptococcus*.
8. Name a bioactive molecule, its source organism and the purpose for which it is given to organ transplant patients.
Ans. Cyclosporin A is a bioactive molecules given to organ transplant patients. It is obtained from a fungus *Trichoderma polysporum*. It is used as an immunosuppressive agent.
9. Name the two different categories of microbes naturally occurring in sewage water. Explain their role in cleaning sewage water into usable water.

Ans. Aerobic and anaerobic bacteria or fungi exist in sewage water. After the primary treatment of water, aerobic bacteria are added in aeration tanks. Growth of these bacteria reduces BOD as they consume organic matter. Anaerobic bacteria are added in anaerobic sludge digesters, where these digest the sludge and form biogas, etc.

10. How do mycorrhizae act as biofertilisers? Explain. Name a genus of fungi that forms a mycorrhizal association with plants.

Ans. Mycorrhizae is a symbiotic association of a fungus with roots of higher plants. The fungus absorbs phosphate from soil and passes it to the plant. It also provides resistance to root-borne pathogen and increase the tolerance of plant to salinity and drought. This way they act as biofertilisers. Genus of fungi — Glomus.

11. How does the application of cyanobacteria help to improve agriculture output?

Ans. Cyanobacteria are autotrophic, free-living or symbiotic microbes. They can fix atmospheric nitrogen. Blue-green algae also add organic matter to the soil and increases its fertility. They replenish soil nutrients and reduce dependence on chemical fertilisers

12. How do mycorrhizae help the plants to grow better?

Ans. Mycorrhizae absorb phosphorus, provide resistance to root-borne pathogens and enhance the tolerance of the plants towards salinity and drought.

13. Explain the function of "anaerobic sludge digester" in a sewage treatment plant.

Ans. Anaerobic sludge digester has anaerobic bacteria that digests the aerobic bacteria and fungi present in the sludge. During the digestion these bacteria produce mixture of gases such as methane, H₂S and CO₂ (biogas).

14. Describe how do 'flocs' and 'activated sludge' help in sewage treatment.

Ans. Flocs are masses of aerobic bacteria associated with fungal filaments to form mesh like structures. These aerobic microbes consume the major part of the organic matter in the effluent. This significantly reduces Biological oxygen demand (BOD) of the effluent. A small part of the activated sludge is used as inoculum and pumped back to aeration tank. The remaining major part of the sludge is pumped into anaerobic sludge digesters where microbes or bacteria grow anaerobically to produce CH₄ or H₂S or CO₂ or biogas.

15. How can sewage be used to generate biogas? Explain.

Ans. When biochemical oxygen demand (BOD) of sewage is reduced, effluent is passed into a settling tank for bacterial flocs to settle down. The sediment is called activated sludge. Activated sludge is pumped into anaerobic sludge digesters. In the digesters, heterotrophic microbes anaerobically digest bacteria and fungi in the sludge producing a mixture of gases which form the biogas.

16. Name the genus to which baculoviruses belong. Describe their role in the integrated pest management programmes.

Ans. Baculovirus belongs to the genus Nucleopolyhedrovirus. Baculoviruses are pathogens that attack insects and other arthropods. These viruses are very useful for species-specific, narrow spectrum insecticidal applications. Also, as they show no negative impacts on plants, mammals, birds, fish or even on non-target

insects, they are beneficial in integrated pest management (IPM) programme in which beneficial insects are conserved.

17. Given below is a list of six microorganisms. State their usefulness to humans.
(a) Nucleopolyhedrovirus (b) *Saccharomyces cerevisiae* (c) *Monascus purpureus*
(d) *Trichoderma polysporum* (e) *Penicillium notatum* (f) *Propionibacterium sharmanii*

Ans. (a) Nucleopolyhedrovirus: Used as bio-control agents. (b) *Saccharomyces cerevisiae*: Used in bread making and in brewing industry. (c) *Monascus purpureus*: Cholesterol lowering agent. (d) *Trichoderma polysporum*: Produces Cyclosporin-A, used as immunosuppressive agent. (e) *Penicillium notatum*: Produces antibiotic penicillin. (f) *Propionibacterium sharmanii*: Produces large amount of CO₂ in Swiss cheese.

18. An organic farmer relies on natural predation for controlling plant pests and diseases. Justify giving reasons why this is considered to be a holistic approach.

Ans. Besides acting as 'conduits' for energy transfer across trophic levels, predators are used in biological control of plant pests. This ability of the predator is based on its regulating the prey population. The natural predators reduce interspecific competition and does not harm the crop plants. For example, in an area the invasive cactus can be brought under control by cactus-feeding predator (a moth). Using natural predation, the ecosystem is kept stable without harming any of the trophic levels.

19. "Microbes play a dual role when used for sewage treatment as they not only help to retrieve usable water but also generate fuel". Explain.

Ans. Microbes naturally present in the sewage are employed in the secondary treatment of the sewage. The effluent from the primary treatment is passed into large aeration tanks. This allows the rapid growth of aerobic microbes into flocs which consume the organic matter of the sewage and reduces the BOD. Then the effluent is passed into a settling tank, where the flocs are allowed to sediment forming the activated sludge. Major parts of this activated sludge is pumped into anaerobic sludge digesters, where the anaerobic bacteria digest microbes in the activated sludge. During this digestion bacteria produce a mixture of gases like methane, hydrogen sulphide and carbon dioxide, which form the biogas and can be used as a source of energy. The effluent is generally released into rivers and streams.

20. Explain the significant role of the genus Nucleopolyhedrovirus in an ecological sensitive area.

Ans. Baculoviruses are pathogens that attack insects and other arthropods. Baculoviruses of genus Nucleopolyhedrovirus are used as biological control agents. They are excellent candidates for species-specific, narrow spectrum insecticidal applications. They do not show negative impact on plants, mammals, birds, non-target insects. Therefore, they are used as biological control agents. Importance in organic farming: It is desirable when beneficial insects are being conserved to aid in an overall Integrated Pest Management (IPM) programme. In organic farming, it is used to conserve beneficial insects and kills harmful ones.

21. Why should biological control of pests and pathogens be preferred to the conventional use of chemical pesticides? Explain how the following microbes act as biocontrol agents: (a) *Bacillus thuringiensis* (b) Nucleopolyhedrovirus

Ans. Biological control of pests and pathogens is preferred because: (i) The chemicals cause pollution of water bodies as well as ground water, besides getting stored in the plants. (ii) The chemicals are toxic thus extremely harmful to human beings and other animals. (a) *Bacillus thuringiensis*: *Bacillus thuringiensis* is available in sachets as dried spores, which are mixed with water and sprayed onto vulnerable plants. When they are eaten by the insect larvae, the toxin is released in the gut where it becomes active and kills the larvae. *B. thuringiensis* toxin genes when introduced into plant, develop resistance to attack by insect pests. Specific Bt toxin genes obtained from *B. thuringiensis* are used in several crop plants which make them resistant to insect pest. (b) Nucleopolyhedrovirus: These viruses are excellent candidates for species-specific, narrow spectrum insecticidal applications. This is especially desirable when beneficial insects are being conserved to aid in an overall integrated pest management (IPM) programme.
