
CHAPTER 10

MICROBES IN HUMAN WELFARE

A. One mark questions:

- 1. Name a bacterium that is involved in the conversion of milk into curd.**
Lactic acid bacteria / Lactobacillus bacteria.
- 2. Give the scientific name of baker's yeast.**
Saccharomyces cerevisiae.
- 3. Large holes in 'Swiss cheese' are due to production of large amount of CO₂ by a bacterium. Name the bacterium cause for it.**
Propionibacterium sharmanii.
- 4. Name the vessels in which microbes are grown in the large scale industrial production.**
Fermentors.
- 5. Name a fungus from which penicillin antibiotic is obtained.**
Penicillium notatum.
- 6. Name an organic acid produced by *Aspegillus niger***
Citric acid.
- 7. Name a bacterium that produces acetic acid.**
Acetobacter aceti.
- 8. Name a bacterium that produces butyric acid**
Clostridium butylicum.
- 9. Name a chemical produced by streptococcus bacterium used as a 'clot buster', for removing clots from the blood vessels of patients who have undergone myocardial infarction.**
Streptokinase .
- 10. Name a fungus that produces Cyclosporin-A.**
Trichoderma polysporum
- 11. Cyclosporin-A is produced by a fungus called *Trichoderma polysporum*. Write its significance.**
Cyclosporin-A is used as immunosuppressive agent during organ transplantation.

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- 12. Name a chemical produced by the yeast *Monascus purpureus* used as blood cholesterol lowering agents.**
Statins
- 13. Statins used as blood cholesterol lowering agents. Name the fungus that produces Statins.**
Monascus purpureus
- 14. Statins produced by *Monascus purpureus* used as blood cholesterol lowering agents. How does it work?**
It acts as competitive inhibitor for the enzyme responsible for the synthesis of cholesterol.
- 15. What is sewage?**
The waste water generated in cities and towns containing human excreta, organic matter and microbes.
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- The municipal waste water is called sewage.
- 16. Expand the abbreviation BOD.**
Biochemical Oxygen Demand
- 17. Define BOD.**
BOD refers to the amount of oxygen required to oxidize total organic matter by bacteria, present in one liter of water.
- 18. How does BOD of sewage water determine polluting potential?**
Greater the BOD of the waste water more is its polluting potential and vice versa.
- 19. What is a biogas?**
Biogas is a mixture of gases containing predominantly methane produced by the microbial activity and is used as fuel.
- 20. Name a bacterium (archaebacterium) involved in the production of biogas.**
Methanogens or *Methanobacterium*
- 21. What is biocontrol?**
Biocontrol refers to the use of biological methods for controlling plant diseases and pests.
- 22. Name a bacterium that is present in the root nodules and fix atmospheric nitrogen.**
Rhizobium.
- 23. Name the genus to which Baculoviruses belong.**
Nucleopolyhedrovirus.
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- 24. How does *Bacillus thuringiensis* (Bt) used to protect plants from butterfly caterpillars?**
Dried spores of Bt are 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 are released and the larvae get killed.
- 25. Name the organism commercially used for the production of single cell protein.**
Spirulina.
- 26. Which of the following is a cyanobacterium that can fix atmospheric nitrogen?**
a) Spirulina, b) Rhizobium, c) Oscillatoria.
Oscillatoria.
- 27. How is the presence of cyanobacteria in the paddy fields beneficial to rice crop?**
Cyanobacteria can fix atmospheric nitrogen into nitrates and increase soil fertility.
- 28. Write the scientific name of the fungal microbe used for fermenting malted cereals and fruit juices.**
Saccharomyces cerevisiae.
- 29. What causes doughing of flour?**
Release of CO₂ during fermentation.
- 30. Name a bacterium used in the production of 'Swiss cheese'.**
Propionibacterium sharmanii.
- 31. Expand the term STP.**
Sewage Treatment Plant.
- 32. What are baculoviruses?**
Viruses used in biological control of insects, pests and other arthropods.
- 33. What are flocs?**
Flocs are masses of bacteria associated with fungal hyphae which form mesh-like structures during secondary treatment of sewage.
- 34. What function do methanogens perform in the rumen of cattle?**
Digestion of cellulose.
- 35. Mention the importance of Lactic acid bacteria to humans other than setting milk into curd.**
LAB increases vitamin B₁₂ in the curd.
- 36. Name a genus of fungi that forms a mycorrhizal association with plants.**
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Glomus.

B. Two marks questions:

- 1. Name any two free living bacteria that fix atmospheric nitrogen and increase nitrogen content in the soil.**
Azospirillum and *Azotobacter*
- 2. What is the key difference between primary and secondary sewage treatment?**
Primary treatment is the physical process where filtration and sedimentation takes place while in secondary treatment, biological process is involved.
- 3. Expand the abbreviations a) LAB b) BOD**
 - a) LAB – Lactic Acid Bacteria
 - b) BOD – Biochemical Oxygen Demand
- 4. Who discovered the first antibiotic? Name the organism from which it was discovered.**
Alexander Fleming discovered penicillin from an organism *Penicillium notatum*.
- 5. Name a microbe used for statin production. How do Statin lower the blood cholesterol?**
Monascus purpureus is used to produce Statin. Statins lower the blood cholesterol level by competitively inhibiting the enzyme responsible for the synthesis of cholesterol.
- 6. Name the source of streptokinase. How does this bioactive molecule function in our body?**
Source is *Streptococcus*. It removes the clot from the blood vessels of patients who had a heart attack.
- 7. How does anabaena and mycorrhiza act as biofertilisers?**
 - a) Anabaena fix atmospheric nitrogen
 - b) Mycorrhiza absorbs phosphorus from soil and passes it to the plant.
- 8. Why is Rhizobium called as 'symbiotic bacterium'? How does it act as a biofertiliser?**
Rhizobium is present in the root nodules of leguminous plants. These bacteria fix atmospheric nitrogen into nitrate.
- 9. Name any two distilled and undistilled alcoholic beverages.**
 - a) Distilled alcoholic beverages: Whisky, Rum, Brandy
 - b) Undistilled alcoholic beverages: Beer and Wine
- 10. Write any two advantages of biofertilisers.**
 - a) Biofertiliser do not cause pollution

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- b) These are not expensive

11. What is activated sludge in a sewage treatment tank? How this activated sludge is used?

- a) Once that BOD of sewage water is reduced significantly, the effluent is passed into a settling tank where aerobic bacterial flocs undergo sedimentation and is called activated sludge.
- b) A small part of the activated sludge is pumped into aeration tank as inoculum for the treatment of sewage water.

12. Expand the term BOD and give the meaning of it.

- a) Biochemical Oxygen Demand.
- b) The amount of oxygen required for micro organism to break organic content present in one litre of water.

13. Legumes fertilise the soil but cereals do not. Discuss.

- a) Leguminous plants possess root nodules where nitrogen is fixed by symbiotic nitrogen fixing bacteria like Rhizobium.
- b) Whereas cereals do not possess nitrogen fixing bacteria in their root nodules, so they cannot fertilise the soil.

C. Three marks questions:

1. Mycorrhiza, a fungus symbiotically associated with root of few plants. List any three benefits for plants from Mycorrhiza.

- a) Mycorrhiza provides phosphorus to the plants from the soil.
- b) Make the plant resistant to root-borne pathogen.
- c) Increase tolerance to salinity and drought.

2. Mention the three enzymes of industrial importance.

Proteases, Pectinases, Lipases, Cellulases.

3. Name the different categories of microbes naturally occurring in sewage water. Explain their role in sewage water treatment.

- a) Aerobic and anaerobic bacteria exist in sewage water.
- b) After the primary treatment aerobic bacteria will reduce BOD in aeration tanks by degrading organic matter.
- c) Anaerobic bacteria are the sludge digesters, where these digest the sludge and form biogas.

4. What is the chemical nature of biogas?

Biogas contains methane (CH₄), carbon dioxide (CO₂) and hydrogen (H₂) gases.

D. Five marks questions:

1. Describe any five useful household products in which microbes are involved.

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- a) Lactic acid Bacteria: Lactic acid Bacteria (LAB) grow in milk and convert it to curd. LAB produces acids that coagulate and partially digest milk proteins. A small amount of curd added to fresh milk as inoculums or starter. LAB improves nutritional quality of milk by increasing vitamin B₁₂. LAB plays very important role in checking disease causing microbes.
 - b) 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.
 - c) Baker's yeast (*Saccharomyces cerevisiae*) is used to making bread.
 - d) 'Toddy' a traditional drink is made by fermentation of sap from palms.
 - e) Large holes in 'Swiss cheese' are due to production of large amount of CO₂ by a bacterium named *Propionibacterium sharmanii*.
 - f) The 'Roquefort cheese' is ripened by specific fungi, which gives specific flavor.

2. Describe the role of microbes in sewage treatment.

- a) The primary effluent is passed into large aeration tanks.
- b) This allows vigorous growth of useful aerobic microbes into flocs.
- c) The growth of microbes consumes the major part of the organic matter in the effluent. This significantly reduces the BOD (biochemical oxygen demand) of the effluent.
- d) BOD refers to the amount of oxygen required to oxidize total organic matter by bacteria, present in one liter of water.
- e) BOD is the measures of the organic matter present in the water.
- f) Greater the BOD of the waste water more is its polluting potential.
- g) Once the BOD of sewage reduced significantly, the effluent is then passed into the settling tank where the bacterial 'flocs' are allowed to sediment. This sediment is called activated sludge.
- h) Small part of activated sludge is pumped back to aeration tank to serve as the inoculums.
- i) The remaining sludge is pumped into anaerobic sludge digester.
- j) In the anaerobic sludge digester there is other kinds of bacteria which grow anaerobically, digest the bacteria and fungi in the sludge.
- k) During this digestion bacteria produce biogas, (mixture of methane, hydrogen sulphide and carbon dioxide)
- l) The effluent from the secondary treatment plant is released into natural water body like rivers and streams.

3. Describe process of primary treatment of sewage water.

- a) Involves the physical removal of particles – large and small from sewage through filtration and sedimentation.
- b) Initially floating debris is removed by sequential filtration.
- c) The grit (soil and small pebbles) are removed by sedimentation.
- d) All solids that settle form the primary sludge, and the supernatant forms the effluents.
- e) The effluents are from the primary settling tank taken for secondary treatment.

4. Describe the structure of biogas plant with a neat labelled diagram.

- a) The biogas plant consists of a concrete tank (10-15 ft deep) in which bio-wastes are collected and slurry of dung is fed.

- b) A floating cover is placed over the slurry, which keeps on rising as the gas is produced in the tank due to microbial (methanogens) activity.
- c) The biogas plant has an outlet, which is connected to a pipe to supply biogas to nearby houses.
- d) Used slurry is removed through another outlet and may be used as fertiliser.
- e) The biogas thus produced is used for cooking and lighting.

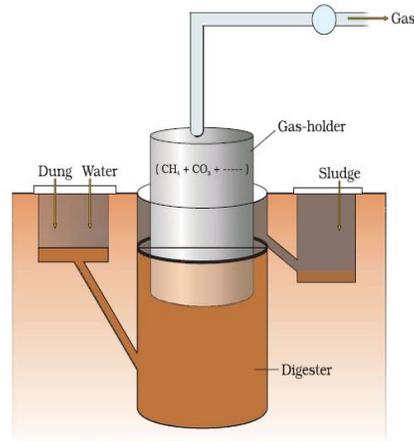


Figure 10.8 A typical biogas plant

5. Describe any five biological controls of pest and disease.

- a) The Ladybird (a familiar beetle with red and black markings) and Dragonflies are useful to get rid of aphids and mosquitoes respectively.
- b) *Bacillus thuringiensis* (Bt) used to control butterfly caterpillars. Dried spores are 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.
- c) *Trichoderma* a free living fungus used to control several plant pathogens.
- d) Baculoviruses are pathogen that attack insects and other arthropods. The majority of Baculoviruses used as biological control agents are in the genus *Nucleopolyhedrovirus*.
- e) These viruses are excellent candidates for species-specific, narrow spectrum insecticidal application. They have no negative impacts on plants, mammals, birds, fish, etc. This is very use full in integrated pest management programme (IPM).

6. Explain the role of any five microbes which enriches soil nutrients.

- a) *Rhizobium* form root nodules in leguminous plants and fix atmospheric nitrogen into organic forms which is used by the plant as nutrient.
- b) *Azospirillum* is living bacteria fix atmospheric nitrogen and thus increasing nitrogen content of the soil.
- c) *Azotobacter* is free living bacteria fix atmospheric nitrogen and thus increasing nitrogen content of the soil.
- d) Mycorrhiza fungi symbiotically associated with root of plants. Many members of the genus *Glomus* form Mycorrhiza. It provides phosphorus to the plants from the soil. Make the plant resistant to root-borne pathogen and increase tolerance to salinity and drought.

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- e) Cyanobacteria are autotrophic microbes widely distributed in aquatic and terrestrial habitats. Many of which fix atmospheric nitrogen. They help in nitrogen fixation, add organic matter to the soil and increase soil fertility. Ex. *Anabaena*, *Nostoc*, and *Oscillatoria* etc.

7. Write the scientific name of a microbe from which following product is obtained:

- a) Statins
 - b) Penicillin
 - c) Citric acid
 - d) Streptokinase
 - e) Cyclosporin – A
- a) Statins – *Monascus purpureus*
 - b) Penicillin – *Penicillium notatum*
 - c) Citric acid – *Aspergillus niger*
 - d) Streptokinase – *Streptococcus*
 - e) Cyclosporin – A – *Trichoderma polysporum*

8. Write the scientific name of a microbe from which following product is obtained. Write one function each on the products.

- a) Statins b) Penicillin c) Acetic acid d) Streptokinase e) Cyclosporin – A
- a) Statins – *Monascus purpureus*
Function: Used as blood cholesterol lowering agents. It acts as competitive inhibitor for the enzyme responsible for the synthesis of cholesterol.
 - b) Penicillin – *Penicillium notatum*
Function: Used to cure many bacterial diseases.
 - c) Acetic acid – *Acetobacter aceti*
Function: Used as food preservative.
 - d) Streptokinase – *Streptococcus*
Function: used as a 'clot buster', for removing clots from the blood vessels of patients who have undergone myocardial infarction.
 - e) Cyclosporin – A – *Trichoderma polysporum*
Function: used as immunosuppressive agent during organ transplantation.