

## CHAPTER 10

# MICROBES IN HUMAN WELFARE

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### POINTS TO REMEMBER

**Activated Sludge Process** : Aerobic sewage treatment process using aerobic micro-organisms present in sewage sludge to break down organic matter in sewage.

**Biofertilisers** : Microorganisms which produce fertilisers and enrich the soil e.g., Bacteria, cyanobacteria and fungi.

**Bioactive Molecules** : Molecules produced for commercial use from microbes and used for various purposes e.g., Trichoderma polysporum (fungus) is used to obtain immunosuppressive agent cyclosporin A.

**Biochemical Oxygen Demand (BOD)** : Total amount of oxygen consumed by bacteria for oxidation of organic matter present in one litre of water.

**Baculovirus** : Pathogens that attack insects and other arthropods. They are used to kill harmful pests and arthropods e.g., Nucleopolyhedrovirus.

**Biocontrol Agents** : Use of biological methods for controlling plant diseases and pests

**Effluent** : The product of primary treatment of sewage which is passed into large aeration tanks for secondary treatment.

**Fermentation** : The process by which microorganisms turn organic materials such as glucose into products like alcohol.

**Fermentors** : A very large vessel used in industry where microbes are grown on an industrial scale.

**Flocs** : During secondary treatment of effluent, excessive growth of aerobic bacteria and fungi form a mass of mesh like structure called flocs.

**Immunosuppressive Agent** : Chemical substances which suppress the immunity against organ transplant.

**Lactic Acid Bacteria (LAB)** : Bacteria growing in milk and convert it into curd e.g., Lactobacillus.

**Organic Farming** : Technique of farming, in which biofertilisers are used to enrich the soil.

**Prions** – The proteinaceous infectious plants.

**Thermal vents** - The sites deep inside the geysers/ hot springs, where the average temp. is as high as 100°C.

**Methanogens** - Bacteria producing large quantity of methane during decomposition of organic matter.

**DO** : Dissolved Oxygen

**GAP** : Ganga Action Plan

**KVIC** : Khadi and Village Industries Commission

**TMV** : Tobacco Mosaic Virus

**YAP** : Yamuna Action Plan

**IPM** : Integrated Pest Management.

□ Microbes includes protozoa, bacteria, fungi, microscopic plants, viruses, viroids and prions.

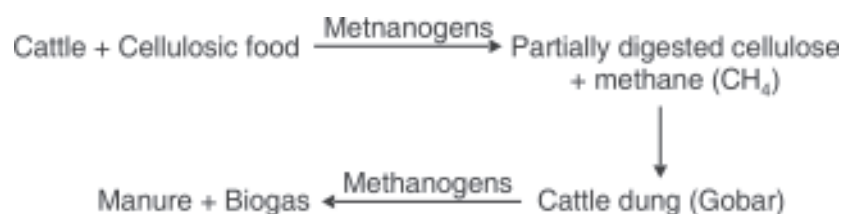
**Microbes in household products :**



**Microbes in production of Biogas**

□ Some bacteria which grow anaerobically on cellulosic material produce large amount of Methane ( $\text{CH}_4$ ), along with Carbondioxide and hydrogen. These bacteria are called methanogens e.g., *Methanobacterium*.

□ Methanogens are naturally found in rumen of cattle and sewage.



**Microbes as Biocontrol Agents**

<i>Microorganisms</i>	<i>Category</i>	<i>Action</i>
(i) Trichoderma Species	fungus	Kills pathogen in the root system
(ii) Bacillus thuringiensis	bacteria	Kills the insect pest (Bt-cotton)
(iii) Nucleopolyhedrovirus (Baculoviruses)	Virus	Kills insects and other arthropods.

**Microbes as Biofertilisers**

*Rhizobium*, Azospirillum, Azotobacter – (Bacteria) Anabaena, Nostoc, Oscillatoria (Cyanobacteria) Genus *Glomus* (Mycorrhiza).

**Microbes in Industries**

- (a) Fermented Beverages : *Saccharomyces cerevisiae* a yeast is used to make bread, fermented fruit juice and alcohol.
- (b) Antibiotics : *Penicillium notatum*
- (c) Other chemicals /enzymes/Bioactive molecules Many organic acids, enzymes are also produced by microorganisms

<i>S.No.</i>	<i>Microbe</i>	<i>Category</i>	<i>Product</i>
1.	<i>Aspergillus niger</i>	Fungus (Yeast)	Citric Acid
2.	<i>Acetobacter</i>	Aceti bacterium	Acetic acid (Vinegar)
3.	<i>Saccharomyces cerevisiae</i>	Fungus	Ethanol
4.	<i>Lactobacillus</i>	Bacteria	Lactic acid
5.	<i>Streptococcus</i>	Bacteria	Streptokinase
6.	<i>Clostridium butylicum</i>	Bacteria	Butyric acid
7.	<i>Monascus purpureus</i>	Fungus (Yeast)	Statin (Blood cholesterol lowering agent)
8.	<i>Trichoderma polysporum</i>	Fungus	Cyclosporin A (Immunosuppressive agent)

**Microbes in sewage Treatment**

Heterotrophic microbes present in the sewage are involved in the treatment of water. Some methanogenic bacteria are commonly found in the anaerobic sludge during sewage treatment.

## QUESTIONS

### VSA (1 MARK)

1. How does a small amount of curd added to fresh milk convert it into curd? Mention a nutritional quality that get added to the curd.
2. Why is secondary treatment of water in sewage treatment plant called biological treatment?
3. An antibiotic called 'Wonder Drug' was used to treat the wounded soldiers of America during World War-II. Name the drug and the scientist who discovered it.
4. You have observed that fruit juice in bottles bought from the market are clearer as compared to those made at home. Give reason.
5. Alexander Fleming discovered 'Penicillin', but its full potential as an effective antibiotic was established by other scientists. Name the two scientists.
6. Name the plant whose sap is used in making 'Toddy'. Mention the process involved in it.

### SA II (2 MARKS)

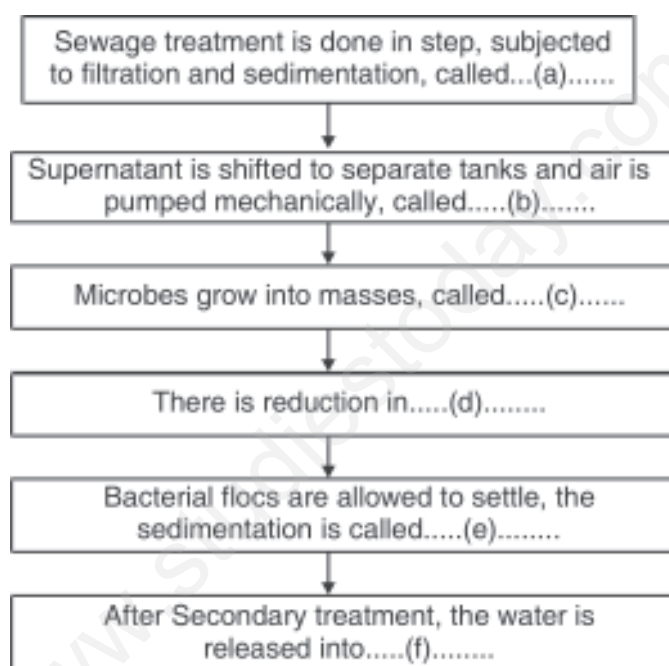
7. Name two alcoholic drinks produced in each of the following ways.  
(i) by distillation and (ii) without distillation.
8. Lactic Acid Bacteria (LAB) is commonly used in the conversion of milk into curd. Mention any two other functions of LAB that are useful to humans.
9. How do mycorrhizae function as biofertilisers? Explain with example.
10. Cyanobacteria (Nostoc, Anabaena) are used as biofertilisers in certain crop fields. Name such one crop. Also, mention the names of two other microorganisms which perform the same function.
11. Which Ministry of Govt. of India had initiated Ganga Action Plan and Yamuna Action Plan? What are the objectives of these plans?
12. Fill in the blanks spaces a, b, c, d, e, and f, given in the following table:

S. No.	Name of Organism	Commercial Product	Application
1.	<i>Penicillium notatum</i>	Penicillium	(a)
2.	(b)	Lactic acid	Making Curd.
3.	<i>Streptococcus</i>	Clot buster enzyme	(c)
4.	<i>Trichoderma polysporum</i>	(d)	Immuno suppressive agent
5.	<i>Saccharomyces cerevisiae</i>	Ethanol	(e)
6.	(f)	Swiss cheese	Food Product

13. What is biochemical oxygen demand (BOD) test? At what stage of Sewage treatment this test is performed?

BOD level of three samples of water labelled as A, B and C are 30 mg/L, 10mg/L and 500 mg/L respectively. Which sample of water is most polluted?

14. Given below is the Flow chart of Sewage treatment. Fill in the blank spaces marked 'a' to 'f'.



15. What are biofertilisers? A farmer is advised to add a culture of bacterium in the soil before sowing the crop. Name the bacterium in the culture. How is this bacterium useful to the crop?
16. What are statins? Name the microorganism that produces this substance. How is it medically important?

### LA (5 MARKS)

17. How does primary sludge differ from activated sludge? What type of changes in the sludge are carried out in anaerobic sludge digester? Give the composition of biogas produced in the sewage treatment plant.

**ANSWERS****VSA (1 MARK)**

1. A large number of lactic acid bacteria are found in small amount of curd which multiply and convert the milk into curd by producing the lactic acid. The nutritional quality improves by increasing Vitamin B<sub>12</sub>.
2. In this treatment Organic wastes of sewage water are decomposed by certain microorganisms in presence of water.
3. Penicillin, Alexander Fleming.
4. Bottle juices are clarified by the use of pectinase and proteases.
5. Ernest chain and Howard Florey.
6. Palm tree, by fermentation.
7. (i) Whisky, brandy, rum – by distillation  
(ii) Wine, beer – without distillation
8. (i) LAB in human intestine synthesizes Vitamin B<sub>12</sub>.  
(ii) LAB in human stomach checks the growth of harmful microbes.
9. Mycorrhiza are fungi associated with the roots of plants. Many members of genus Glomus form mycorrhiza. These fungal symbiont absorbs water and minerals like phosphorus from the soil and provide them to the plant.
10. Peddy (Rice Crop), *Rhizobium* and Azotobacter.
11. ☐ The Ministry of Environment and Forests.  
☐ The objective of Ganga Action Plan and Yamuna Action Plan is to save these rivers from pollution. It was proposed to build a large number of sewage treatment plants. So that only treated sewage may be discharged into these rivers.

**SA-I (3 MARKS)**

12. (i) to kill disease causing bacteria  
(b) Lactobacillus  
(c) remove clots from blood vessels  
(d) Cyclosporin A  
(e) Beverage/medicines  
(d) *Propionibacterium sharmanii*.

13. ☐ The BOD test measures the rate of uptake of oxygen by microorganisms in a sample of water.
- ☐ Biological treatment or Secondary treatment
  - ☐ Sample 'C' is most polluted because it has highest BOD level among the three samples of water.
14. (a) Primary treatment (b) Aeration  
(c) Flocs (d) Biochemical Oxygen Demand (BOD)  
(e) Activated sludge (f) Water bodies like riverstream.
15. ☐ Biofertilisers are organisms that enrich the nutrient quality of the soil.
- ☐ Azotobacter/Azospirillum (free living)
  - ☐ This bacterium fixes atmospheric nitrogen into organic forms, which is used by the plants as nutrient.
16. ☐ Statins are cholesterol reducing agents.
- ☐ They are produced by *Monascus purpureus* (Yeast)
  - ☐ They act by Competitively inhibiting the enzymes responsible for synthesis of cholesterol and are used as blood cholesterol lowering agents.

### LA (5 MARKS)

17. Primary sludge is all solids like soil, small pebbles that settle down in settling tank during primary treatment of sewage.

Activated sludge is the sediment of bacterial 'flocs' in settling tank during biological treatment. Flocs are masses of bacteria held together by slime and fungal filaments. A part of activated sludge is used as inoculum in aeration tank and remaining is passed into a large tank called anaerobic sludge digester. In this tank, other kind of bacteria which grow anaerobically, digest the bacteria, fungi and biomass in the sludge. Biogas that produced in Sewage treatment plant is a mixture of methane, hydrogen and Carbon dioxide.