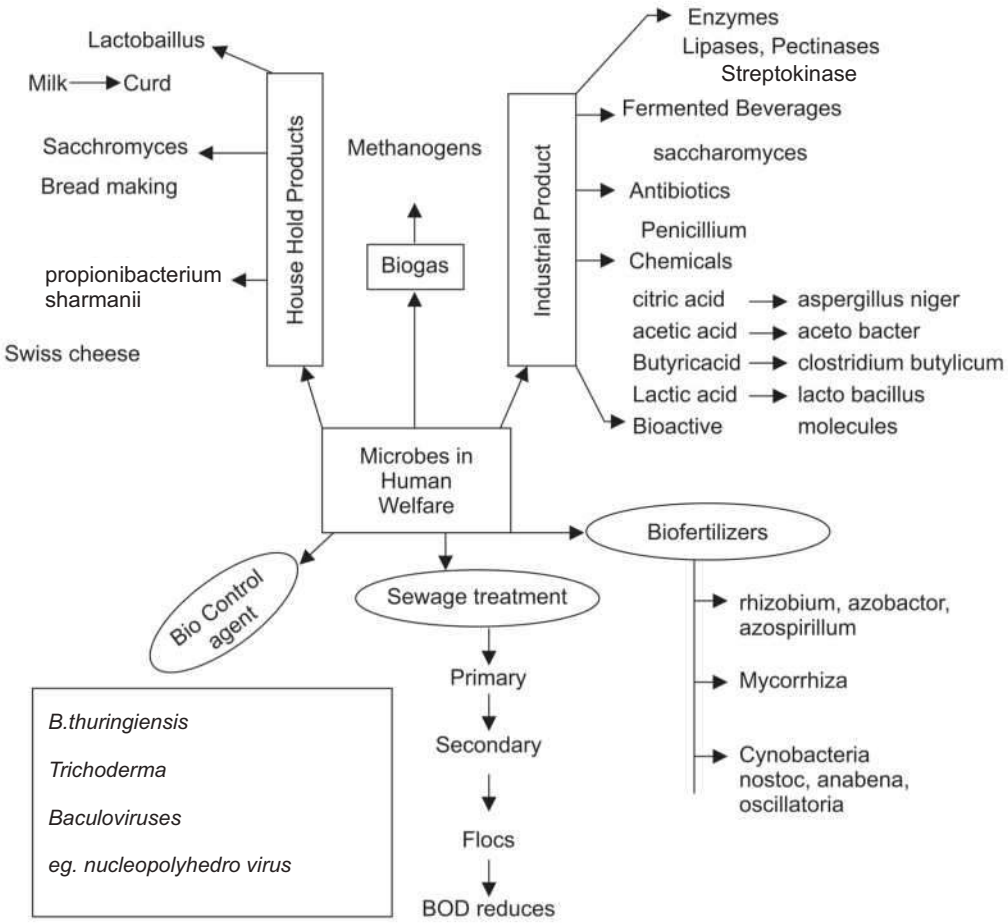
Chapter - 8

Microbes in Human Welfare



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.*

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

Immunosuppressive Agent : Chemicals which suppress the immunity against organ transplant.

Organic Farming : Technique of farming, in which biofertilisers are used to enrich the soil, without using chemical fertilisers and pesticides to reduce their harmful effect on human health.

Biological Control : Reduction of pest population by natural enemies minimising the use of harmful chemical pesticide. e.g. ladybird beetle can eradicate aphids.

Thermal vents : The sites deep inside the geysers/hot springs and oceans where the average temperature is as high as 100°C.

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

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 (the infectious protein)

Microbes in Household Products

Milk $\xrightarrow[\text{LAB}]{\text{Lactobacillus}}$ Curd

Dough $\xrightarrow[\text{Fermentation}]{\text{Yeast}}$ Swollen, Little fermented dough

Palm sap $\xrightarrow[\text{Yeast}]{\text{Microbes}}$ Toddy (fermented drink)

Microbes in production of Biogas

- Some bacteria which grow anaerobically on cellulosic material produce large amount of Methane (CH_4), along with Carbondioxide and hydrogen. These bacteria are called methanogens.
- Methanogen are naturally found in rumen of cattle, Cowdung and sewage.

Microbes as Biocontrol Agents

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

Microbes as biofertilisers.

Rhizobium **:** Have symbiotic association with roots of leguminous plants, help in atmospheric nitrogen fixation.

Azospirillum **and** ***Azotobacter*** **:** Free living in soil and help in nitrogen fixation enrich nitrogen content of soil.

Mycorrhiza : Symbiotic; association of fungi with roots of higher plants. Fungi help in absorption of phosphorous from soil. It belongs to genus *Glomus* It provides resistance to root borne pathogens, tolerance to salinity and drought.

Cyanobacteria : Found in aquatic or terrestrial environment, help in nitrogen fixation, add organic matter to the soil, increase fertility of soil, e.g., Nostoc, *Anabaena, Oscillatoria*.

In paddy fields, these acts as biofertilisers.

Microbes in Industries

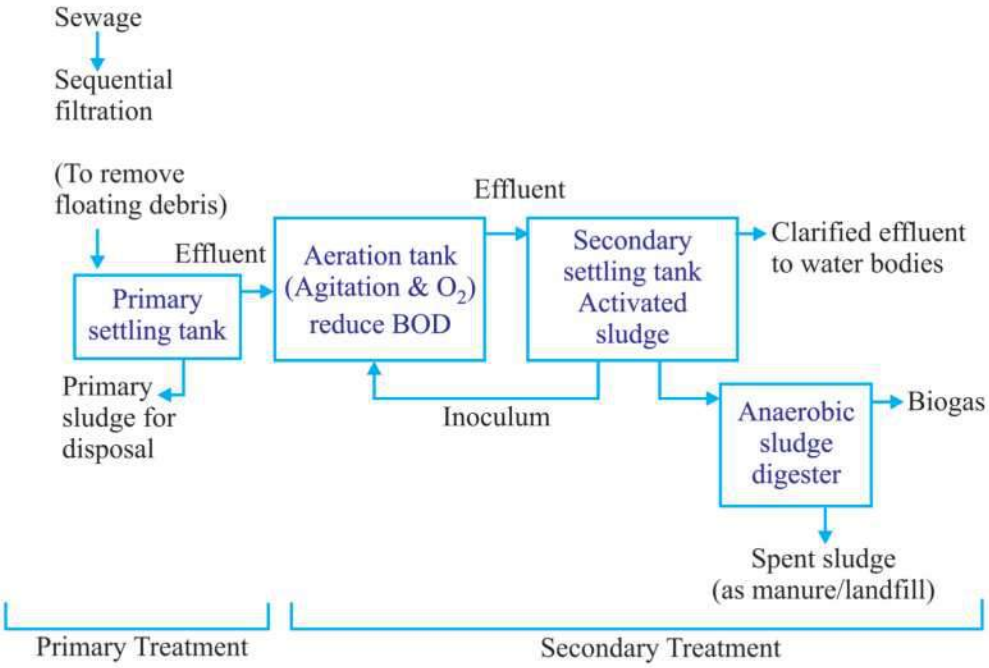
(a) Fermented Beverages : Liquid food made by anaerobic digestion of carbohydrate rich food is called beverage. *Saccharomyces cerevisae* (yeast) is also used to make bread, fermented fruit juice and alcohol.

(b) Antibioitics : *Penicillium notatum*

(c) Other chemicals/enzymes/Bioactive molecules Many organic acids, enzymes are also produced by microorganisms.

S. No.	Microbe	Category	Product	Role (Used as)
1.	*Aspergillus niger*	Fungus (Yeast)	Citric Acid	Used in beverages
2.	*Acetobacter*	Aceto bacterium	Acetic acid (Vinegar)	Preservative
3.	*Saccharomyces cerevisae*	Fungus	Ethanol	Disinfectant, fuel
4.	*Lactobacillus*	Bacteria	Lactic acid	In making Curd
5.	*Streptococcus*	Bacteria	Streptokinase	Clot buster
6.	*Clostridium butylicum*	Bacteria	Butyric acid	Prolective agent against in flammatory bowel diseases
7.	*Monascus purpureus*	Fungus (Yeast)	Statin	Blood cholestrol lowering agent
8.	*Trichoderma polysporum*	Fungus	Cyclosporin A	immunosupressive agent

Sewage treatment :



Antibiotics : Secondary metabolites produced by microbes and used to kill pathogenic microbes.

Penicillin, First antibiotic discovered by Alexander Flemming from fungus *Penicillium notatum*.

Mode of action of antibiotics

(1) Bacteriocidal : To kill bacteria by stopping cell wall formation

(2) **Bacterio-static :** To stop growth or multiplication of bacteria by stopping DNA replication or other cellular metabolism.

Production of Antibiotics : Mass production of antibiotics is done in fermentor tanks from lichens, fungi, actinomycetes, eubacteria etc. Maximum antibiotics are produced from bacillus (eubacteria)

Precautions in taking antibotics :

- Keep intake continuous as prescribed by doctor till course gets completed.
- Avoid over use otherwise our body become resistant to antibiotics.

QUESTIONS

VSA (1 Mark)

1. Why is secondary treatment of water in sewage treatment plant called biological treatment ?
2. An antibiotic called 'Wonder Drug' was used to treat the wounded soldiers of America during World War-ll. Name the drug and the scientist who discovered it.
3. You have observed that fruit juice in bottles bought from the market are clearer as compared to those made at home. Give reason.
4. Name the plant whose sap is used in making 'Toddy'. Mention the process involved in it.

MULTIPLE CHOICE TYPE QUESTIONS

5. Spirulina is :

a) Bio fertilizer

b) Bio pesticide

c) Edible fungus

d) Single cell protein

6. Baker's yeast is

a) S. Cerevisae

b) Ludwingi

c) S. octosporus

d) Schizo Saccharomyes

7. Which one is wrongly matched?

a) Streptomyces - Antibiotics

b) Coli forms - Vingar

c) Methanogens - Gobar gas

d) Yeast - ethanol

8. Bt. cotton is resistant to

a) Insects

b) Herbicides

c) Salt

d) Drought

9. Which is wrongly matched

a) Alcohol - Nitrogen

b) Detergents - Lipase

c) Textiles - Amylase

d) Fruit juice - Pectinase

10. Assertion : Curdling is required in the manufacture of cheese.

Reason : Lactic acid bacteria are used for the purpose.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not true correct explanation of assertion.

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

11. Assertion : Yeasts such as Saccharomyces cerevisiae are used is baking industry.

Reason : Carbon dioxide produced during fermentation causes bread dough to rise by thermal expansion.

a) If both assertion and reason are true and the reason is the correct explanation of the assertion.

b) If both assertion and reason are true but the reason is not the correct explanation of the explanation of the assertion.

c) If assertion is true statements but reason is false.

d) If both assertion and reason are false.

12. More than 25% of human population is suffering from hunger and malnutrition. Scientist from developed techniques where microbes are grown on industrial scale as a source of good protein which can be grown from waste water animal and even sewage.

Answer the following questions:

i) Example of SCP is

a) Azolla b) Anabaena c) Oscillatoria d) Spirulina

ii) SCP is

a) Single cell protein

b) Single cytoplasmic protein

c) Solute cell protein

d) Soluble cell protein

iii) The malnutrition due to protein and carbohydrate is

a) Vitamin deficiency

b) Mineral deficiency

c) PEM

d) Carbohydrate disorders

iv) Hunger signs are due to

a) Mineral deficiency

b) Protein deficiency

c) Vitamin deficiency

d) All of the above

SA-I **(2 Marks)**

13. Name two alcoholic drinks produced in each of the following ways.
    (i) by distillation and
    (ii) without distillation.
14. 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.
15. Which Ministry of Govt, of India had initiated Ganga Action Plan and Yamuna Action Plan ? What are the objectives of these plans?

SA-II **(3 Marks)**

16. 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.	*Penicillium notatum*	*Penicillium*	(a)
2.	(b)	Lactic acid	Making Curd.
3.	*Streptococcus*	Clot buster enzyme	(c)
4.	*Trichoderma polysporum*	(d)	Immuno supp-ressive agent
5.	*Saccharomyces cerevisiae*	ethanol	(e)
6.	(f)	Swiss cheese	Food Product

17. 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 ?
18. Given below is the Flow chart of Sewage treatment. Fill in the blank spaces marked 'a' to 'f'.

Sewage treatment is done in step, subjected to filtration and sedimentation, called.....(a).....

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Supernatant is shifted to separate tanks and air is pumped mechanically, called.....(b).....

↓

Microbes grow into masses, called.....(c).....

↓

There is reduction in.....(d).....

↓

Bacterial flocs are allowed to settle, the sedimentation is called .....(e).....

↓

After Secondary treatment, the water is released into .....(f).....

19. A girl visits a cotton field and observes that a liquid is being sprayed on the plants. On being enquired she comes to know that it is to protect the crop from the insects. As a biology students can you explain the process to her that how would this liquid help in getting rid of the insects.
20. Plants have symbiotic associations with fungi show many benefits. Mention 5 such advantages.
21. What are biofertilisers? How are they useful instead of chemical fertilises?

Answers

VSA **(1 Mark)**

1. In this treatment Organic wastes of sewage water are decomposed by certain microorganisms in presence of water.
2. Penicillin, Alexander Fleming.
3. Bottle juices are clarified by the use of pectinase and proteases.
4. Palm tree, by fermentation.

Solution Lesson : 10

MCQ

5. d) 6. a) 7. b) 8. a) 9. a) 10. b) 11. d)

Solution

Ans. 12 i) d) ii) a) iii) c) iv) d)

SA-I (2 Marks)

13. (i) Whisky, brandy, rum—by distillation

(ii) Wine, beer - without distillation

14. (i) LAB in human intestine synthesizes Vitamin B_{12}.

(ii) LAB in human stomach checks the growth of harmful microbes.

15. The Ministry of Enviorment 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-II (3 Marks)

16. (a) to kill disease causing bacteria

(b) *Lactobacillus*

(c) remove clots from blood vessels

(d) Cyclosporin A

(e) Beverage/medicines

(d) *Propionibacterium sharmanii*.

17. 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.

18. (a) Primary treatment

(b) Aeration

(c) Flocs

(d) Biochemical oxygen Demand (BOD)

(e) Activated sludge

(f) Water bodies like river.

19. Liquid containing spores of Bacillus thuringiensis; eated by insect larvae; toxin released inside gut; larvae killed.

20. (i) Increased absorption of phosphorus
    (ii) Resistance to root-borne pathogens;
    (iii) tolerance to salinity and drought;
    (iv) Overall increase in plant growth;
    (v) Overall increase in plant developmet

21. Biofertilisers are organisms that enrich the nutrient quality of the soil.
    Advantage no negative impact on soil. Doesn't cause water pollution