Microbes in Human Welfare-2

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Class: XII **Biology**

Very Short Answer Type Questions

1. Why does 'Swiss cheese' have big holes?

The big holes in 'swiss cheese' are made by a bacterium known as ***Propionibacterium sharmanii***, which utilises lactic acid to produce propionic acid and carbon dioxide.

2. What are fermentors?

The large sterilised vessels that are used for the growth of microorganisms under optimal conditions are called fermentors. They are also known as bioreactors.

The microorganisms can be grown in large quantities to produce metabolites for commercial uses.

3. Name a microbe used for statin production. How do statins lower blood cholesterol levels?

Monascus purpureus is a yeast, which is used for the production of statin.

Statin lowers blood cholesterol levels by acting as a **competitive inhibitor** of the enzyme that catalyses the biosynthesis of cholesterol.

4. Why do we prefer to call secondary wastewater treatment as biological treatment?

Secondary wastewater treatment is preferred to call as biological treatment as it involves the use of microorganisms for the treatment of wastewater.

5. For what purpose Nucleopolyhedroviruses are being used nowadays?

Nucleopolyhedroviruses (NPVs) are being used nowadays as a biological pesticide to kill insects such as **caterpillars** and **butterflies**, which damage the crop plants.

6. How has the discovery of antibiotics helped mankind in the field of medicine?

Antibiotics have helped **mankind** in the treatment of many infectious diseases, thus saved the lives of many people.

Diseases like tuberculosis, leprosy, whooping cough, tetanus, diphtheria have stopped being life-threatening because of antibiotics.

7. Why is distillation required for producing certain alcoholic drinks?

The process of obtaining a pure liquid from a mixture by evaporation and condensation is called distillation.

It is required for producing certain alcoholic drinks because it increases the overall **alcohol content** in the drinks.

Whiskey, brandy and rum are produced by distillation of the fermented broth.

Wine and beer are produced without distillation.

8. Write the most important characteristic that Aspergillus niger, Clostridium butylicum, and Lactobacillus share.

The most important characteristic that Aspergillus niger, Clostridium butylicum, and Lactobacillus share are

They are all microorganisms which are involved in the **production of various acids**.

Aspergillus niger is used for the production of citric acid,

Clostridium butylicum is used for the production of butyric acid, and Lactobacillus is used for the production of lactic acid.

Microbe	Acid
Aspergillus niger (fungus)	Citric acid
Acetobacter aceti (bacterium)	Acetic acid
Clostridium butylicum (bacterium)	Butyric acid
Lactobacillus delbrueckii bacterium)	Lactic acid

9. What would happen if our intestine harbours microbial flora exactly similar to that found in the rumen of cattle?

If our intestine harbours microbial flora exactly similar to that found in the rumen of cattle, our digestive system would be able to digest cellulose, and methane can be produced in our digestive system.

So, we could **digest cellulose** and **biogas** could be obtained from the excreta.

10. Give any two microbes that are useful in biotechnology.

Escherichia coli and agrobacterium are the two microbes which are useful in biotechnology.

Escherichia coli:

The enzyme restriction endonuclease (EcoRI) is obtained from Escherichia coli is used as Molecular Scissor to cut specific nucleotide sequences of DNA. This is useful in creating recombinant DNA.

The plasmid of E. coli is used as gene cloning vehicle (vector) to introduce foreign DNA segment in desired organisms.

Agrobacterium tumefaciens:

The plasmid extracted from Agrobacterium tumefaciens is used to transfer desired genes into the plants, which help in the formation of transgenic plants.

Bacillus thuringiensis:

The Bt gene obtained from Bacillus thuringiensis is introduced in cotton plants to convert them into pest resistant plants.

Bacteria	Biotechnological Use
Restriction endonuclease (EcoRI)	Molecular Scissor
The plasmid of E. coli	Gene cloning vehicle (vector)
Plasmid of Agrobacterium tumefaciens	Plant Vector
Bt gene of Bacillus thuringiensis	Conversion of Pest Resistant plants

11. What is the source organism for ECORI, restriction endonuclease?

The source organism for ECORI, restriction endonucleases is Escherichia coli (E.Coli).

It is a **gram-negative, rod-shaped bacteria** which is found in the intestines of warm-blooded animals.

12. Name any genetically modified crop.

Bt cotton is a genetically modified (GM) crop which produces an insecticide which makes the plant resistant to bollworms.

13. Why are blue-green algae not popular as biofertilizers?

Blue green algae are not popular as biofertilizers as they produce **slippery mucus** and also cause **algal bloom**.

14. Which species of Penicillium produces Roquefort cheese?

The species of Penicillium which produces Roquefort cheese is Penicillium roqueforti.

15. Name the states involved in the Ganga action plan.

The states which are involved in the Ganga action plan are **Jharkhand, UP, Bihar,** and **West Bengal**.

16. Name any two industrially important enzymes.

(i) Lipase:

Lipase is an enzyme that catalyzes the hydrolysis of lipids and used for the removal of oily stains from clothes and used widely in detergents.

(ii) Amylase:

Amylase is an enzyme that catalyzes the hydrolysis of starch into sugars and used in the food and fermentation industry.

17. Name an immune immunosuppressive agent?

Cyclosporin A is an immunosuppressive agent produced by the Trichoderma polysporum fungus.

It is an immunosuppressant drug widely used to prevent organ rejection in during organ transplantation.

18. Give an example of a rod-shaped virus.

An example of a rod-shaped virus is **Tobacco Mosaic virus** which causes a disease known as a **mosaic disease** in tobacco leaves.

19. What is the group of bacteria found in both the rumen of cattle and the stage of sewage treatment?

Methanogens are a group of anaerobic bacteria found in both the rumen of cattle and sludge of sewage treatment plant. Methanogens release methane gas.

The methanogens present in the rumen of the cattle help in the digestion of cellulose and derive energy from cellulose.

The activated sludge formed is transferred to the anaerobic sludge digesters where methanogens digest the microbes of the flocs.

This process releases a mixture of gases called biogas (Mainly CH_4, CO_2, N_2, H_2S, H_2 and traces of volatile organic compounds)

20. Name a microbe used for the production of Swiss cheese.

The microbe used for the production of Swiss cheese is ***Propionibacterium sharmanii***, which utilises lactic acid to produce propionic acid and carbon dioxide.

The large holes in swiss cheese is due to the production of a large amount of carbon dioxide.

Short Answer Type Questions

1. Why are flocs important in the biological treatment of wastewater?

Flocs are important in the biological treatment of wastewater as they help in reducing the biological Oxygen Demand (BOD) in the water.

They help to reduce pollution of wastewater and make it habitable for aquatic animals.

2. How has the bacterium Bacillus thuringiensis helped us in controlling caterpillars of insect pests?

The bacterium *Bacillus thuringiensis* helps us in controlling caterpillars of insect pests by producing an endotoxin in the midgut of the caterpillar.

The released endotoxin destroys the midgut epithelial lining of the insects and kill them.

3. How do mycorrhizal fungi help the plants harbouring them?

Mycorrhizal fungi help the plants harbouring them in providing more nutrients like **phosphorous.**

They also help in **supplying more water to the plants,** which increases the ability of plants to withstand drought.

4. Why are cyanobacteria considered useful in paddy fields?

Cyanobacteria are considered to be useful in paddy fields because they fix the atmospheric **nitrogen** and also provide **organic matter,** which increases the fertility of the soil.

5. How was penicillin discovered?

In 1921, Alexander Fleming discovered penicillin.

Once returned from a vacation to find that one of his staphylococcus culture plates had accidentally got contaminated with mould.

The mould inhibited the growth of staphylococcus culture.

This made him to isolate antibiotic from the fungus Penicillium notatum.

6. Name the scientists who were credited for showing the role of Penicillin as an antibiotic?

Alexander Fleming discovered penicillin in 1921, but he was not credited for showing its role as an antibiotic.

However, its full potential as an effective antibiotic was established much later by **Ernest Chain** and **Howard Florey** and were awarded the Nobel Prize in 1945 for this discovery.

(The Nobel Prize for Medicine in 1945 was awarded jointly to Sir Alexander

Fleming, Ernst Boris Chain and Sir Howard Walter Florey "for the discovery of penicillin and its curative effect in various infectious diseases")

7. How do bioactive molecules of fungal origin help in restoring good health of humans?

Bioactive molecules of fungal origin help in restoring the good health of humans as follows;

(a) Cyclosporin A is an immunosuppressive agent.

(b) Statin helps in lowering the blood cholesterol level.

Bioactive Molecules	Microbes	Role
Cyclosporin A	Trichoderma polysporum (fungus)	Immunosupressive agent
Statins	Monascus purpureus (yeast)	Lowers blood cholesterol levels

8. What roles do enzymes play in detergents that we use for washing clothes? Are these enzymes produced from some unique microorganisms?

Lipase is used in detergent formulations to clean and remove oily stains from clothes.

Lipases are obtained from Bacillus and Pseudomonas bacteria.

9. What is the chemical nature of biogas? Name an organism which is involved in biogas production.

The major component of biogas is methane and carbon dioxide. It also consists of a little amount of nitrogen, hydrogen sulphide and hydrogen.

Methanogens are the organisms which are involved in biogas production.

Composition	Volume
Methane (CH_3)	50-75 %
Carbon dioxide (CO_2)	25-50%
Nitrogen (N_2)	2-8%
Hydrogen sulphide (H_2S)	0-2%
Hydrogen (H_2)	0-1%

10. How do microbes reduce the environmental degradation caused by chemicals?

Microbes reduce the environmental degradation caused by chemicals in the following ways;

Bioremediation can reduce pesticide contamination of agricultural soils by biodegradation processes with the help of microorganisms.

Biofertilizers consist of microbes which enrich the soil by fixing the atmospheric nitrogen.

Biopesticides are used to kill pests by producing endotoxins.

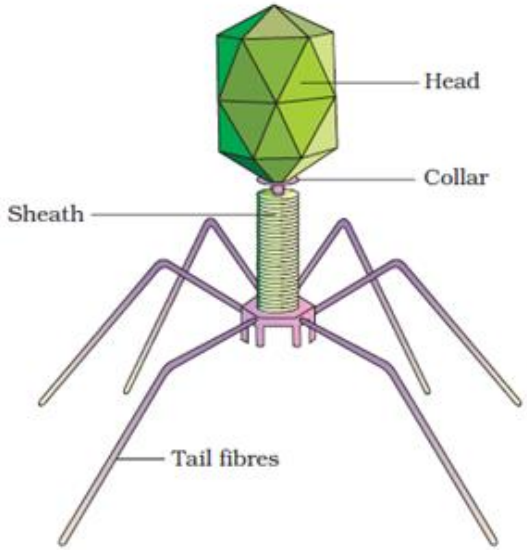
11. What is a broad-spectrum antibiotic? Name one such antibiotic.

Broad spectrum antibiotics are a class of antibiotics which can be used for treating multiple bacterial infections targeting both gram-positive and gram-negative bacteria.

Examples Ampicillin, azithromycin, amoxicillin, tetracycline.

12. What are viruses parasitising bacteria called? Draw a well-labelled diagram of the same.

The viruses parasitising on bacteria are known as bacteriophages.



13. Which bacterial enzyme has been used as a clot-buster? What is its mode of action?

Bacterium Streptococcus produces an enzyme known as streptokinase is widely used as a **clot-buster** for removing clots from the blood vessels.

Streptokinase is used to dissolve blood clots that have formed in the blood vessels. It is used immediately after symptoms of a heart attack

14. What are biofertilizers? Give two examples.

Biofertilizers are products that contain living microorganisms essential for soil fertility and plant growth when added to the soil.

They are used to provide additional supplements for increasing the nutrient content in the soil.

They help in the overall development and growth of the plants.

Rhizobium and Nostoc are examples of biofertilizers.

Long Answer Type Questions

1. Why is aerobic degradation more important than anaerobic degradation for the treatment of large volumes of wastewater rich in organic matter? Discuss.

Aerobic degradation is more important than anaerobic degradation for the treatment of large volumes of wastewater rich in organic matter because:

i) By aerobic degradation, the major part of the organic sludge is digested in the wastewater

ii) After the aerobic degradation of the decomposers, they get separated along with the organic matter, which is rich in nutrients.

iii) Biological oxygen demand (BOD) is reduced during aerobic degradation, which makes the water more suitable for aquatic organisms.

iv) Activated sludge is produced in aerobic degradation that produces gases like methane and carbon dioxide, which are the main constituents of the biogas.

2. (a) Discuss the major programs that the Ministry of Environment and Forests, Government of India, has initiated to save major Indian rivers from pollution.

(b) Ganga has recently been declared the national river. Discuss the implication with respect to the pollution of this river.

(a) The Ministry of Environment and Forests, Government of India, has initiated two plans:

i. Ganga Action Plan

ii. Yamuna Action Plan

These plans were planned to involve a large number of sewage treatment plants.

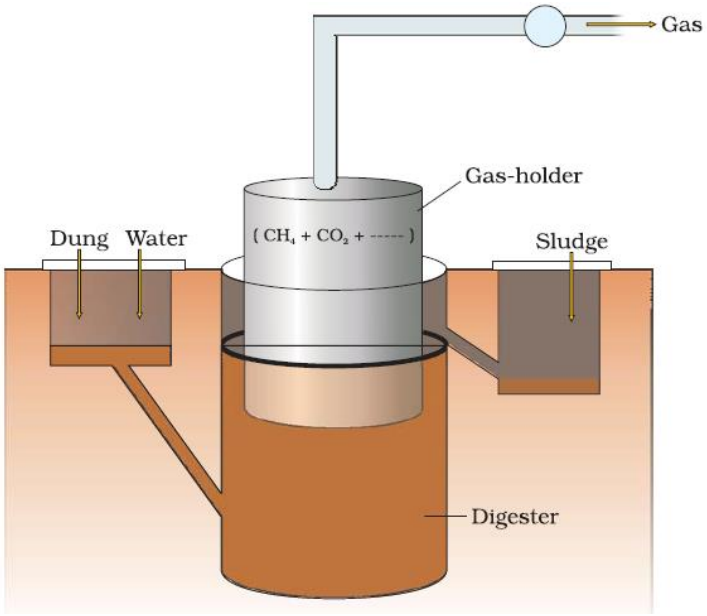
Ganga and Yamuna are very important rivers in terms of flora and fauna and as a tourist and religious attraction spot.

(b) The river Ganga is the largest river in India which covers a total distance of approximately 2520 km across India and Bangladesh

It provides the habitat for more than 140 different species of fish and about 90 different species of amphibians and many endangered species.

So, the river Ganga is considered as the largest river and requires to be free from pollution.

3. Draw a diagrammatic sketch of the biogas plant, and label its various components given below: Gas Holder, Sludge Chamber, Digester, Dung + water chamber.



4. Describe the main ideas behind the biological control of pests and diseases.

The main ideas behind the biological control of pests and diseases are to control the number of pests by introducing natural predators to the environment for this pest.

Examples are:

(i) The Ladybird beetle is used to control the population of insects like Aphids.

(ii) Dragonflies are used to control mosquitoes.

(III) Bacillus thuringiensis control caterpillars of butterfly.

(iv) Trichoderma species are free-living fungi that are very common in the root ecosystems.

They are effective biocontrol agents of several plant pathogens.

(v) Baculoviruses are pathogens that attack insects and other arthropods.

No	Organisms	Pathogens
1	Lady birds	Aphids
2	Dragonflies	Mosquitoes
3	Bacillus thuringiensis	Caterpillars
4	Trichoderma	Plant Pathogens
5	Baculoviruses	Insects

5. (a) What would happen if a large volume of untreated sewage is discharged into a river?

(b) In what way anaerobic sludge digestion is important in sewage treatments?

a) The Biological Oxygen Demand (BOD) will get higher, which would lead to the death of organisms such as fish due to the low availability of oxygen in the water.

Waterborne diseases like cholera and dysentery, as people drink water directly from the river will be spread.

b) Anaerobic sludge digestion is important in sewage treatments because it decreases the Biological Oxygen Demand (BOD) and the sludge digestion occurs in the presence of anaerobic bacteria.

When the sludge is digested, the anaerobic bacteria release a mixture of gases like methane (CH_3), carbon dioxide(CO_2) and hydrogen sulphide (H_2S).

These are the main constituents of biogas.

6. Which type of food would have lactic acid bacteria? Discuss their useful application.

Lactic acid bacteria occur in curd.

They convert lactose sugar into lactic acid.

They improve the nutritional quality of curd by increasing vitamin B12.

They are also found in our stomach where they check disease-causing microbes.

They convert the lactose present in the milk into lactic acid and help the people with lactose intolerance in easy digestion of milk lactose.

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