NCERT Solutions For Class 12 Biology Chapter 8: Chapter 8 of NCERT Class 12 Biology, Microbes in Human Welfare, explores the diverse roles of microorganisms in various fields. It highlights their use in industries for producing beverages, antibiotics, and enzymes, as well as in agriculture for biofertilizers and biopesticides. The chapter explains how microbes are vital in sewage treatment, biogas production, and bioremediation. It also covers their role in food processing and healthcare.

Through examples like Rhizobium, Lactobacillus, and Methanogens, the chapter emphasizes the beneficial aspects of microbes in sustainable development, waste management, and improving human welfare, showcasing their indispensable role in maintaining ecological balance.

NCERT Solutions For Class 12 Biology Chapter 8 Overview

Chapter 8 of NCERT Class 12 Biology, Microbes in Human Welfare, emphasizes the critical importance of microorganisms in enhancing human life and sustaining the environment. Microbes play a pivotal role in industrial processes, producing antibiotics, beverages, and enzymes, and are essential in agriculture as biofertilizers and biopesticides for eco-friendly crop management.

They contribute to waste treatment through sewage processing, biogas production, and bioremediation, reducing pollution and conserving resources. Additionally, microbes are crucial in food processing and medicine, underscoring their role in promoting health and sustainability. This chapter showcases how harnessing microbes can drive progress while protecting ecological balance.

NCERT Solutions For Class 12 Biology Chapter 8 Microbes in Human Welfare

Below we have provided NCERT Solutions For Class 12 Biology Chapter 8 Microbes in Human Welfare -

1. Bacteria cannot be seen with the naked eye, but these can be seen with the help of a microscope. If you have to carry a sample from your home to your biology laboratory to demonstrate the presence of microbes with the help of a microscope, which sample would you carry and why?

Solution:

Curd is suitable for using a microscope to show the presence of bacteria. Because it has a lot of Lactobacillus or lactic acid bacteria, it can be used as a sample. These are the microorganisms

that create the acids that break down and coagulate the proteins in milk. There are millions of microorganisms in a tiny drop of curd. Under a microscope, these are plainly observable.

2. Give examples to prove that microbes release gases during metabolism.

Solution:

Microbes release gases during metabolism; some examples are as follows:

(i) The methanobacterium found in anaerobic sludge produces a lot of methane in addition to carbon dioxide and hydrogen gas.

(ii) Carbon dioxide is released during the fermentation of cheese, bread, and beverages. Lactic acid bacteria, Saccharomyces cerevisiae, and Propionibacterium sharmanii are the microorganisms that are involved in the process.

3. In which food would you find lactic acid bacteria? Mention some of their useful applications.

Solution:

We can find lactic acid bacteria in curd. Some of the useful applications of these bacteria are:

(i) It causes an increase in the Vitamin B_{12} level of curd, thus increasing the nutritional value of curd

(ii) It can be used to ferment or culture food

(iii) They improve the health of the gut

4. Name some traditional Indian foods made of wheat, rice and Bengal gram (or their products) which involve use of microbes.

Solution:

Some Indian food made of wheat, rice and Bengal gram are:

(i) Wheat: Bread, Bhatura and Cake are made of Wheat

(ii) Rice: Idli, Dosa and Uttapam are made of Rice

(iii) Bengal gram: Dhokla and Khandvi are made of Bengal gram

5. In which way have microbes played a major role in controlling diseases caused by harmful bacteria?

Solution:

Microbes play an important role in controlling diseases caused by harmful bacteria; some are given below:

(i) Microbes are known to produce antibiotics which can be used to treat harmful diseases such as leprosy, diphtheria etc

(ii) Microbes produce antitoxins or antisera, which act against a specific pathogen. Antisera is known to be widely used against lock jaw tetanus, diphtheria etc

(iii) They produce antibodies which contain antitoxins and opsonins that check the occurrence of diseases, namely, cholera, typhoid, smallpox etc

(iv) The design of antibiotics is such that they destroy bacteria by weakening their cell walls. This, in turn, weakens several immune cells (white blood cells) that enter the bacterial cell, causing cell lysis. The process of destructing cells such as blood cells by bacteria is known as cell lysis.

(v) Penicillium notatum, a fungus, produces the chemical penicillin. It inhibits the growth of bacteria named Staphylococci in the body

6. Name any two species of fungus, which are used in the production of the antibiotics.

Solution:

Several microbes produce antibiotics, that kill other microbes which cause diseases. These antibiotics are typically acquired from fungi and bacteria. Two species of fungus that are used in the production of antibiotics are:

(i) Penicillin – the fungal source is *Penicillium notatum*

(ii) Cephalosporin – the fungal source is *Cephalosporium acremonium*

7. What is sewage? In which way can sewage be harmful to us?

Solution:

Sewage is the term used to describe the stuff that is transported away in drains and sewers as municipal trash. Both liquid and solid wastes that are high in organic materials and microorganisms are referred to as sewage.

The majority of these microorganisms are pathogenic, meaning they have the ability to cause illnesses including water-borne infections. One of the main sources of drinking water contamination is this sewage water. Sewage water must therefore be collected and disposed of in order to be treated.

8. What is the key difference between primary and secondary sewage treatment?

Solution:

The key differences are as follows:

Primary sewage treatment	Secondary sewage treatment
It is the mechanical or physical removal of small and large substances from sewage	It includes the removal of organic matter by microbes
The process deployed is through sedimentation and filtration	The process used is the biological digestion of wastes
Less complicated and relatively low-priced method of treatment	It is a complicated process and is expensive.

9. Do you think microbes can also be used as source of energy? If yes, how?

Solution:

Microbes can be a great source of energy. For example, certain bacteria like methane-producing bacteria can be used to generate biogas (also called gobar gas). In a biogas plant, biogas is produced under anaerobic conditions (without oxygen). The plant has a deep concrete tank (10-15 feet) with inlets and outlets.

Dung is mixed with water to form a slurry, which is added to the tank. Inside, the digester contains methane-producing bacteria that break down the slurry to produce biogas. The gas is extracted through a pipe and used as energy. The leftover slurry is removed and used as fertilizer.

10. Microbes can be used to decrease the use of chemical fertilisers and pesticides. Explain how this can be accomplished.

Solution:

Chemical fertilisers and pesticides are not used in the practice of organic farming. In organic farming, microbes are crucial. By providing nutrients, bio-fertilizers use beneficial microorganisms to enhance plant development. Living organisms known to improve soil fertility are called bio-fertilizers. In order to make nutrients available and replenish the soil with organic nutrients, these are added to the roots, seeds, and soil. Numerous bacterial and cyanobacteria species have the capacity to fix nitrogen that is free in the atmosphere.

Leguminous plant root nodules contain the symbiotic bacterium Rhizobium. Nostoc, Oscillitoria, and Anabaena are examples of nitrogen-fixing cyanobacteria, whereas Azotobacter and Azospirillium are free-living nitrogen-fixing bacteria. These biofertilizers are economical and environmentally beneficial.

However, microorganisms can also be used as biopesticides to control insect pests in plants. A toxin produced by the biopesticide Bacillus thuringiensis kills insect pests.

Fields are sprayed with a mixture of water and withered bacterial spores. When the larvae of different insects feed on the crops, these spores enter their guts and produce toxins. Similarly, higher plants' roots contain the free-living fungus Trichoderma, which protects them against infections. Baculovirus is another biopesticide that is utilised as a biological control agent against insects and other arthropods.

11. Three water samples namely river water, untreated sewage water and secondary effluent discharged from a sewage treatment plant were subjected to BOD test. The samples were labelled A, B and C; but the laboratory attendant did not note which was which. The BOD values of the three samples A, B and C were recorded as 20mg/L, 8mg/L and 400mg/L, respectively. Which sample of the water is most polluted? Can you assign the correct label to each assuming the river water is relatively clean?

Solution:

The amount of oxygen that would be consumed if bacteria were to oxidise all of the organic matter in one litre of water is known as the biochemical oxygen demand, or BOD. Since the BOD test gauges how quickly microorganisms in a water sample absorb oxygen, it is considered a gauge of the amount of organic matter present in the water. Consequently, wastewater's potential for pollution increases with its BOD.

Sample A with BOD 20mg/L can be assigned as the secondary effluent discharged from a sewage treatment plant.

Sample B with BOD 8mg/L can be assigned as river water

Sample C with BOD 400mg/L can be assigned as untreated sewage water.

This assignment is on the basis that the highest BOD value is the sample carrying the most polluted water.

12. Find out the name of the microbes from which Cyclosporin A (an immunosuppressive drug) and Statins (blood cholesterol lowering agents) are obtained.

Solution:

Cyclosporin A, an immunosuppressive drug, is obtained from the fungus *Trichoderma polysporum*. Statins, a blood cholesterol-lowering agent, is obtained from the yeast *Monascus purpureus*.

13. Find out the role of microbes in the following and discuss it with your teacher.

(a) Single cell protein (SCP)

(b) Soil

Solution:

The role of microbes in the following are as follows:

(a) Single cell protein (SCP)

(i) It refers to the harmless microbial cells that can be substituted for good proteins.

(ii) Some forms of microbial cells can be consumed as food enriched in minerals, proteins, fats, vitamins and carbohydrates, like how mushrooms are consumed and yeast is eaten by athletes as a source of protein.

(iii) Methylophilus methylotrophus, and Spirulina are cultivated on a large scale on materials comprising starch-like wastewater from potato processing plants, molasses, straw, animal manure and sewage

(b) Soil

(i) The role of microbes is crucial in preserving the fertility of the soil

(ii) It helps in forming nutrient-rich humus by the phenomena of decomposition

(iii) Several bacteria and cyanobacteria species have the potential to fix atmospheric nitrogen to a form that can be used by plants

(iv) A symbiotic bacteria, Rhizobium, is found in the root nodules of leguminous plants

(v) Some free-living nitrogen-fixing bacteria, Azotobacter and Azospirillum, and some nitrogen-fixing cyanobacteria – Nostoc, Oscillitoria, and Anabaena, are found here.

14. Arrange the following in the decreasing order (most important first) of their importance, for the welfare of human society. Give reasons for your answer. Biogas, Citric acid, Penicillin and Curd.

Solution:

The following are arranged in decreasing order of importance, the first being the most important for the welfare of human society.

Penicillin > Biogas > Curd > Citric acid

Reason:

(i) Penicillin is an antibiotic that saves lives by eliminating microorganisms that cause dangerous illnesses and infections. It is therefore the most crucial.

(ii) The next in line is biogas, which is produced as a byproduct of sewage treatment and is a clean, non-polluting fuel. In distant locations, it can be used to light homes and cook meals.

(iii) Next is curd. It has a high nutritional value supplying vitamin B_{12}. It helps maintain the health of the gut and replaces harmful bacteria in the stomach with beneficial ones.

(iv) The last in order is citric acid. It is used as a food preservative.

15. How do biofertilisers enrich the fertility of the soil?

Solution:

Bio-fertilizers are beneficial microbes that enhance plant growth by providing essential nutrients and improving soil fertility. These living organisms are applied to roots, seeds, or soil to enrich it with organic nutrients, making nutrients more accessible to plants. Some microbes, like cyanobacteria and bacteria, can fix free atmospheric nitrogen.

Rhizobium, a symbiotic bacterium, resides in the root nodules of leguminous plants, while free-living nitrogen-fixing bacteria include Azotobacter and Azospirillum. Nitrogen-fixing cyanobacteria like Nostoc, Oscillatoria, and Anabaena also contribute to soil fertility. Bio-fertilizers are not only eco-friendly but also a cost-effective solution for sustainable agriculture, reducing the need for chemical fertilizers.

Benefits of Using NCERT Solutions For Class 12 Biology Chapter 8

- **In-depth Understanding**: Simplifies complex topics like microbial applications in industries, agriculture, and waste management for better clarity.
- **Exam-Oriented**: Provides accurate, step-by-step answers as per the CBSE marking scheme, aiding in scoring high marks.
- **Concept Reinforcement**: Enhances comprehension of practical applications of microbes in sustainable development.
- **Time Management**: Saves time during exam preparation with concise, well-structured answers.
- **Practice Resource**: Serves as an excellent revision tool, covering all important questions and key points effectively.
- **Confidence Booster**: Builds confidence by aligning solutions with NCERT guidelines and exam patterns.