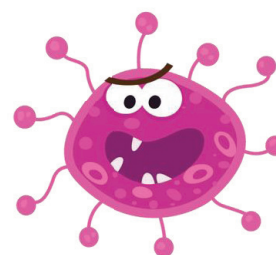
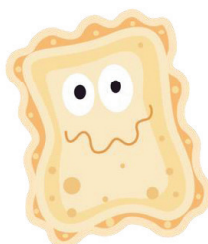
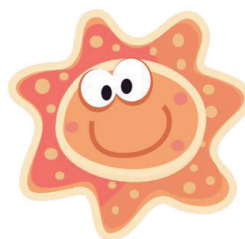
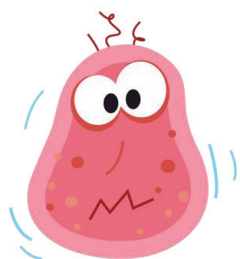
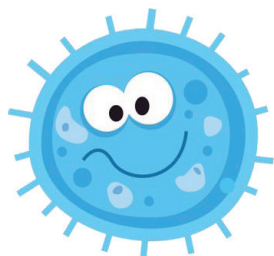


MICROBES IN HUMAN WELFARE



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MICROBES IN HUMAN WELFARE

Microbes in Human Welfare:

Apart from the harmful and Infectious disease-causing pathogens, there are several useful microorganisms which are beneficial to humans in various ways. Some of the most important contributions of microbes to human welfare are discussed below.

In Household Products:

- Fermentation of milk to prepare yogurt.
- Curdling of milk to prepare curd, cheese, and paneer.
- Fermentation of dough, which is used for making bread, idli, and dosa.

In Industrial Products:

- Production Beverages like wine, beer, whiskey, brandy or rum.
- Production antibiotics like Penicillin and other chemical substances to kill or retard the growth of disease-causing microbes.
- Few Chemicals, Enzymes and other Bioactive Molecules are also produced by these microbes for various human uses.

Antibiotics:

Antibiotics are chemical substances produced using microbes against any disease-causing microbe. Penicillin, the first antibiotic discovered was obtained from mold is referred to as *Penicillium notatum*. For the treatment of different diseases like Whooping cough, leprosy, diphtheria, plague, etc antibiotics are required.

For the production of certain chemicals like alcohols, enzymes, organic acids, etc, microbes are used. For example, *Acetobacter aceti* is used to produce acetic acid, *Aspergillus niger* is used to produce citric acid and *Lactobacillus* is used to produce lactic acid. Lipase enzymes can also be prepared using microbes. Streptokinase is produced by the bacterium *Streptococcus* which is very useful in removing clots from the blood vessels of patients who have undergone myocardial infarction leading to heart attack, thus acting as a 'clot buster'. An immunosuppressive agent known as cyclosporin A is obtained from the fungus known as *Trichoderma polysporum* is used during organ transplant.

Chemicals, Enzymes and other Bioactive Molecule:

Microbes are also used for commercial and industrial production of certain chemicals like organic acids, alcohols and enzymes.

Examples of acid producers are Chemicals:

- *Aspergillus niger* (fungus): Citric acid
- *Acetobacter aceti* (bacterium): Acetic acid
- *Clostridium butylicum* (bacterium): Butyric acid
- *Lactobacillus* (bacterium): Lactic acid

- *Saccharomyces cerevisiae*: Ethanol

Enzymes:

- Lipase: Used in laundry detergents.
- Pectinase and protease: Used in bottled juices.
- **Streptokinase (*Streptococcus bacterium*)**: Used as clot buster (to remove clots) from the blood vessels of patients who have undergone myocardial infarction leading to heart attack.

Bioactive molecules:

- **Cyclosporin A (*Trichoderma polysporum* fungi)**: Used as immunosuppressive agent (for organ transplant patients).
- **Statins (*Monascus purpureus* yeast)**: Used as blood cholesterol lowering agents.

Microbes in Sewage Treatment:

Municipal wastewater (sewage) contains large amount of organic matter and microbes which are pathogenic and cannot be discharged into natural water bodies like rivers and streams.

Sewage is treated in sewage treatment plant to make it less polluting by using heterotrophic microbes naturally present in sewage. Sewage treatment is done in two stages:

Primary treatment: In primary treatment, floating debris is removed by sequential filtration. Grit (soil and small pebbles) are removed by sedimentation.

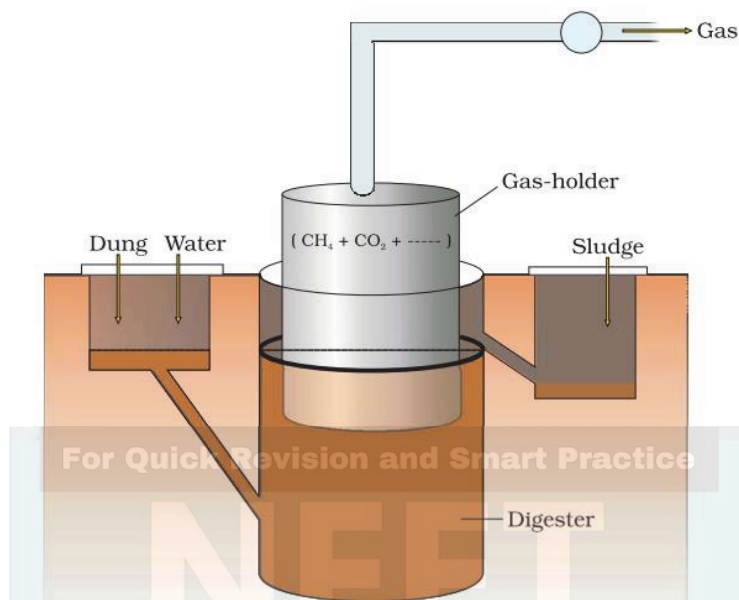
Secondary treatment: Secondary treatment or biological treatment involves passing of primary effluents in large aeration tank to help the growth of aerobic microbes into flocs (masses of bacteria associated with fungal filaments to form mesh like structures). These microbes increase the consumption of organic wastes and decrease the BOD (biological oxygen demand) of the effluents.

BOD (biochemical oxygen demand):

- BOD is the amount of oxygen that would be consumed if all the organic matter in one litre of water were oxidized by bacteria. It measures the amount of organic matter present in the water. Greater the BOD of water more it is polluted.
- Once the BOD of sewage or waste water is reduced, the effluent is then passed into a settling tank where the bacterial 'flocs' are allowed to sediment. This sediment is called activated sludge.
- Sludge is passed into large tanks called anaerobic sludge digesters in which anaerobic bacteria digest the bacteria and fungi in the sludge and produce mixture of gas called biogas, which is a mixture of methane, hydrogen sulphide and carbon dioxide.
- The effluents from the secondary treatment plant are released into water bodies.

Microbes in Production of Biogas:

Biogas is a mixture of gases produced by the microbial activity that can be used as fuel. Certain bacteria that grow anaerobically on cellulosic material produce large amount of methane along with CO_2 and H_2 . These bacteria are collectively called methanogens (Methanobacterium).



Biogas Plant:

- The excreta of cattle (gobar) is rich in methanogens bacteria and is used for generation of biogas also called as gober gas.
- The technology of biogas production was developed in India mainly due to the efforts of Indian Agricultural Research Institute (IARI) and Khadi and Village Industries Commission (KVIC).
- Biogas plant consists of a concrete tank in which bio-wastes are collected and slurry of dung is fed.
- A floating cover is placed over digester that moves upward when gas is produced. The gas produced is removed and supplied through an outlet pipe for consumption.
- The spent slurry is removed through another outlet and used as fertilisers. Biogas plant is more often build in rural areas as large amount of cattle dug is available easily.

Microbes as Biocontrol agent:

Biocontrol means use of biochemical method for controlling plant disease and pests. The chemical used as pesticides and insecticides are harmful to human beings and animals.

Biological control of pests and disease is a method of controlling pest on natural prediction rather than chemicals. The organic farmer creates a system where the



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