



MICROBES IN HUMAN WELFARE

I. Introduction:

1. Microbes are a very important components of life on earth.
2. Microbes are diverse- protozoa, bacteria, fungi and microscopic animal and plant viruses, viroids and also prions that are proteinaceous infectious agents.
3. Microbes like bacteria and many fungi, can be grown on nutritive media to form colonies, that can be seen with the naked eyes.

II. Microbes in Household Products

1. **LAB (Lactic acid Bacteria):** -Microorganisms such as Lactobacillus and others commonly called Lactic acid bacteria (LAB) grow in milk and convert it to curd.
2. The LAB produces acids that coagulate and partially digest the milk proteins.
3. LAB at suitable temperature multiplies and converting milk to curd which also improves its nutritional quality by increasing Vit B₁₂.
4. The LAB plays very beneficial role in checking disease-causing microbes.
5. The dough which is used for making foods such as dosa and idle is also fermented by bacteria.
6. The puffed - up appearance of dough is due to the production of CO₂ gas.
7. Bread is fermented by using baker's yeast *Saccharomyces cerevisiae*.
8. Toddy is a traditional drink of some parts of southern India made by fermenting sap from Pains is called Toddy.
9. Microbes are also used for ferment fish, soyabean and bamboo - shoots to make foods.
10. Cheese is one of the oldest food items in which microbes were used.
11. Swiss cheese is formed by the bacterium *Propionibacterium sharmanii*
12. The large hole in Swiss cheese is due to production of a large *Propionibacterium sharmanii*.
13. Roquefort cheese are ripened by growing a specific fungus on them, which gives them a particular flavour.

III. Microbes in Industrial Products

1. Fermentors are very large vessels used for growing microbes during the production of beverages and antibiotics on an industrial scale are called Fermentors.
2. Brewer's yeast *Saccharomyces cerevisiae* is used for fermenting malted cereals and fruit juices to produce ethanol.
3. Wine and beer are produced without distillation of fermented broth.
4. Whisky, brandy and rum are produced by distillation of fermented broth.
5. Antibiotics are chemical substances, which are produced by some microbes and can kill or retard the growth of other [disease-causing] microbes.
6. Penicillin was first antibiotic discovered by Alexander Fleming from *Penicillium notatum* fungi.
7. Penicillin as an effective antibiotic was established much later by Ernest Chain and Howard Florey.
8. Penicillin was extensively used to treat American Soldiers wounded in World War II.
9. Alexander Fleming, Ernest Chain and Howard Florey were awarded the Noble Prize in 1945 for this discovery of Penicillin.
10. *Aspergillus Niger* (a fungus) produces citric acid.
11. *Acetobacter acetic* (a bacterium) produces acetic acid.
12. *Clostridium butylicum* (a bacterium) produces butyric acid.
13. *Lactobacillus* (a bacterium) produces lactic acid.



14. *Saccharomyces cerevisiae* (a fungus) produces ethanol.
15. Enzyme lipase used in detergent formulations and are helpful in removing oily stains (laundry).
16. The bottled juices are clarified by the use of pectinases and proteases.
17. Streptokinase is produced by the bacterium *Streptococcus* and modified by genetic engineering is used as a 'clot buster' for removing clots from the blood vessels of patients who have undergone myocardial infarction leading to heart attack.
18. Cyclosporin A is used as an immunosuppressive agent for organ transplant patients and is produced by the fungus *Trichoderma polysporum*.
19. Statins are produced by the yeast *Monascus purpureus* have been commercialised as bloodcholesterol lowering agents. It acts by competitively inhibiting the enzyme responsible for synthesis of cholesterol.

III. Microbes in Sewage Treatment

1. **Sewage:** The municipal wastewater is also called sewage. A major component of this waste water is human excreta.
2. Treatment of wastewater is done by the heterotrophic microbes naturally present in the sewage.
3. Primary Sewage Treatment is basically involving physical removal of particles-large and small, from the sewage through filtration and sedimentation.
4. Initially floating debris are removed by sequential filtration.
5. The grit (soil and small pebbles) are removed by sedimentation.
6. **Primary Sludge:** All solids that settle during the Primary Sewage Treatment is called Primary sludge.
7. The supernatant forms the effluent during primary sewage treatment.
8. Secondary Sewage Treatment is also called as biological treatment.
9. Flocs: Masses of bacteria associated with fungal filaments to form mesh like structures are called Flocs.
10. **Biochemical oxygen demand (BOD):** - It refers to the amount of the oxygen that would be consumed if all the organic matter in one liter of water oxidised by bacteria.
11. BOD test measures the rate of uptake of oxygen by micro-organisms in a sample of water present. The greater the BOD of wastewater, more is its polluting potential.
12. **Activated Sludge:** If the BOD of sewage or wastewater is reduced significantly, the effluent is then passed into a settling tank where the bacterial 'flocs' are allowed to sediment and this sediment is called activated sludge.
13. **Inoculum:** A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum.
14. The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters.
15. During biological or secondary treatment anaerobic bacteria produce a mixture of gases such as methane, hydrogen sulphide and carbon dioxide. These gases form 'biogas'.
16. The effluent from the secondary treatment plant is generally released into natural water bodies like rivers and streams.
17. The ministry of Environment and Forest has initiated Ganga Action Plan and Yamuna Action Plan (GAP & YAP) to save these major rivers of our country from pollution.

IV Microbes in Production of Biogas

1. Biogas is a mixture of gases (containing predominantly methane) produced by the microbial activity 1. which may be used as fuel.
2. **Methanogens:** Certain bacteria grow anaerobically on cellulosic material, produce large amount of methane along with CO₂ and H₂. These bacteria collectively called Methanogens.
3. Methanol bacterium is also present in rumen of cattle & help in breakdown of cellulose.
4. Gobar is the excreta (dung) of cattle, commonly called asgobar.
5. Dung can be used for generation of biogas commonly called as gobar gas.
6. **The biogas plant:** - It consists of a concrete tank (10 - 15 feet deep) in which biowastes are collected and a slurry of dung is fed.



7. A floating cover is placed over the slurry which keeps on rising as the gas is produced in the tank due to the microbial activity.
8. The biogas plant has an outlet which is connected to a pipe to supply biogas to nearby houses.
9. The spent slurry is removed through another outlet and may be used as fertiliser.
10. Biogas plants are more often build in rural areas.

V. MICROBES AS BIOCONTROLAGENTS

1. **The beetle with red and black markings** - the Ladybird are useful to get rid of aphids.
2. The dragonflies are useful to get rid of mosquitoes.
3. The bacteria *Bacillus thuringiensis* is used to control butterfly caterpillar.
4. **Bt - Cotton:** By the development of methods of genetic engineering, the scientists have introduced *B. Thuringiensis* toxin genes into plants and such plants are resistant to attack by insect pests. e.g: - Bt-Cotton
5. **Trichoderma species:** They are free living fungi that are very common in the root ecosystems. They are effective biocontrol agents of several plant pathogens.
6. Baculoviruses are pathogens that attack insects and other arthropods.
7. The majority of the Baculoviruses used as biological control agents are in the genus Nucleopolyhedrovirus.
8. Nucleopolyhedroviral are excellent candidates for species-specific, narrow spectrum insecticidal applications.
9. IPM - Integrated Pest Management

VI Microbes as Biofertilisers

1. Bio-fertilizers are organisms that enrich the nutrient quality of the soil.
2. Bio-fertilizers are used in organic farming
3. The main source of biofertilizers are bacteria, fungi and cyanobacteria.
4. **Rhizobium:** It is a bacterium which shows symbiotic association with the root nodules of leguminous plants for Nitrogen fixation.
5. **Azotobacter & Azospirillum:** These are free-living N_2 fixing bacteria in the soil and enriching the nitrogen content of the soil.
6. **Mycorrhiza:** The symbiotic association between fungi and root system of vascular plants is called mycorrhiza.
7. Many members of the genus *Glomus* form mycorrhiza.
8. The fungal symbiont in mycorrhizal association absorbs phosphorus from soil and passes it to the plant.
9. Plants having mycorrhizal association show other benefits such as resistant to root borhe pathogens, tolerance to salinity and drought and an overall increase in plant growth and development.
10. **N_2 fixing Cyano bacteria:** - These are autotrophic microbes widely distributed in aquatic and terrestrial environments many of which can fix atmospheric nitrogen. e.g., *Anabaena*, *Nostoc*, *Oscillatoria*
11. In paddy fields, cyanobacteria serve as an important biofertilizer.
12. Blue green algae also add organic matter to the soil and increase its fertility.
13. A number of biofertilizers are available commercially in the market and farmers use these regularly in the fields to replenish soil nutrients and to reduce dependence on chemical fertilisers.

