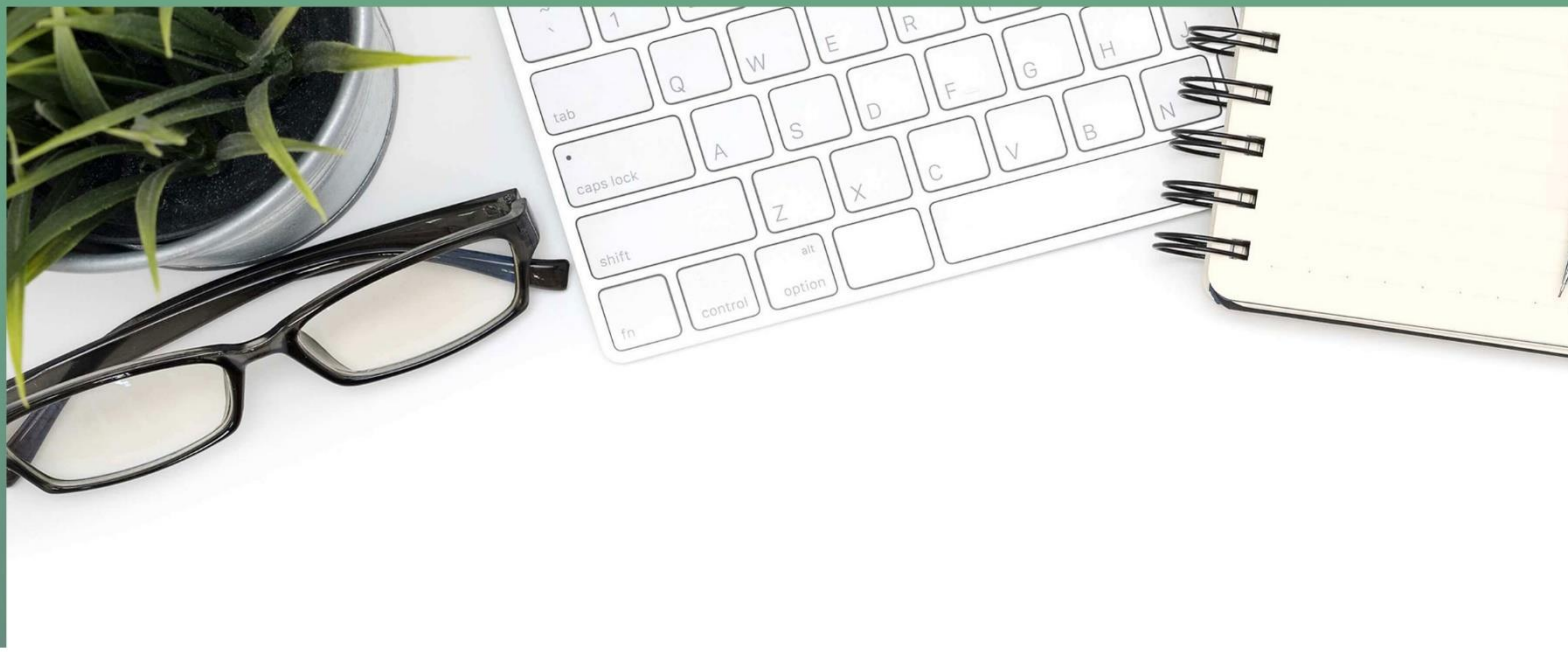

NEET Biology

Short Notes

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In this article we are providing Short notes on Microbes in Human Welfare for NEET 2019! It is one of the easiest and scoring chapter from the Unit Microbes In Human Welfare. Every year 1-2 questions are asked from this chapter in NEET, AIIMS, JIPMER and various other medical examination. Let's begin with a brief introduction about the Microbes. Moreover, you can download the Microbes in Human Welfare Notes PDF, we have shared at the end.

MICROBES IN HUMAN WELFARE

The major biological components on this earth besides animals and plants are microbes. Microbes are ubiquitous, that is, they can be found everywhere, even at those places where other life form could not exist. They include bacteria, viruses, prions, viroids, protozoa and fungi. They are known to cause various diseases in plants, animals, and human beings. However, they are not always harmful. Many of them are useful and contribute to human welfare as well.

MICROBES IN HOUSEHOLD PRODUCTS

Microbes and their products are used almost every day.

1. **CURD PRODUCTION FROM MILK –** In milk, LAB (Lactic acid bacteria) including *Lactobacillus* and other bacteria are grown. Their growth allows the formation of curd by the conversion of milk. Lactic acid is produced by these bacteria while growing. This acid causes coagulation of the milk protein and its partial digestion. Curd formation from milk requires the addition of curd in small amount containing LAB in millions, which acts as starter or inoculum. These bacteria multiply at suitable temperature and results in curd formation. This increases vitamin B_{12} and thus, its nutritional quality is also improved. They are also beneficial as they check the growth of microbes that are disease causing in our stomach.
2. **FERMENTED PRODUCTS –** Louis Pasteur discovered fermentation, which is an anaerobic process. In this process, sugar is converted to form alcohol. For example, bacteria ferments the dough used to make idli, dosa and other such foods. Carbon dioxide is produced during the process and is responsible for the dough's puffed-up appearance. *Saccharomyces cerevisiae*, the baker's yeast, is used to ferment the dough that is required for bread formation. Microbes also ferment various traditional foods and drinks. In some southern parts of India, palm sap is fermented to make a traditional drink named 'Toddy'. Bamboo-shoots, soyabean and fish are also fermented by microbes for making foods. Different microbes are also used to specifically produce different cheese varieties. They have different characteristic taste, flavour and texture. For example, *Propionibacterium sharmanii* produce CO_2 in large amount leading to large holes found in Swiss cheese. A specific fungi ripens 'Roquefort cheese' providing a flavour to it.

MICROBES IN INDUSTRIAL PRODUCTS

Microbes are also used in industries for synthesizing various products useful to humans. For example, antibiotics and beverages are the industrial products. These require the microbes to be grown in large vessels called fermentors for large scale production.

1. **FERMENTED BEVERAGES** – Yeasts are being used in beverage production such as beer, brandy, whisky, rum and wine from time immemorial. Saccharomyces cerevisiae, also called brewer's yeast, ferments fruit juices and malted cereals, leading to ethanol production. Alcoholic drinks of different types are obtained based on the raw material used during fermentation and the processing type (without or with distillation). The fermented broth is distilled and produce rum, brandy and whisky. However, the production of beer and wine occurs without distillation.
2. **ANTIBIOTICS –** Microbes also produce antibiotics. The term antibiotics is derived from two Greek words 'anti' meaning 'against' and 'bio' meaning 'life'. So, the meaning of the term is against life, that is, against disease causing microbes. However, for human beings, they are not against but 'pro life'. Some microbes produce chemical substances that can prevent the growth of or kill other disease causing microbes. These substances are called antibiotics. The first antibiotic that was discovered by Alexander Fleming was Penicillin. Once he observed the growth of a mould in the unwashed *Staphylococci* culture plates around which the growth of bacteria was inhibited. This mould was *Penicillium notatum* and a chemical was being produced by this mould and was named Penicillin after the name of the mould. The discovery of this antibiotic occurred by chance but Howard Florey and Ernest Chain established its full potential much later. In World War II, Penicillin was used extensively for the treatment of wounded American soldiers. In 1945, Nobel Prize was also awarded for this discovery to Florey, Chain and Fleming. Later, purification of other antibiotics also occurred from other microbes. For example, streptomycin was purified from Streptomyces. With antibiotics, the treatment capacity for various deadly diseases such as kali khansi (whooping cough), kusht rog (leprosy), plague, and gal ghotu (diphtheria), has greatly improved.
3. **ENZYMES, CHEMICALS AND OTHER BIOACTIVE MOLECULES –** Certain chemicals like enzymes, alcohols, and organic acids are also produced industrially and commercially using microbes.

   a. ORGANIC ACIDS –

ORGANIC ACID	MICROBES
Citric acid	A fungus, *Aspergillus niger*
Acetic acid	A bacterium, *Acetobacter aceti*
Butyric acid	A bacterium, *Clostridium butylicum*
Lactic acid	A bacterium, *Lactobacillus*

   b. ALCOHOLS – Ethanol is produced commercially by *Saccharomyces cerevisiae*, a yeast.

   c. ENZYMES – Enzymes are also produced by microbes.

ENZYMES	USES
Lipases	Formulation of detergents. Oily stain removal from the laundry.
Proteases and pectinases	Clarification of bottled juices.
Streptokinase	Production occurs by *Streptococcus*, a bacterium, and genetic engineering is used to modify. Functions as a clot buster in myocardial infraction patients causing heart attack and remove the blood clots from the vessels.
Amylases	Digestion of starch.

d. OTHER BIOACTIVE MOLECULES –

BIOACTIVE MOLECULES	MICROBE	USES
Cyclosporin A	A fungus, *Trichoderma polysporum*	In organ-transplant patients, used as immunosuppressive agent.
Statins	A yeast, *Monascus purpureus*	It lowers the blood cholesterol by competitively inhibiting cholesterol synthesising enzyme.

MICROBES IN SEWAGE TREATMENT

In towns and cities, waste water generation occurs in large quantities everyday. Human excreta forms its major component. This waste water is given the name sewage. It contains microbes (some pathogenic) and organic matter in large amounts. This waste water should not be directly discharged into streams, rivers or other natural water bodies. So, the sewage is made less polluting by its treatment in STPs (sewage treatment plants) before being disposed. Sewage contains heterotrophic microbes that are responsible for wastewater treatment. There are three stages of treatment.

1. **PRIMARY TREATMENT –** This includes physical processes in which small and large particles are removed from the sewage through the process of sedimentation and filtration. The stages of the removal are:
   a. Removal of the floating debris by filtering sequentially.
   b. Sedimentation removes grit that includes small pebbles and soil. Primary sludge is formed by the settled solids and the effluent is formed by the supernatant.

   This is followed by the secondary treatment of the effluent formed in the primary settling tank.
2. **SECONDARY TREATMENT –** It is also called biological treatment. The primary effluent is taken to large aeration tanks. Here the effluent undergoes constant mechanical agitation and aeration. Due to this useful aerobic microbes grow vigorously into flocs. Flocs are the bacterial masses that form mesh like structures by the association of fungal filaments. In the effluent, maximum organic matter is consumed by these microbes during their growth. Due to this effluent's biochemical oxygen demand (BOD) is significantly reduced. BOD is the amount of consumed oxygen if bacteria oxidises all the organic matter per liter of water. The treatment of the sewage water is done to reduce the BOD. BOD test measures the organic matter as it measures the rate of microbial oxygen uptake in a water sample. The water is said to have more polluting potential if it has greater BOD.

   With the significant reduction in the BOD of waste water or sewage, settling tank come into action. Here the sedimentation of the bacterial 'flocs' occur giving activated sludge sediment at the bottom. A small amount of the activated sludge functions as the inoculum and is sent back to the aeration tank. Rest of the sludge enters large anaerobic sludge digesters. In these digesters fungi and bacteria present in the sludge are digested by the anaerobic bacteria. A mixture of gases such as carbon dioxide, hydrogen sulphide and methane are produced during digestion, forming biogas. This biogas is inflammable and can be used as an energy source.

3. **TERTIARY TREATMENT –** This treatment is the process of final cleaning for improving the quality pf waste water before being discharged into the streams, rivers and other natural water bodies. The remaining inorganic compounds, phosphorus, nitrogen and other substances are removed during this stage. For example, additional phosphorus particles can be removed by using alum.
   Removal of harmful parasites, viruses and bacteria also occur at this stage. This can be done by chlorination of the water.

So, across the globe, millions of gallons of waste water is treated with microbes playing a major role during the process. The production of sewage has increased manifolds with the increasing urbanization. However, there are not enough sewage treatment plants. Due to this, the sewage remains untreated and is directly discharged into the water bodies, resulting in an increase in water pollution and water-borne diseases.
Therefore, in our country, Yamuna Action Plan and Ganga Action Plan has been initiated by the Ministry of Environment and Forests to save these major rivers. These Plans propose sewage treatment plants to be built in large numbers so as to allow the discharge of only treated sewage into the rivers.

All the best!
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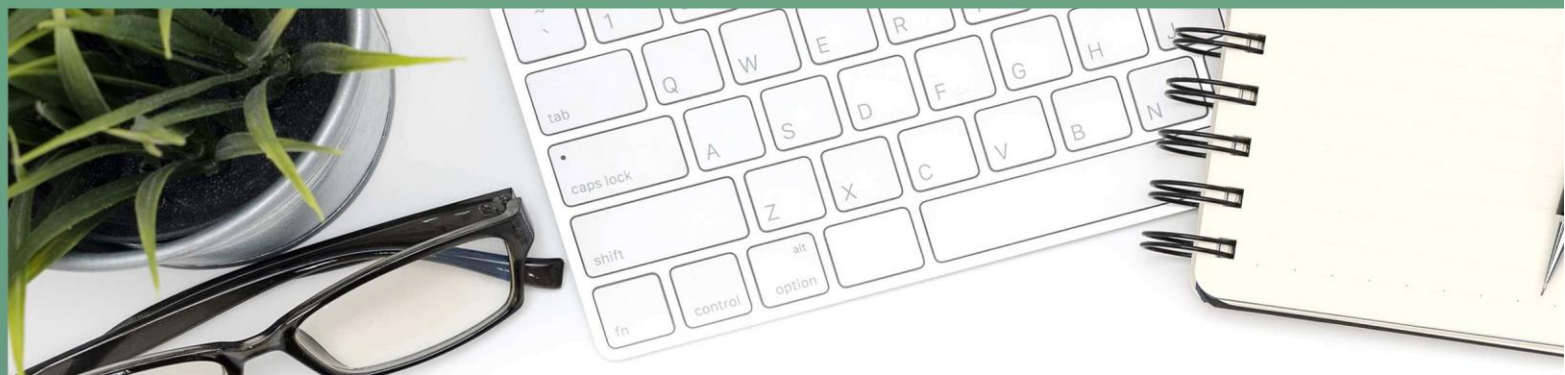

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