

Mrs. M. AHAMED NOWROSE BEGAM M.Sc., M.Phil., B.Ed., M.A., M.Phil., (Edn.)
PRINCIPAL, J.M. MATRIC. GIRLS HR. SEC. SCHOOL, CHENNAI – 6000 007

+2 ZOOLOGY

UNIT - III

CHAPTER – 9

MICROBES IN HUMAN WELFARE

FULL STUDY MATERIAL

1. How is milk converted into curd? Explain the process of curd formation.

The LAB bacteria grow in milk and convert it into curd, thereby digesting the milk protein casein. A small amount of curd added to fresh milk as a starter or inoculum contains millions of *Lactobacilli*, which under suitable temperature ($\leq 40^{\circ}\text{C}$) multiply and convert milk into curd. Curd is more nutritious than milk as it contains a number of organic acids and vitamins.

2. Give any two bioactive molecules produced by microbes and state their uses.

Cyclosporin A is a bioactive molecule produced from the fungus *Trichoderma polysporum*.

It is an active immunosuppressant, used in organ transplantation. It serves as an antibacterial, anti-inflammatory antifungal and antiparasitic.

Recombinant human insulin is another bioactive molecule produced predominantly using *E. coli* and *Saccharomyces cerevisiae*. It is used to treat diabetic patients.

3. Define the following terms: a) Antibiotics b) Zymology c) Superbug

Antibiotics are chemical substances produced by microorganisms which can kill or retard the growth of other disease-causing microbes even in low concentration. Antibiotic means "against life". Antibiotics are used to treat diseases such as plague, meningitis, diphtheria, syphilis, leprosy, tuberculosis etc.,

Zymology is an applied science which deals with the biochemical process of fermentation and its practical uses.

Super bug:

"Superbug" is a term used to describe strains of bacteria that are resistant to the majority of antibiotics commonly used today.

4. Write short notes on the following:

a) Brewer's yeast b) *Ideonella sakaiensis* c) Microbial fuel cells

a) Brewer's yeast:

Saccharomyces cerevisiae commonly called brewer's yeast is used for fermenting malted cereals and fruit juices to produce various alcoholic beverages.

b) *Ideonella sakaiensis*:

Mrs. M. AHAMED NOWROSE BEGAM M.Sc., M.Phil., B.Ed., M.A., M.Phil., (Edn.)
PRINCIPAL, J.M. MATRIC. GIRLS HR. SEC. SCHOOL, CHENNAI – 6000 007

It is currently tried for recycling of PET plastics. These bacteria use PETase and MHETase enzymes to breakdown PET plastic into terephthalic acid and ethylene glycol.

c) **Microbial Fuel Cells:**

A microbial fuel cell is a bio-electrochemical system that drives an electric current by using bacteria and mimicking bacterial interaction found in nature.

5. List the advantages of biogas plants in rural areas.
 - The raw materials required to produce biogas like agricultural wastes, manure, municipal wastes, plant material, sewage, food waste, etc., are easily available in rural areas. Hence biogas plants in rural areas is inexpensive.
 - The biogas plant can be easily set up in rural areas as more space is available close to kitchen in rural areas as compared to urban areas.
 - The slurry drained during the biogas production can be used as fertilizer in farm lands, hence it is cost effective.
6. When does antibiotic resistance develop?
Antibiotic resistance develops when bacteria are able to defeat the drug designed to kill or inhibit their growth. Antibiotic resistance is accelerated by the misuse and over use of antibiotics, as well as poor infection prevention control.
7. What is referred as industrial alcohol? Briefly describe its preparation.
Ethanol is referred as industrial alcohol.
The process of ethanol production starts by milling a feed stock followed by the addition of dilute or fungal amylase (enzyme) from *Aspergillus* to break down the starch into fermentable sugars. Yeast is then added to convert the sugars to ethanol which is then distilled off to obtain ethanol which is up to 96 percent in concentration.
8. What is bioremediation?
The use of naturally occurring or genetically engineered microorganisms to reduce or degrade pollutants is called bioremediation.
Additional questions:
9. What does antibiotic mean?
It means “against life.”
10. What was the antibiotic discovered by Selman Waksman?
Streptomycin
11. Who coined the term antibiotic?
Selman Waksman

Mrs. M. AHAMED NOWROSE BEGAM M.Sc., M.Phil., B.Ed., M.A., M.Phil., (Edn.)
PRINCIPAL, J.M. MATRIC. GIRLS HR. SEC. SCHOOL, CHENNAI – 6000 007

12. Who discovered the first antibiotic?

Alexander Fleming discovered the first antibiotic, Penicillin.

13. Where is Penicillin extracted from?

It is extracted from the fungus *Penicillium notatum* and *Penicillium chrysogenum*.

14. How is *Penicillium* is useful?

It is bactericidal (antibiotics that kill bacteria) in action and inhibits the synthesis of bacterial cell wall.

15. Why is Penicillin referred as the “queen of drugs”?

It is because of its full potential as an effective antibiotic and its superiority over other drugs by acting against pathogens.

16. What do the following terms refer to?

a) Antibiosis b) Broad spectrum antibiotics c) Narrow spectrum antibiotics

a) Antibiosis is the property of antibiotics to kill microorganisms.

b) Broad-spectrum antibiotics act against a wide range of disease- causing bacteria.

c) Narrow-spectrum antibiotics are active against a selected group of bacterial types.

17. Say about a. Tetracycline b. Chlortetracycline c. Streptomycin

Tetracycline is a broad-spectrum bacteriostatic antibiotic (antibiotics that limit the growth of bacteria) that inhibits microbial protein synthesis.

Chlortetracycline is the first antibiotic of this group, isolated from the cultures of *Streptomyces aureofaciens*.

Streptomycin is a broad-spectrum antibiotic isolated from the actinomycetes, *Streptomyces griseus*. It is bactericidal against both gram positive and gram-negative bacteria, especially against *Mycobacterium tuberculosis*.

18. Mention some antibiotics, isolated as microbial products.

Erythromycin, Chloromycetin, Griseofulvin, Neomycin, Kanamycin, Bacitracin

19. Why testing injection given, before injecting Penicillin drug into a body?

Hypersensitivity reaction is a major problem with the use of penicillin, resulting in nausea, vomiting, wheezing and ultimately cardiovascular collapse.

To check the sensitivity reaction, doctors use a needle to prick the forearm of the patients to give a weak dose of penicillin. An itchy red region in the forearm is an indication that the patient is allergic to

Mrs. M. AHAMED NOWROSE BEGAM M.Sc., M.Phil., B.Ed., M.A., M.Phil., (Edn.)
PRINCIPAL, J.M. MATRIC. GIRLS HR. SEC. SCHOOL, CHENNAI – 6000 007

penicillin. This test is important before administration of penicillin to a patient.

20. What is Pasteur effect?

The inhibiting effect of oxygen on the fermentation process is called Pasteur effect.

21. Name the science that deals with the study of wine and wine making.
Oenology

22. Differentiate between red wine and white wine.

Red wine is produced from black grapes. Their skin and sometimes the stems also are used to produce red wine.

In contrast white wine is produced only from the juice of either white or red grapes without their skin and stems.

23. How are the following fermented beverages produced?

a. Beer b. Rum c. Whisky

Beer is produced from germinated barley malt grain by *Saccharomyces carlsbergensis* or *Saccharomyces cerevisiae*.

Rum is made from fermented sugarcane or molasses or directly from sugarcane juice by *Saccharomyces cerevisiae*.

Whisky is a type of distilled alcoholic beverage made from fermented grain mash by *Saccharomyces cerevisiae*.

24. What is Pathaneer?

Pathaneer is a traditional drink produced in some parts of South India. It is obtained from fermenting sap of palms and coconut trees.

25. Say about the economic importance of Pathaneer.

It is a refreshing drink, which on boiling, produces jaggery or palm sugar.

When pathaneer is left undisturbed for few hours it gets fermented to form toddy with the help of naturally occurring yeast, to form a beverage that contains 4 percent alcohol.

After 24 hours toddy becomes unpalatable and is used for the production of vinegar.

26. Which is called as industrial alcohol?

Ethanol

27. Say about the alcoholic contents in various beverages.

Beer - contains 3 to 5 percent of alcohol.

Wine - contains 9 to 14 percent alcohol.

Wine coolers - contain about 4 to 6 percent alcohol.

Distilled spirits such as whiskey, gin, scotch and vodka - usually contain 35 to 50 percent alcohol.

28. What do you mean by wine coolers?

Mrs. M. AHAMED NOWROSE BEGAM M.Sc., M.Phil., B.Ed., M.A., M.Phil., (Edn.)
PRINCIPAL, J.M. MATRIC. GIRLS HR. SEC. SCHOOL, CHENNAI – 6000 007

Wine coolers are the beverages made by mixing wine, carbonated water and flavourings.

29. Say briefly about biodiesel.

Biodiesel is a fuel made from vegetable oils, fats or greases. Biodiesel fuel can be used in diesel engines without altering the engine. Pure biodiesel is non-toxic, biodegradable and produces lower level of air pollutants than petroleum-based diesel fuel.

The Government of India approved the National Policy on Biofuels in December 2009 and identified *Jatropha curcas* as the most suitable oilseed for biodiesel production. *Pongamia* species is also a suitable choice for production of biodiesel.

30. When is biodiesel day celebrated? What is its significance?

World biofuel day is observed every year on 10th August to create awareness about the importance of renewable bio-fuels as an alternative to conventional non-renewable fossil fuels.

31. Mention the names of microbes and the organic acids produced using them.

Microbe	Organic acid
<i>Aspergillus niger</i>	Citric acid
<i>Acetobacter aceti</i>	Acetic acid
<i>Rhizopus oryzae</i>	Fumaric acid
<i>Clostridium butyricum</i>	Butyric acid
<i>Lactobacillus</i>	Lactic acid

32. Name the enzyme which is used in detergent formulations and to remove oily stains from laundry.

Lipases

33. How are bottled juices clarified?

Bottled juices are clarified by the use of pectinase, protease and cellulase.

34. What is the use of rennet in food processing?

Rennet is used to separate milk into solid curds for cheese making.

35. Explain about the microbes and their role in the field of medicine.

Streptokinase: is produced by the bacterium *Streptococcus* and genetically engineered *Streptococci* are used as “clot buster” for removing clots from the blood vessels of patients who have undergone myocardial infarction.

Cyclosporin A: It is an immunosuppressant used in organ transplantation.

It is produced from the fungus *Trichoderma polysporum*. It is also used for its anti-inflammatory, antifungal and anti-parasitic properties.

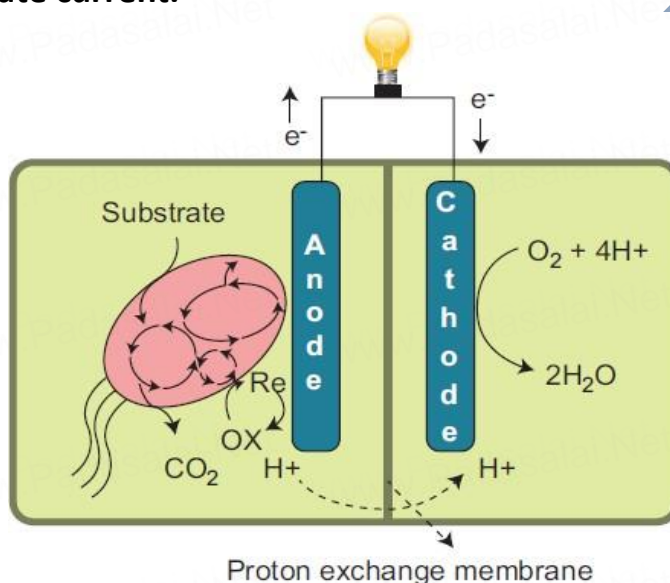
Mrs. M. AHAMED NOWROSE BEGAM M.Sc., M.Phil., B.Ed., M.A., M.Phil., (Edn.)
PRINCIPAL, J.M. MATRIC. GIRLS HR. SEC. SCHOOL, CHENNAI – 6000 007

Statins: produced by the yeast *Monascus purpureus* have been used to lower blood cholesterol levels. It acts by competitively inhibiting the enzyme responsible for the synthesis of cholesterol.

Recombinant human insulin: It has been produced predominantly using *E. coli* and *Saccharomyces cerevisiae* for therapeutic use in human.

36. How does MFC work?

A MFC consists of an anode and a cathode separated by a proton exchange membrane. Microbes at the anode oxidize the organic fuel generating protons which pass through the membrane to the cathode and the electrons pass through the anode to the external circuit to generate current.



37. Why is bioremediation better than other remediation processes?

Bioremediation is better than other remediation processes, because it is less expensive and more sustainable than other remediations available.

38. What are the two methods of bioremediation?

It is grouped into in situ bioremediation and ex situ bioremediation. In situ bioremediation refers to treatment of contaminated soil or water in the site of their generation, whereas ex situ bioremediation refers to treatment of contaminated soil or water that are removed and treated away from their site of generation.

39. What are the two types of microbes involved in bioremediation?

Aerobic microbes and anaerobic microbes

40. What are aerobic microbes? What pollutants aerobic microbes degrade?

Aerobic microbes degrade the pollutants in the presence of oxygen. They mainly degrade pesticides and hydrocarbons.

Mrs. M. AHAMED NOWROSE BEGAM M.Sc., M.Phil., B.Ed., M.A., M.Phil., (Edn.)
PRINCIPAL, J.M. MATRIC. GIRLS HR. SEC. SCHOOL, CHENNAI – 6000 007

41. What bacterium helps in reducing oil spills?

Pseudomonas putida is a genetically engineered microorganism (GEM). It is a multi-plasmid hydrocarbon-degrading bacterium that can digest the hydrocarbons in the oil spills.

42. What pollutants *Nitrosomonas europaea* act upon?

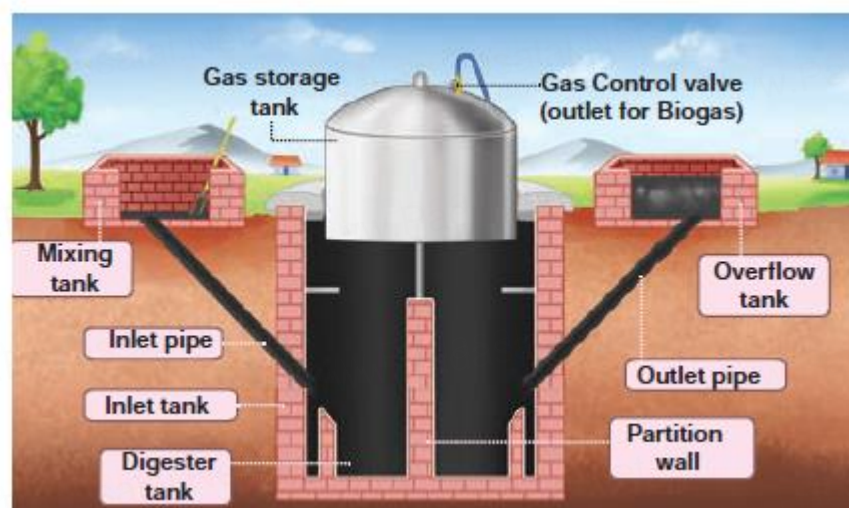
Nitrosomonas europaea can degrade benzene and a variety of halogenated organic compounds including trichloroethylene and vinyl chloride.

43. Explain about the role of different anaerobic microbes in the degradation process of various pollutants.

- *Dechloromonas aromatica*: – It has the ability to degrade benzene anaerobically and to oxidize toluene and xylene.
- *Phanerochaete chrysosporium*: It is an anaerobic fungus. It exhibits strong potential for bioremediation of pesticides, polyaromatic hydrocarbons, dyes, trinitrotoluene, cyanides, carbon tetrachloride, etc.,
- *Dehalococcoides* species: These are responsible for anaerobic bioremediation of toxic trichloroethene to non-toxic ethane.
- *Pestalotiopsis microspore*: It is a species of endophytic fungus capable of breaking down and digesting polyurethane. This makes the fungus a potential candidate for bioremediation projects involving large quantities of plastics.

44. Explain the production of biogas in biogas plant with illustration.

- ✓ In a biogas plant, anaerobic digestion is carried out in an air tight cylindrical tank known as digester.
- ✓ It is made up of concrete bricks and cement or steel.
- ✓ Bio-wastes are collected and slurry of dung is fed into this digester.
- ✓ It has a side opening into which organic materials for digestion are incorporated for microbial activity.



**Mrs. M. AHAMED NOWROSE BEGAM M.Sc., M.Phil., B.Ed., M.A., M.Phil., (Edn.)
PRINCIPAL, J.M. MATRIC. GIRLS HR. SEC. SCHOOL, CHENNAI – 6000 007**

- ✓ **Anaerobic digestion is accomplished in three stages: solubilisation, acidogenesis and methanogenesis.**
- ✓ **The outlet is connected to a pipe to supply biogas.**
- ✓ **The slurry is drained through another outlet and is used as fertilizer.**
- ✓ **Biogas is used for cooking and lighting.**

JIBREEL ACADEMY