For BioResire students

NEET Biology Material

Elite Batch

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MICROBES IN HUMAN WELFARE

SEWAGE TREATMENT

Primary treatment - Physical removed of wastes.

Secondary Treatment - Biological treatment.

BIOCONTROL AGENTS

Bacillus thuringiensis (BT)

- Control butterfly caterpillar.
- Dried spores of Bt are available in sachets.

Trichoderma

- There are free living present in the root ecosystem.
- They Control several plant pathogen.

Baculoviruses

- Especially genus Nucleopoly hedrovirus
- Attacks insects and other arthropods
- This is desirable in IPM (Integrated Pest Management) program to conserve beneficial insects

MICROBES IN HOUSEHOLD PRODUCT

(Toddy)

Microbes ferment sap from plant

(curd)

Lactobacillus /LAB

(Bread)

Saccharomyces cerevisiae

(SWISS CHEESE)

Propionibacterium Shermanii

MICROBESING BIO-FERTILIZERS

Fungi

- Mycorrhiza Associated to fungi.

(eg. genus of glomus)

Cyanobacteria

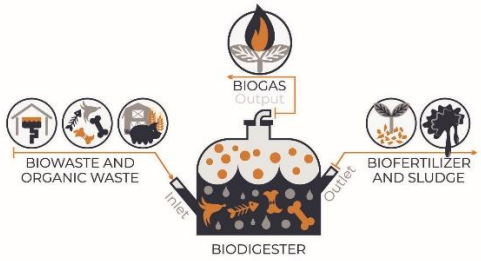
- Symbiosis : Anabaena in Azolla.
- Free living : blue green algae.

Rhizobium

- Symbiotic bacteria in root Nodules of leguminous plant.
- Fix atmospheric N_2.
- Eg Azospirillum

PRODUCTION OF BIOGAS

- Biogas is a mixture of gases (mainly methane).
- Methanogens grow anaerobically on cellulosic material and produce CH_4. Eg methanobacterium.
- The Dung of Cattle (gobar) is rich in these bacteria.
- Indian Agricultural Research Institute (IARI) and Khadi and Village Industries Commission (KVIC) Developed technology of biogas.



MICROBES IN INDUSTRIAL PRODUCT

ENZYME

Lipases

- Used in detergent formulation.
- Removes oily stains from laundry.

Pectinase and Proteases

- Used to clarify bottled juice

Streptokinase

- Produced by Streptococcus
- Used as clot buster

BIO-ACTIVE MOLECULES

Statins

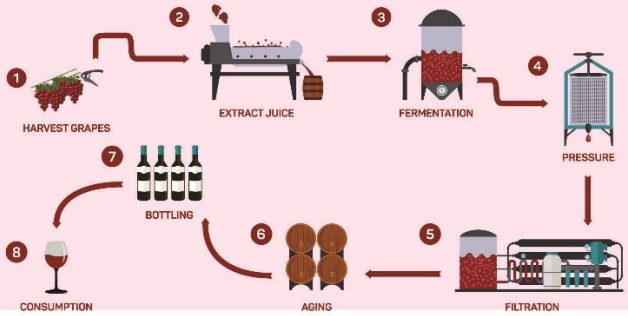
- Produced by yeast monascus purpures.

CyclosporiN'S A

- Produced fungus, Trichoderma Polysporum.
- Useful as immuno suppressive agent

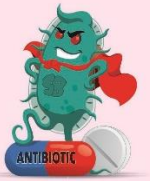
Alcohol

- Saccharomyces Cerevisiae



Organic chemical

- Aspergillus Niger form citric acid
- Acetobacter acetiox form acetic acid
- Clostridium butylicum form Butyric acid
- Lacto bacillus form Lactic Acid



Anti-biotics

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 infraction 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.

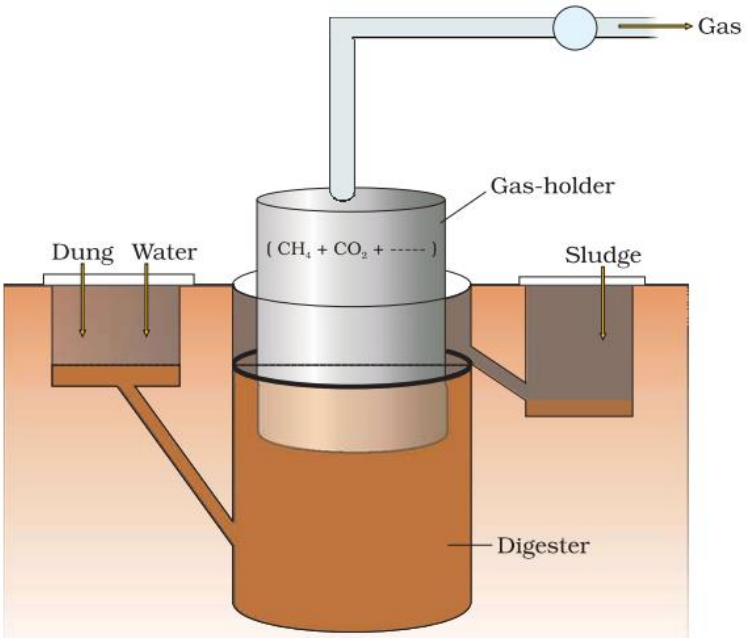
Secondary treatment: Secondary treatment or biological treatment involves passing of primary effluents in large aeration tank to help the growth of aerobic microbes into flocs (masses of bacteria associated with fungal filaments to form mesh like structures). These microbes increase the consumption of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

pests are not eradicated but kept at manageable level by complex system of check and balance within the living and vibrant ecosystem. For example, the Ladybird and Dragonflies are used to get rid of aphids and mosquitoes respectively. On brassicas and fruit tree, to control butterfly caterpillars bacteria Bacillus thuringiensis is used.

Biological control developed for use in the treatment of plant disease is the fungus Trichoderma. Trichoderma are free-living fungi that are very common in the root systems that control several plant pathogens.

Baculoviruses are pathogens that attack insects and other arthropods. The majority of baculoviruses used as biological control agents are in the genus Nucleopolyhedrovirus. These viruses are excellent candidates for species-specific, narrow spectrum insecticidal applications.

Microbes as Bio fertilizers:

Bio fertilizers are organisms that enrich the nutrient quality of the soil. The main sources include bacteria, fungi and cyanobacteria.

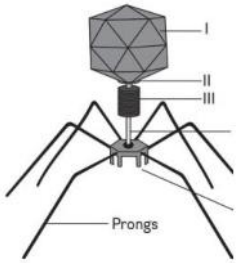
The root nodule formed by Rhizobium bacteria on root of leguminous plants increase the nitrogen level of soil, necessary for various metabolic processes. Azotobacter and Azospirillum are free living bacteria that live in soil and fix atmospheric nitrogen into organic forms.

Symbiotic association of fungi with angiosperm plants (mycorrhiza) also increase the fertility of soil. Glomus form mycorrhiza that absorbs phosphorus from the soil and passes it to the plant. These microbes also provide benefits like resistance to root-borne pathogens, tolerance to salinity and drought.

Cyanobacteria (Nostoc, Anabaena), an autotrophic microbes found in aquatic and terrestrial environment fix atmospheric nitrogen. In paddy field this acts as important bio-fertilizer. Blue green algae also add organic matter to the soil and increase its fertility.

NCERT LINE BY LINE QUESTIONS

1. Which of the following statements is incorrect? (Pg. 179, E)
   A) Besides microscopic plants and animals, microbes are the major components of biological systems on
   this earth
   B) Microbes are present everywhere even in the harsh environments such as deep inside the geysers (thermal vents) where the temperature may be as high as 1000C.
   C) Microbes are diverse–protozoa, bacteria, fungi and microscopic plant viruses, viroids and also prions.
   D) Prions are proteinaceous non- infectious agents.
2. Which of the following statements is correct? (Pg. 179, E)
   A) Microbes like protozoa can be grown on nutritive media to form colonies
   B) Microbes can cause diseases in animals not plants.
   C) Microbes are not found in highly acidic environments.
   D) All microbes are not harmful; several microbes are useful to human beings in diverse ways.
3. Following is the image of a bacteriophage. (Pg. 180, E)



   Which of the following options correctly labels its various parts?
   A) I: Head, II: Neck, III: Collar B) I: Collar, II: Head, III: Tail
   C) I: Collar, II: Tail, III: Head D) I: Tail, II: Collar, III: Head
4. The organisms responsible for converting milk into curd is- (Pg. 180, E)
   A) Lactobacillus B) Propionibacterium sharmanii C) LAB D) Both (a) and (c)
5. Which of the following statements is not incorrect? (Pg. 181, E)
   A) LAB produces acids that coagulate and completely digest the milk proteins.
   B) A small amount of cheese is added to the fresh milk as inoculum or starter contain millions of LAB, C) LAB multiply at a suitable temperature, thus converting curd to milk, which also improves its nutritional quality by increasing vitamin B12 in our stomach.
   D) LAB plays very beneficial role in checking disease causing microbes.
6. The vitamin whose content increases during curd formation by lactic acid bacteria is (Pg. 181, E)
   A) Vitamin C B) Vitamin D C) Vitamin B_{12} D) Vitamin E
7. The small amount of curd added to the fresh milk to convert it into curd is called (Pg. 181, E)
   A) starter B) inoculum C) implant D) both (A) and (B)
8. How many of the following statements are correct? (Pg. 181, E)
   I. The dough which is used for making food such as dosa and idli is also fermented by yeast.
   II. The puffed-up appearance of dough is due to the production of CO2 gas.
   III. The dough which is used for making bread, is fermented using brewer's yeast
   IV. 'Toddy', a traditional drink of some parts of Southern India is made by fermenting fruits from palms
   V. Microbes are also used to ferment fishes, soyabean and bamboo-roots to make foods.
   A) 4 B) 3 C) 2 D) 1

9. Choose the incorrect statement among the following. (Pg. 181, E)
A) Different varieties of cheese are known by their characteristic texture, flavour and taste, the specificity coming from the microbes used.
B) Large holes in 'Swiss cheese' are due to production of a large amount of SO_2 . by a bacterium named Propionibacterium sharmanii
C) The 'Roquefort cheese' are ripened by growing a specific fungi named Penicillium roqueforti which gives them a particular flavour.
D) Adenovirus is diamond like in structure and causes respiratory infections.

10. Yeast is used in the production of **(Pg. 181, E)**
A) citric acid and lactic acid B) lipase and pectinase
C) bread and beer D) cheese and butter

11. Big holes in Swiss cheese are made by a **(Pg. 181, E)**
A) a machine B) methanogens
C) the bacterium Propionibacterium sharmanii producing a large amount of carbon dioxide
D) Lactobacillus

12. How many of the following beverages are produced by distillation of the fermented broth?
Whisky, wine, rum, brandy, beer **(Pg. 181, E)**
A) 5 B) 4 C) 3 D) 1

Microbes in Industrial Products (excluding beverages)

13. Which of the following statements is incorrect? (Pg. 181, E)
A) Very large vessels in which microbes are grown for the purpose of production of beverages and antibiotics on industrial scale are termed as fermenters
B) Microbes especially yeasts have been used from time immemorial for the production of beverages like wine, beer, whisky, brandy or rum
C) For this purpose the same yeast Saccharomyces cerevisiae used for bread-making and commonly called brewer's yeast, is used for fermenting malted cereals and fruit juices, to produce ethanol
D) Antibiotics produced by microbes are regarded as one of the most significant discoveries of the 19th century and have greatly contributed towards the welfare of the human society

14. How many of the following statements are not incorrect? (Pg. 182, E)
I. Anti is a Greek word that means 'against', and bio means 'life', together they mean 'against life'.
II. Antibiotics are chemical substances, which are produced by some microbes and can kill or retard the growth of other (disease-causing) microbes.
III. Penicillin is the first antibiotic to be discovered.
IV.Alexander Fleming discovered Penicillin while working on a Staphylococci bacteria.
V. The full potential as an effective antibiotic was established much later by Ernest Chain and Howard Florey.
A) 5 B) 4 C) 3 D) 1

15. Which of the following statements is correct? (Pg. 182, E)
A) Penicillin was used to treat American soldiers wounded in World War I.
B) Fleming, Chain and Florey were awarded the Nobel Prize in 1954, for this discovery.
C) Before Penicillin, antibiotics were also purified from other microbes
D) Antibiotics have greatly improved our capacity to treat deadly diseases such as plague, whooping cough, diphtheria and leprosy.

16. Microbes are used for commercial and industrial production of certain chemicals like organic acids, alcohols and enzymes. Which of the following is incorrect regarding this? (Pg. 183, E)
A) Aspergillus – fungus – citric acid B) Acetobacter aceti – bacteria – vinegar
C) Clostridium butylicum – protozoan- butyric acid
D) Lactobacillus - bacteria - lactic acid.

17. The substance which is used in detergent formulations and helpful in removing oily stains are – (Pg. 183, E) A) Pectinases B) Proteases C) Lipases D) Statins

18. Bottled juices are clarified by the enzyme- (Pg. 183, E)
A) Pectinase and lipases B) Pectinase and peptidase C) Pectinase and protease D) Pectinase only

19. Match the following columns: (Pg. 183, M)

	Column-I		Column-II
a)	Cyclosporin A	1	Blood Cholesterol lowering agent
b)	Streptokinase	2	Immunosuppressive agent
c)	Statins	3	Clot buster for removing clots
d)	Saccharomyces	4	Production of ethanol

Which of the following is the correct option?

	a	b	c	d
A)	1	3	4	2
B)	3	2	1	4
C)	2	3	1	4
D)	4	3	2	1

20. How many of the following statements are correct? (Pg. 183, H)
I. A bioactive molecule, cyclosporin A, is produced by the fungus Trichoderma polysporum
II. Statins are produced by the fungus Monascus purpureus.
III. Statins act by competitively inhibiting the enzyme responsible for synthesis of cholesterol.
IV. Streptokinase is used to remove clots from the blood vessels of patients who have undergone myocardial infarction leading to heart attack.
A) 3 B) 4 C) 2 D) 1

21. A good producer of citric acid is (Pg. 183, E)
A) Pseudomonas B) Clostridium C) Saccharomyces D) Aspergillus

22. Which of the following is correctly matched for the product produced by them? (Pg. 183, E)
A) Acetobacter aceti: Antibiotics B) Methanobacterium: Lactic acid
C) Penicillium notatum: Acetic acid D) Saccharomyces cerevisiae: Ethanol

23. Which of the following is wrongly matched in the given table? (Pg. 183, M)

	Microbe		Product		Application
A	Trichoderma polysporum	I	Cyclosporin A	1	Immunosuppressive
B	Monascus purpureus	ii	Statins	2	Blood Cholesterol lowering agent
C	Streptococcus	iii	Streptokinase	3	Removal of clot from blood vessels
D	Clostridium acetobutylicum	iv	Lipase	4	Removal of oil stains

24. Match Column-I with Column-II and select the correct option using the codes. (Pg. 183, E)

	Column-I		Column-II
(a)	Citric acid	(1)	Trichoderma
(b)	Cyclosporin	(2)	Clostridium
(c)	Statins	(3)	Aspergillus
(d)	Butyric acid	(4)	Monascus

Which of the following is the correct option?

	a	b	c	d
A)	3	1	4	2
B)	4	3	1	2
C)	2	1	4	3
D)	2	3	1	4

25. Match the following list of microbes and their importance: (Pg. 183, M)

	Column-I		Column-II
(a)	Saccharomyces	(1)	Production of immunosuppressive agents
(b)	Monascus purpureus	(2)	Ripening of Swiss cheese
(c)	Trichoderma polysporum	(3)	Commercial production of ethanol
(d)	Propionibacterium sharmanii	(4)	Production of blood cholesterol-lowering agent

Which of the following is the correct option?

	a	b	c	d
A)	2	4	1	3
B)	4	3	1	2
C)	2	1	4	3
D)	3	4	1	2

Microbes in Sewage Treatment

26. How many of the following are not incorrect with respect to wastewater treatment? (Pg. 183, E)
I. A major component of waste water is human excreta.
II. The municipal waste-water is called sewage which contains large amounts of inorganic matter and microbes. Many of which are pathogenic.

III. Sewage is treated in sewage treatment plants (STPs) to make it non- polluting.
IV. Treatment of waste water is done by the aerobic microbes naturally present in the sewage.
A) 4 B) 3 C) 2 D) 1

27. Which of the following statements is correct with respect to wastewater treatment? (Pg. 184, E)
A) Treatment of wastewater is carried out in three stages- Primary, Secondary and Biological Treatment.
B) Primary treatment basically involves physical removal of particles – large and small – from the sewage through sedimentation then filtration.
C) All solids that settle form the primary sludge, and the supernatant forms the effluent
D) The sludge from the primary settling tank is taken for secondary treatment.

28. Which of the following statements is incorrect with respect to wastewater treatment? (Pg. 184, E)
A) The primary effluent is passed into large aeration tanks where it is constantly agitated mechanically and air is pumped into it. This allows vigorous growth of useful aerobic microbes into flocs
B) Flocs are masses of bacteria associated with fungal filaments to form mesh like structures.
C) While growing, microbes consume the major part of the organic matter in the effluent. This significantly elevates the BOD (biochemical oxygen demand) of the effluent.
D) BOD refers to the amount of the oxygen that would be consumed if all the organic matter in one liter of water were oxidised by bacteria.

29. Which of the following statements is wrong with respect to wastewater treatment? (Pg. 183, E)
A) The BOD test measures the rate of uptake of oxygen by micro-organisms in the sample of water
B) BOD is a direct measure of the organic matter present in the water
C) The greater the BOD of waste water, more is its polluting potential
D) Once the BOD of sewage or waste water is reduced significantly, the effluent is then passed into a settling tank where the bacterial 'flocs' are allowed to sediment

30. The gases which evolve from the anaerobic sludge digester constituting biogas are (Pg. 184, E)
A) Methane, sulphur dioxide, carbon sulphide B) Carbon dioxide, hydrogen chloride, methane
C) Methane, hydrogen chloride and carbon dioxide
D) Methane, carbon dioxide, hydrogen sulphide

31. Which of the following statement is wrong? (Pg. 184, E)
A) In settling tank, the sedimented bacterial flocs are called activated sludge
B) A small part of the activated sludge is pumped back into the anaerobic sludge digester to serve as the inoculum
C) In anaerobic sludge digesters, other kinds of bacteria which grow anaerobically, digest the bacteria and the fungi in the sludge
D) The biogas can be used as source of energy as it is inflammable

32. Which of the following statements is incorrect? (Pg. 184, E)
A) The effluent from the secondary treatment plant is generally released into natural water bodies like rivers and streams
B) Microbes play a major role in treating millions of gallons of waste water everyday across the globe. This methodology has been practiced for more than a decade now, in almost all parts of the world.
C) Till date, no manmade technology has been able to rival the microbial treatment of sewage
D) The Ministry of Environment and Forests has initiated Ganga Action Plan and Yamuna Action Plan to save these major rivers of our country from pollution.

33. The primary treatment of wastewater removes (Pg. 184, E)
A) dissolved impurities B) stable particles
C) methane D) pathogens

34. Which of the following in sewage treatment removes suspended solids? (Pg. 184, E)
A) Tertiary treatment B) Secondary treatment C) Primary treatment D) Sludge treatment

35. Secondary sewage treatment is mainly a (Pg. 184, E)
A) physical process B) mechanical process C) chemical process D) biological process

36. BOD of wastewater is represented as (Pg. 184, E)
A) total inorganic matter B) biodegradable matter C) carbon dioxide evolution D) oxygen consumption

37. The high value of BOD (Biochemical Oxygen Demand) indicates that (Pg. 184, E)
A) water is pure.
B) water is highly polluted.
C) water is less polluted.
D) consumption of organic matter in the water is higher by microbes

38. If the activated sludge flocs do not get enough oxygen supply, (Pg. 184, E)
A) it will increase the rate of the treatment
B) the center of flocs will become anoxic, which would cause the death of bacteria and eventually breakage of flocs
C) it will increase the size of flocs.
D) protozoa would grow in large numbers

39. Methanogenic bacteria are not present in (Pg. 184, E)
A) gobar gas plant
B) stomach of ruminants
C) bottom of water-logged paddy fields
D) activated sludge

40. Activated sludge should settle quickly so that (Pg. 184, E)
A) it is rapidly pumped back from sedimentation tank to aeration tank
B) absorb pathogenic bacteria present in wastewater
C) it is anaerobically digested
D) absorbs inorganic matter

41. The sludge generated by wastewater treatment is treated by (Pg. 184, E)
A) anaerobic digesters
B) floc
C) chemicals
D) oxidation pond

42. What gases are produced in anaerobic sludge digesters? (Pg. 184, E)
A) Methane and CO2 only.
B) Methane, Hydrogen sulfide and CO2.
C) Hydrogen Sulfide and CO2.
D) Methane and CO2.

43. During sewage treatment, biogases are produced which include (Pg. 184, E)
A) hydrogen sulfide, nitrogen, methane
B) methane, hydrogen sulfide, carbon dioxide
C) methane, oxygen and hydrogen sulfide
D) hydrogen sulfide, methane and sulfur dioxide

Microbes in Production of Biogas

44. The predominant gas in biogas is- (Pg. 185, E)
A) Methane B) Carbon dioxide C) Hydrogen sulphide D) ethane

45. Which of the following is incorrect with respect to production of biogas? (Pg. 185, E)
A) The type of the gas produced depends upon the microbes and the organic substrates they utilize
B) Certain bacteria, which grow anaerobically on cellulosic material, produce large amount of methane along with CO2 and N2
C) Methanogens are commonly found in the anaerobic sludge during sewage treatment, the common example is Methanobacterium.
D) Methanogens are also present in the rumen of cattle where they help in the breakdown of cellulose and play an important role in the nutrition of cattle.

46. The depth of concrete tank of biogas plant in which bio-wastes are collected and a slurry of dung is fed is (Pg. 185, E)
A) 10-12 meters B) 10-12 feet C) 10-15 meters D) 10-15 feet

47. 47. How many of the following statements are incorrect? (Pg. 185, E)
I. The gobar gas is a special type of biogas generated from the dung of cattle.
II. 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.

III. A typical biogas plant has two main outlets, one for biogas which is used by nearby houses and the other for spent which may be used as fertilizer

IV. The technology of biogas production was developed in India mainly due to the efforts of IARI and KVIC.

V. Biogas plants are more often built in rural areas due to availability of large quantities of cattle dung and thus the biogas produced is used for cooking and lighting.

A) 5 B) 4 C) 3 D) none

48. IARI stands for – (Pg. 186, E)

A) Indian Academy of Research and Intelligence B) International Agricultural Research Institute

C) Indian Agricultural Research Institute D) International Academy of Research and Intelligence

49. KVIC stands for – (Pg. 186, E)

A) Khadi and Village Industries Company B) Kisan and Village Industries Company

C) Khadi and Village Industries Commission D) Khadi and Village Interest Commission

50. Select the correct option among the following (Pg. 186, E)

A) A – slurry, B – Digester, C – Gas Holder, D - Sludge

B) A – sludge, C – Gas mixture, B – Slurry, D – Water + Dung

C) A – sludge, B – Digester, C – Gas Holder, D – Slurry

D) A – slurry, C – Gas mixture, B – Sludge, D – Water + Dung

51. Which of the following is mainly produced by the activity of anaerobic bacteria on sewage? (Pg. 186, E)

A) Propane B) Mustard gas C) Marsh gas D) Laughing gas

52. Which of the following statements about methanogens is not correct? (Pg. 186, E)

A) They produce methane gas. B) They can be used to produce biogas.

C) They are found in the rumen of cattle and their excreta.

D) They grow aerobically and breakdown cellulose-rich food

53. Select the correct statement from the following (Pg. 186, E)

A) Activated sludge-sediment in settlement tanks of the sewage treatment plant is a rich source of aerobic bacteria.

B) Methanobacterium is an aerobic bacterium found in the rumen of cattle.

C) Biogas is produced by the activity of aerobic bacteria on animal waste

D) Biogas, commonly called gobar gas, is pure methane

Microbes as Biocontrol Agent

54. The use of biological methods for controlling plant disease and pest is known as – (Pg. 186, E)

A) Bioinvestment B) Bioremediation C) Biofortification D) Biocontrol

55. How many of the following statements are incorrect? (Pg. 186, E)

I. In agriculture, there is a method of controlling pests that relies on natural predation rather than introduced chemicals.

II. A key belief of the organic farmer is that biodiversity furthers health.

III. The conventional farming practices rarely used chemical methods to kill both useful and harmful life forms indiscriminately

IV. The organic farmer holds the view that the eradication of the creatures that are often described as pests is not only possible, but also undesirable.

A) 4 B) 3 C) 2 D) 1

56. In a system of checks and balances- (Pg. 187, E)

A) The insects that are sometimes called pests are completely eradicated.

B) All insects are eradicated.

C) When pests are beyond manageable levels, they are completely eradicated.

D) Pests are not eradicated but they are kept at manageable levels.

57. The biopesticide used to get rid of aphids is – (Pg. 187, E)
A) Dragonflies B) Baculoviruses
C) Ladybird D) Bacillus thuringiensis

58. Microbial biocontrol agent that can be introduced in order to control butterfly caterpillar is- (Pg. 187, E)
A) Fungus Trichoderma B) Bacillus tracin
C) Baculoviruses D) Bacillus thuringiensis

59. The bacteria bacillus thuringiensis is available in the market in the form of (Pg. 187, E)
A) Tablets B) Powder C) Spores D) Gel form

60. Which of the following statements is incorrect? (Pg. 187, E)
A) Eradication of the pests is undesirable as without them the beneficial predatory and parasitic insects which depend upon them as food or hosts would not be able to survive.
B) An important part of the biological farming approach is to become familiar with the various life forms that inhabit the field, predators as well as pests, and also their life cycles, patterns of feeding and the habitats that they prefer.
C) The very familiar beetle with red and black markings is the Ladybird
D) Bt spores are mixed with water and sprayed onto valuable plants such as brassicas and fruit trees, where these are eaten by the insect adults

61. How many of the following are correct with respect to Trichoderma? (Pg. 187, E)
I. Developed for use in the treatment of plant diseases
II. It's species are free living fungi that are very common in root ecosystems.
III. It belongs to the division Ascomycetes
IV. They are very effective biocontrol agents for several plant pathogens.
A) 4 B) 3 C) 2 D) 1

62. How many of the following are correct with respect to baculoviruses? (Pg. 187, E)
I. They are pathogens that attack insects and other arthropods.
II. The majority of baculoviruses used as biological control agents are in the family nucleopolyhedrovirus.
III. These viruses are excellent candidates for species-specific, narrow spectrum insecticidal applications.
IV. They have been shown to have no negative impacts on plants, mammals, birds, fish or even on non-target insects
V. This is especially desirable when beneficial insects are being conserved to aid in an overall integrated pest management programme, or when an ecologically sensitive area is being treated.
A) 5 B) 4 C) 3 D) 2

63. Which one of the following is not an example of carrying out biological control of pests/diseases using microbes? (Pg. 187, E)
A) Ladybird beetle against aphids in mustard.
B) Bt-cotton to increase cotton yield. C) Nucleopolyhedrovirus against white rust in Brassica. D) Trichoderma sp. against certain plant pathogens.

64. Match the items in Column-I and Column-II and choose the correct answer. (Pg. 187, E)

	Column-I		Column-II
(a)	Ladybird	(1)	Methanobacterium
(b)	Mycorrhiza	(2)	Trichoderma
(c)	Biological control	(3)	Aphids
(d)	Biogas	(4)	Glomus

Which of the following is the correct option?

	a	b	c	d
A)	1	4	3	2
B)	3	4	2	1
C)	4	1	2	3
D)	3	2	1	4

Microbes as Biofertilizer

65. Which of the following is incorrect? (Pg. 188, E)
A) Biofertilizers are organisms that enrich the nutrient quality of the soil.
B) Realising the problems associated with the overuse of chemical fertilisers, there is a large pressure to switch to organic farming – the use of biofertilisers.
C) The main sources of biofertilisers are bacteria, fungi, protozoans and cyanobacteria.
D) In the root nodules of leguminous plants, symbiotic association is formed by Rhizobium

66. The fungal symbiont in mycorrhiza association absorbs _____from soil and passes it to the plant. (Pg. 188, E)
A) N B) N and K C) P D) Ca

67. How many of the following are correct with respect to mycorrhiza? (Pg. 188, E)
I. Fungi are also known to form symbiotic associations with plants (mycorrhiza).
II. Many members of the genus Glomus form mycorrhiza.
III. It provide resistance to root-borne pathogens.
IV. It provide tolerance to salinity and drought.
V. It helps in overall increase in plant growth and development.
A) 5 B) 4 C) 3 D) 1

68. Which of the following is incorrect? (Pg. 188, E)
A) Rhizobium fixes atmospheric nitrogen into inorganic forms which are used by plants as nutrients.
B) Cyanobacteria are autotrophic microbes widely distributed in aquatic and terrestrial environments many of which can fix atmospheric nitrogen.
C) Blue green algae add organic matter to the soil and increase its fertility.
D) In paddy fields, cyanobacteria serve as an important biofertiliser.

69. The bacteria which can fix atmospheric nitrogen in it's free-living form in the soil are(Pg. 188, E)
A) Azospirillum and Azorhizobium B) Azospirillum and Azotobacter
C) Azotobacter and Rhizobium D) Frankia and Azospirillum

70. Which one of the following microbes form a symbiotic association with plants and helps them in their nutrition? (Pg. 188, E)
A) Azotobacter B) Aspergillus C) Glomus D) Trichoderma

71. Which one of the following helps in the absorption of phosphorus from the soil by plants? (Pg. 188, E)
A) Anabaena B) Glomus C) Rhizobium D) Frankia

72. Which of the following is not a biofertilizer? (Pg. 188, E)
A) Rhizobium B) Nostoc C) Mycorrhiza D) Agrobacterium

NEET PREVIOUS YEARS QUESTIONS

1. Conversion of milk to curd improves its nutritional value by increasing the amount of : **[2018]**
(a) Vitamin D (b) Vitamin A (c) Vitamin E (d) Vitamin B12

2. Which of the following in sewage treatment removes suspended solids? **[2017]**
(a) Secondary treatment (b) Primary treatment
(c) Sludge treatment (d) Tertiary treatment

3. Which of the following is correctly matched for the product produced by them? **[2017]**
(a) *Methanobacterium* : Lactic acid (b) *Penicillium notatum* : Acetic acid
(c) *Saccharomyces cerevisiae* : Ethanol (d) *Acetobacter aceti* : Antibiotics

4. The primitive prokaryotes responsible for the production of biogas from the dung of ruminant animals, include the: **[2016]**
(a) Halophiles (b) Thermoacidophiles (c) Methanogens (d) Eubacteria

5. Which of the following is wrongly matched in the given table? **[2016]**

Microbe	Product	Application
(a) *Trichoderma polysporum*	Cyclosporin A	immunosuppressive drug
(b) *Monascus purpureus*	Statins	lowering of blood cholesterol
(c) *Streptococcus*	Streptokinase	removal of clot from blood vessel
(d) *Clostridium butylicum*	Lipase	removal of oil stains

6. The guts of cow and buffalo possess: **[2015]**
(a) *Chlorella* spp (b) Methanogens (c) *Cyanobacteria* (d) *Fucus* spp

7. Match the following list of microbes and their importance **[2015]**
A. *Saccharomyces cerevisiae* (i) Production of immunosuppressive agents
B. *Monascus Purpureus* (ii) Ripening of Swiss cheese
C. *Trichoderma polysporum* (iii) Commercial production of ethanol
D. *Propionibacterium sharmanii* (iv) Production of blood cholesterol lowering agents
(a) A – (iv); B – (iii); C – (ii); D – (i) (b) A – (iv); B – (ii); C – (i); D – (iii)
(c) A – (iii); B – (i); C – (iv); D – (ii) (d) A – (iii); B – (iv); C – (i); D – (ii)

8. What gases are produced in anaerobic sludge digesters? **[2014]**
(a) Methane and CO2 only (b) Methane, Hydrogen sulphide and CO2
(c) Methane, Hydrogen sulphide and O2 (d) Hydrogen sulphide and CO2

9. Which one of the following equipment is essentially required for growing microbes on a large scale, for industrial production of enzymes? **[NEET-2019]**
(1) BOD incubator (2) Sludge digester (3) Industrial oven (4) Bioreactor

10. Match the following organisms with the products they produce :- **[NEET-2019]**
(a) Lactobacillus (i) Cheese
(b) Saccharomyces (ii) Curd cerevisiae
(c) Aspergillus niger (iii) Citric Acid
(d) Acetobacter aceti (iv) Bread
(v) Acetic Acid

Select the correct option.

(a) (b) (c) (d)	(a) (b) (c) (d)	(a) (b) (c) (d)	(a) (b) (c) (d)
(1) (ii) (iv) (v) (iii)	(2) (ii) (iv) (iii) (v)	(3) (iii) (iv) (v) (i)	(4) (ii) (i) (iii) (v)

11. Which of the following can be used as a biocontrol agent in the treatment of plant disease? **[NEET-2019]**
(1) Trichoderma (2) Chlorella (3) Anabaena (4) Lactobacillus

12. Which of the following is a commercial blood cholesterol lowering agent? **[NEET-2019]**
(1) Cyclosporin A (2) statin (3) Streptokinase (4) Lipases

13. Select the correct group of biocontrol agents.
(1) Bacillus thuringiensis,Tobacco mosaic virus, Aphids
(2) Trichoderma, Baculovirus, Bacillus thuringiensis
(3) Oscillatoria, Rhizobium, Trichoderma
(4) Nostoc, Azospirillium, Nucleopolyhedrovirus

14. A biocontrol agent to be a part of an integrated pest management should be **[NEET-2019 ODISSA]**
(1) Species-specific and symbiotic (2) Free living and broad spectrum
(3) Narrow spectrum and symbiotic (4) Species-specific and inactive on non-target organisms

15. Which of the following statements about methanogens is not correct? **[NEET-2019 ODISSA]**
(1) They can be used to produce biogas.
(2) They are found in the rumen of cattle and their excreta

(3) They grow aerobically and breakdown cellulose-rich food. (4) They produce methane gas.

16. Among the following pairs of microbes, which pair has both the microbes that can be used as biofertilizers? **[NEET-2019 ODISSA]**

(1) Aspergillus and Rhizopus (2) Rhizobium and Rhizopus
(3) Cyanobacteria and Rhizobium (4) Aspergillus and Cyanobacteria

17. Which of the following is put into anaerobic sludge digester for further sewage treatment? **[NEET-2020]**

1) Activated sludge 2) Primary sludge 3) Floating debris 4) Effluents of primary treatment

18. Match the following columns and select the correct option **[NEET-2020]**

Column-I	**Column-II**
a) Clostridium butylicum	i) Cyclosporin-A
b) Trichoderma polysporum	ii) Butyric acid
c) Monascus purpureus	iii) Citric acid
d) Aspergillus niger	iv) Blood cholesterol lowering agent

	a	b	c	d		a	b	c	d
1)	iv	iii	ii	I	2)	iii	iv	ii	i
3)	ii	i	iv	iii	4)	i	ii	iv	iii

19) Match List-I with List-II **[NEET-2021]**

List-I		**List-II**	
(a)	**Aspergillus niger**	**(i)**	**Acetic Acid**
(b)	**Acetobacter aceti**	**(ii)**	**Lactic Acid**
(c)	**Clostridium butylicum**	**(iii)**	**Citric Acid**
(d)	**Lactobacillus**	**(iv)**	**Butyric Acid**

	(a)	**(b)**	**(c)**	**(d)**
1)	(i)	(ii)	(iii)	(iv)
2)	(ii)	(iii)	(I)	(iv)
3)	(iv)	(ii)	(i)	(iii)
4)	(iii)	(i)	(iv)	(ii)

20. Identify the microorganism which is responsible for the production of an immunosuppressive molecule cyclosporine A: **[NEET-2022]**

1) Trichoderma polysporum 2) Clostridium butylicum
3) Aspergillus niger 4) Streptococcus cerevisiae

21. Match List I with List II

List I

A. Clostridium butylicum

B. Saccharomyces cerevisiae

C. Trichoderma polysporum

D. Streptococcus sp.

List II

I. Ethanol

II. Streptokinase

III. Butyric acid

IV. Cyclosporin-A

Choose the correct answer from the options given below:

(a) A-III, B-I, C-II, D-IV

(b) A-II, B-IV, C-III, D-I

(c) A-III, B-I, C-IV, D-II

(d) A-IV, B-I, C-III, D-II **[NEET 2024]**

22. Which of the following is an example of nondistilled alcoholic beverage produced by yeast?
(a) Whisky
(b) Brandy
(c) Beer
(d) Rum

[NEET 2025]

23. Streptokinase produced by bacterium Streptococcus is used for
(a) Curd production
(b) Ethanol production
(c) Liver disease treatment
(d) Removing clots from blood vessels

[NEET 2025]

24. Which of following organisms cannot fix nitrogen?
A. Azotobacter
B. Oscillatoria
C. Anabaena
D. Volvox
E. Nostoc
Choose the correct answer from the options given below:
(a) A only
(b) D only
(c) B only
(d) E only

[NEET 2025]

25. Which of the following microbes is NOT involved in the preparation of household products?
A. Aspergillus niger
B. Lactobacillus
C. Trichoderma polysporum
D. Saccharomyces cerevisiae
E. Propionibacterium sharmanii
Choose the correct answer from the options given below:
(a) A and B only
(b) A and C only
(c) C and D only
(d) C and E only **[NEET 2025]**

NCERT LINE BY LINE QUESTIONS – ANSWERS

1) D	2) D	3) A	4) D	5) D	6) C	7) D	8) A	9) B	10) C
11) C	12) C	13) D	14) A	15) B	16) C	17) C	18) D	19) C	20) B
21) D	22) D	23) D	24) A	25) D	26) B	27) A	28) C	29) B	30) D
31) B	32) B	33) B	34) C	35) D	36) D	37) B	38) C	39) D	40) A
41) A	42) B	43) B	44) A	45) B	46) D	47) D	48) C	49) C	50) C
51) C	52) D	53) D	54) D	55) D	56) D	57) C	58) D	59) C	60) D
61) B	62) A	63) B	64) B	65) C	66) C	67) A	68) A	69) B	70) C
71) B	72) A								

NEET PREVIOUS YEARS QUESTIONS-ANSWERS

1 (d) **2** (b) **3** (c) **4** (c) **5** (d) **6** (b) **7** (d) **8** (b) **9** (4) **10** (2)
11 (1) **12** (2) **13** (2) **14** (4) **15** (3) **16** (3) **17** (1) **18** (3) 19 (4) **20** (1)
21(c)22(c)23(d)24(b)25(b)26()27()

NEET PREVIOUS YEARS QUESTIONS-EXPLANATIONS

1. (d) Curd has enriched presence of vitamins specially Vitamin B12, which improves its nutritional value than milk.

2. (b) Primary treatment is a physical process which involves two process, i.e. filtration and sedimentation of big solid waste.

3. (c) *Saccharomyces cerevisiae* commonly know as Brewer's yeast causes fermentation of carbohydrates and produces ethanol.

4. (c) Methanogens are microorganisms that produce methane as a metabolic byproduct in anoxic conditions. They are obligate anaerobic and primitive bacteria. They are involved in methanogenesis.

5. (d) *Clostridium butylicum* is used for butyric acid production.

6. (b) Methanogens (microorganisms producing methane) are found in the guts of ruminant animals. E.g. cows and buffaloes.

7. (d)

8. (b) Anaerobic digestion is a series of processes in which microorganisms break down biodegradable material in the absence of oxygen, used for industrial or domestic purposes to manage waste and/or to release energy. The process of anaerobic digestion produces a biogas, consisting of methane (it will burn), carbon dioxide (it does not burn) and traces of other contaminant gases.

17. Sediment in settling tank is called activated sludge

18. a) Clostridium butylicum- Butyric acid
b) Trichoderma polysporum - Cyclosporin-A
c) Monascus purpureus- Blood cholesterol lowering agent
d) Aspergillus niger- Citric acid

19.

List-I	List-II

(a)	**Aspergillus niger**	**(i)**	**Citric Acid**
(b)	**Acetobacter aceti**	**(ii)**	**Acetic Acid**
(c)	**Clostridium butylicum**	**(iii)**	**Butyric Acid**
(d)	**Lactobacillus**	**(iv)**	**Lactic Acid**

20. A bioactive molecule, cyclosporin A, that is used as an immunosuppressive agent in organ-transplant patients, is produced by the fungus *Trichoderma polysporum*

21.Ans.(c)

Explanation

A. Clostridium butylicum	-	Butyric acid
B. Saccharomyces cerevisiae	-	Ethanol
C. Trichoderma polysporum	-	Cyclosporin-A
D. Streptococcus sp.	-	Streptokinase

22.Ans. (c)
Explanation
Wine and beer are produced without distillation whereas whisky, brandy and rum are produced by distillation of the fermented broth.

23.Ans. (d)
Explanation
Streptokinase produced by the bacterium Streptococcus is used as a 'clot buster' for removing clots from the blood vessels of patients who have undergone myocardial infarction leading to heart attack.

24.Ans. (b)
Explanation
The nodules on the roots of leguminous plants are formed by the symbiotic association of Rhizobium. These bacteria fix atmospheric nitrogen into organic forms, which is used by the plant as
nutrient. Other bacteria can fix atmospheric nitrogen while free-living in the soil (examples Azospirillum and Azotobacter), thus enriching
the nitrogen content of the soil. Cyanobacteria are autotrophic microbes widely distributed in aquatic and terrestrial environments many of which can fix atmospheric nitrogen, e.g. Anabaena, Nostoc, Oscillatoria, etc

25.Ans. (b)
Explanation

- A. Aspergillus niger - Used industrially for citric acid production, not for household products
- B. Lactobacillus - Used in curd formation
- C. Trichoderma polysporum - Produces immunosuppressive drug (Cyclosporin A), not used in household products
- D. Saccharomyces cerevisiae - Used in baking and alcohol fermentation
- E. Propionibacterium sharmanii - Used in Swiss cheese production

So, A and C are NOT involved in household product preparation.

About us

BioResire (NEET | CSIR NET | Biotech Internships) is a life sciences research and training organization dedicated to bridging the gap between academic learning and industry skills. We provide internships, projects, and programs in Bioinformatics, Biotechnology, Molecular Biology, Cancer Research, Neuroscience, and related fields, helping students build job-oriented scientific careers.

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