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Microbes in Human Welfare

TOPIC 1

Microbes in Household Products

01 Yeast is used in the production of
[CBSE AIPMT 2012]

- (a) citric acid and lactic acid
- (b) lipase and pectinase
- (c) bread and beer
- (d) cheese and butter

Ans. (c)

Saccharomyces cerevisiae is known as baker's yeast and *Saccharomyces ellipsoidens* is called wine yeast. These are used in baking and brewing industry respectively.

TOPIC 2

Microbes in Industrial Products

02 Match the List-I with List-II.
[NEET 2021]

List-I	List-II
A. <i>Aspergillus niger</i>	1. Acetic Acid
B. <i>Acetobacter aceti</i>	2. Lactic Acid
C. <i>Clostridium butylicum</i>	3. Citric Acid
D. <i>Lactobacillus</i>	4. Butyric Acid

Choose the correct answer from the options given below.

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

Ans. (a)

(A)-(3),(B)-(1),(C)-(4),(D)-(2)
Citric acid is a principal organic acid present in citrus fruits. To meet the increasing demand, it is produced from carbohydrate feedstock by fermentation with the fungus *Aspergillus niger*.

Acetobacter aceti uses sugars and alcohols for its carbon source and turns them into their acetic acid.

Clostridium butyricum are Gram-positive bacteria that helps in the production of butyric acid.

Lactobacillus is a genus of Gram-positive, facultative an aerobic, rod-shaped, non-spore forming bacteria. They convert sugars to lactic acid.

03 Cyclosporin*A used as immunosuppression agent, is produced from [NEET (Oct.) 2020]

- (a) *Monascus purpureus*
- (b) *Saccharomyces cerevisiae*
- (c) *Penicillium notatum*
- (d) *Trichoderma polysporum*

Ans. (d)

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

Monascus purpureus is a yeast which helps to produce statins (blood cholesterol lowering agent).

Saccharomyces cerevisiae is a yeast which produces ethanol. *Penicillium notatum* is a yeast which produces penicillin (an antibiotics).

04 Match the following columns and select the correct option.

[NEET (Sep.) 2020]

Column I	Column II
A. <i>Clostridium butylicum</i>	1. Cyclosporin-A
B. <i>Trichoderma polysporum</i>	2. Butyric acid
C. <i>Monascus purpureus</i>	3. Citric acid
D. <i>Aspergillus niger</i>	4. Blood cholesterol lowering agent

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

Ans. (a)

The correct match is option (a). It can be explained as follows

Butyric acid is produced by *Clostridium butylicum*. It is a strictly anaerobic endosporeforming Gram-positive bacteria.

Cyclosporin A is produced by the fungus *Trichoderma polysporum* that is used as an immunosuppressive agent in organ transplant patients.

Statins produced by the yeast *Monascus purpureus* have been commercialised as blood cholesterol lowering agent.

Citric acid is produced by fungus *Aspergillus niger*.

05 Match the following organisms with the products they produce

[NEET (National) 2019]

A. <i>Lactobacillus</i>	(i)	Cheese
B. <i>Saccharomyces cerevisiae</i>	(ii)	Curd
C. <i>Aspergillus niger</i>	(iii)	Citric acid
D. <i>Acetobacter aceti</i>	(iv)	Bread
	(v)	Acetic acid

Select the correct option.

- A B C D
 (a) (ii) (iv) (iii) (v)
 (b) (iii) (iv) (v) (i)
 (c) (ii) (i) (iii) (v)
 (d) (ii) (iv) (v) (iii)

Ans. (a)

(A)-(ii), (B)-(iv), (C)-(iii), (D)-(v)

Lactobacillus bacteria helps in the production of curd. The yeast, *Saccharomyces cerevisiae* helps in bread making. The fungus, *Aspergillus Niger* is used for citric acid production. The bacteria *Acetobacter aceti* is used in the production of acetic acid.

06 Which of the following is correctly matched for the product produced by them? [NEET 2017]

- (a) *Acetobacter aceti*: Antibiotics
 (b) *Methanobacterium*: Lactic acid
 (c) *Penicillium notatum*: Acetic acid
 (d) *Saccharomyces cerevisiae*: Ethanol

Ans. (d)

Acetobacter aceti produces acetic acid. *Methanobacterium* produces methane. *Penicillium notatum* produces penicillin. *Saccharomyces cerevisiae* produces ethanol.

07 Which of the following is wrongly matched in the given table? [NEET 2016, Phase I]

Microbe	Product	Application
(a) <i>Monascus purpureus</i>	Statins	Lowering of blood cholesterol
(b) <i>Streptococcus</i>	Streptokinase	Removal of clot from blood vessel
(c) <i>Clostridium butylicum</i>	Lipase	Removal of oil stains
(d) <i>Trichoderma polysporum</i>	Cyclosporin-A	Immunosuppressive drug

Ans. (c)

Butyric acid is produced by fermentive activity of the bacteria called *Clostridium butylicum*. It does not produce lipase. Lipase is obtained from *Candida albicans*.

08 Match column I with column II and select the correct option using the codes given below [NEET 2016, Phase II]

Column I	Column II
A. Citric acid	1. <i>Trichoderma</i>
B. Cyclosporin	2. <i>Clostridium</i>
C. Statins	3. <i>Aspergillus</i>
D. Butyric acid	4. <i>Monascus</i>

Codes

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

Ans. (b)

The correct match are

- (a) Citric acid — *Aspergillus*
 (b) Cyclosporin — *Trichoderma*
 (c) Statins — *Monascus*
 (d) Butyric acid — *Clostridium*

Thus option (b) is correct.

09 Match the following list of microbes and their importance. [CBSE AIPMT 2015]

A. <i>Saccharomyces cerevisiae</i>	1. Production of immuno suppressive agents
B. <i>Monascus purpureus</i>	2. Ripening of Swiss cheese
C. <i>Trichoderma polysporum</i>	3. Commercial production of ethanol
D. <i>Propionibacterium sharmanii</i>	4. Production of blood-cholesterol lowering agents

Codes

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

Ans. (a)

Correct match is

Column I	Column II
A. <i>Saccharomyces cerevisiae</i>	3. Commercial production of ethanol

B. <i>Monascus purpureus</i>	4. Production of blood-cholesterol lowering agents
C. <i>Trichoderma polysporum</i>	1. Production of immuno suppressive agents
D. <i>Propionibacterium sharmanii</i>	2. Ripening of Swiss cheese

10 The most abundant prokaryotes helpful to human in making curd from milk and in production of antibiotics are the ones categorised as [CBSE AIPMT 2012]

- (a) cyanobacteria
 (b) archaeobacteria
 (c) chemosynthetic autotrophs
 (d) heterotrophic bacteria

Ans. (d)

Heterotrophic bacteria are most abundant in nature. Many of them have a significant impact on human affairs. These are helpful in making curd from milk (e.g. *Lactobacillus* sp.), production of antibiotics (e.g. *Streptomyces* sp.) and fixing nitrogen in legume roots (e.g. *Rhizobium* sp.).

11 *Monascus purpureus* is a yeast used commercially in the production of [CBSE AIPMT 2012]

- (a) ethanol
 (b) streptokinase for removing clots from the blood vessels
 (c) citric acid
 (d) blood cholesterol lowering statins

Ans. (d)

Monascus purpureus is a yeast used in the production of statins which are blood cholesterol lowering agents.

12 A patient brought to a hospital with myocardial infarction is normally immediately given [CBSE AIPMT 2012]

- (a) penicillin
 (b) streptokinase
 (c) cyclosporin-A
 (d) statins

Ans. (b)

Streptokinase (SK), a protein secreted by several species of *Streptococci* can bind and activate human plasminogen. It is used as an effective and inexpensive thrombolysis medication in some cases of myocardial infarction and pulmonary embolism.

13 Ethanol is commercially produced through a particular species of

[CBSE AIPMT 2011]

- (a) *Clostridium* (b) *Trichoderma*
(c) *Aspergillus* (d) *Saccharomyces*

Ans. (d)

Ethanol is commercially produced through a particular species of yeast called as *Saccharomyces cerevisiae*.

14 The most common substrate used in distilleries for the production of ethanol is

[CBSE AIPMT 2011]

- (a) soya meal (b) ground gram
(c) molasses (d) corn meal

Ans. (c)

Molasses is a viscous byproduct of the processing of sugarcane, grapes or sugarbeets in sugar. It is the most common substrate used in distilleries for the production of ethanol. It can be used as the base material for fermentation into rum. In Australia, molasses is fermented to produce ethanol for use as an alternative fuel in motor vehicles.

15 Which of the microorganism is used for production of citric acid in industries?

[CBSE AIPMT 1998]

- (a) *Lactobacillus bulgaris*
(b) *Penicillium citrinum*
(c) *Aspergillus niger*
(d) *Rhizopus nigricans*

Ans. (c)

Aspergillus niger is the microorganism used for production of citric acid in industries. Citric acid has an extraordinary range of uses.

It gives tartness and flavour to the foods. It is an antioxidant and pH adjuster in many foods and dairy products, it often serves as an emulsifier.

16 Which one thing is not true about antibiotics?

[CBSE AIPMT 1996]

- (a) The term 'antibiotic' was coined by Selman Waksman in 1942
(b) first antibiotic was discovered by Alexander Flemming
(c) Each antibiotic is effective only against one particular kind of germ
(d) Some persons can be allergic to a particular antibiotic

Ans. (c)

The statement (c) is wrong regarding to antibiotics because antibiotics are divided into two categories depending upon their effect

(i) **Broad spectrum antibiotics** They have ability to act on several pathogenic species differing from each others in structure and composition of cell wall.

(ii) **Specific antibiotics** They act on a few similar type of pathogens.

17 Yeast (*Saccharomyces cerevisiae*) is used in the industrial production of

[CBSE AIPMT 1998]

- (a) citric acid (b) tetracycline
(c) ethanol (d) butanol

Ans. (c)

Yeast contains an enzyme zymase which catalyse the fermentation of sugar to form ethyl alcohol (ethanol) and CO₂.

18 Which one of the following microorganisms is used for production of citric acid in industries?

[CBSE AIPMT 1998]

- (a) *Penicillium citrinum*
(b) *Aspergillus niger*
(c) *Rhizopus nigricans*
(d) *Lactobacillus bulgaricus*

Ans. (b)

Citric acid is commercially prepared is by fermentation of sugar with *A. niger*.

Citric acid has an extraordinary range of uses. It gives tartness and flavour to the foods. It is an antioxidant and pH adjuster in many foods and dairy products, it often serves as an emulsifier.

TOPIC 3 Microbes as Biocontrol Agents

19 Match the following columns and select the correct option from the codes given below.

[NEET (Oct.) 2020]

Column I	Column II
A. Dragonflies	1. Biocontrol agents of several plant pathogens
B. <i>Bacillus thuringiensis</i>	2. Get rid of Aphids and mosquitoes
C. <i>Glomus</i>	3. Narrow spectrum Insecticidal applications
D. Baculoviruses	4. Biocontrol agents of lepidopteran plant pests
	5. Absorb phosphorus from soil

Codes

	A	B	C	D
(a)	3	5	4	1
(b)	2	1	3	4
(c)	2	3	4	5
(d)	2	4	5	3

Ans. (d)

Option (d) is the correct match which is as follows

Dragonflies help to get rid of Aphids and mosquitoes.

Bacillus thuringiensis acts as biocontrol agent for lepidopteran and plant pests. *Glomus* is a fungus which forms mycorrhiza to absorb phosphorus from soil.

Baculoviruses are used in narrow spectrum insecticidal applications.

20 A biocontrol agent to be a part of an integrated pest management should be

[NEET (Odisha) 2019]

- (a) species-specific and symbiotic
(b) free-living and broad spectrum
(c) narrow spectrum and symbiotic
(d) species-specific and inactive on non-target organisms

Ans. (d)

A biocontrol agent to be a part of an Integrated Pest Management (IPM) programme should be species-specific and inactive or have no negative impacts on non-target organisms like plants, mammals, birds, fish and even on other non-target insects. It should kill only targeted insects/pests (organisms).

21 Which of the following can be used as a biocontrol agent in the treatment of plant disease?

[NEET (National) 2019]

- (a) *Chlorella* (b) *Anabaena*
(c) *Lactobacillus* (d) *Trichoderma*

Ans. (d)

Trichoderma can be used as a biocontrol agent in the treatment of plant disease. It is a filamentous soil fungus having mycoparasitic activity. On the other hand, *Anabaena* helps in nitrogen-fixation, *Lactobacillus* helps in the production of organic acid, e.g. lactic acid and *Chlorella* is a single cell protein which acts as food supplement.

22 Select the correct group of biocontrol agents.

[NEET (National) 2019]

- (a) *Trichoderma*, *Baculovirus*, *Bacillus thuringiensis*
(b) *Oscillatoria*, *Rhizobium*, *Trichoderma*

- (c) *Nostoc*, *Azospirillum*,
Nucleopolyhedrovirus
(d) *Bacillus thuringiensis*, Tobacco
mosaic virus, Aphids

Ans. (a)

The correct group of biocontrol agents is *Trichoderma*, *Baculovirus* and *Bacillus thuringiensis*. *Baculovirus* are pathogens that attack insects and other arthropods. Most of *Baculoviruses* used as biocontrol agent belong to the genus *Nucleopolyhedrovirus*.

Trichoderma is extensively used against pathogenic fungi which causes soil borne diseases.

Bacillus thuringiensis secretes toxin crystals which kill the insect larvae. On the other hand, *Rhizobium*, *Nostoc*, *Azospirillum* and *Oscillatoria* are used as biofertilisers. Tobacco mosaic virus is a pathogen and aphids are pests that harm crop plants.

- 23** Which one of the following is an example of carrying out biological control of pests/diseases using microbes? [CBSE AIPMT 2012]

- (a) *Trichoderma* sp. against certain plant pathogens
(b) Nucleopolyhedrovirus against white rust in *Brassica*
(c) Bt cotton to increase cotton yield
(d) Lady bird beetle against aphids in mustard

Ans. (c)

Out of the given statement 'c' is correct example because Bt cotton is Genetically Modified (GM) cotton which has an incorporated gene extracted from the bacterium *Bacillus thuringiensis*. This gene codes for Bt toxin in plant tissues which is harmful only to a small fraction of insects, most notably the larvae of lepidopterans, moths, butterflies, beetles, flies, etc, and harmless to other forms of life. So, it is used as biological control of pests/diseases.

- 24** A common biocontrol agent for the control of plant diseases is [CBSE AIPMT 2010]

- (a) *Baculovirus*
(b) *Bacillus thuringiensis*
(c) *Glomus*
(d) *Trichoderma*

Ans. (d)

Trichoderma is a genus of fungi that is present in all soils. Several strains of *Trichoderma* have been developed as

biocontrol agents against fungal diseases of plants. The various mechanisms include antibiosis, parasitism, inducing host-plant resistance and competition.

Most biocontrol agents are from the species *T. harzianum*, *T. viride* and *T. hamatum*. The biocontrol agent generally grows in its natural habitat on the root surface and so, affects root disease in particular but can also be effective against foliar diseases.

- 25** The bacterium *Bacillus thuringiensis* is widely used in contemporary biology as a/an [CBSE AIPMT 2009]

- (a) indicator of water pollution
(b) insecticide
(c) agent for production of dairy products
(d) source of industrial enzyme

Ans. (b)

Bacillus thuringiensis is used as an insecticide. It is a Gram-positive, soil dwelling bacterium, also occurs naturally in the gut of caterpillars of various types of moths and butterflies.

During sporulation, *B. thuringiensis* forms crystals of proteinaceous insecticidal δ -endotoxins (*cry* toxins), which are encoded by *cry* genes.

It was determined that the *cry* genes are harbored in the plasmids of *B. thuringiensis* strains. *Cry* toxins have specific activities against species of the order-Lepidoptera (moths and butterflies), Diptera (flies and mosquitoes) and Coleoptera (beetles).

Thus, *B. thuringiensis* serves as an important reservoir of *cry* toxins and *cry* genes for the production of biological insecticides and insect resistant genetically modified crops.

- 26** What is true about Bt toxin? [CBSE AIPMT 2009]

- (a) The inactive protoxin gets converted into active form in the insect gut
(b) Bt protein exists as active toxin in the *Bacillus*
(c) The activated toxin enters the ovaries of the pest to sterilise it and thus, prevent its multiplication
(d) The concerned *Bacillus* has antitoxins

Ans. (a)

Bacillus thuringiensis toxin is an inactive protoxin, which gets converted into active form in the insect gut. It works as an insecticide.

- 27** Which of the following is not used as a biopesticide? [CBSE AIPMT 2009]

- (a) *Bacillus thuringiensis*
(b) *Trichoderma harzianum*
(c) Nuclear Polyhedrosis Virus (NPV)
(d) *Xanthomonas campestris*

Ans. (d)

The bacterium *Xanthomonas campestris* is the causative agent of plant disease, black rot of cabbage.

Bacillus thuringiensis, *T. harzianum* and NPV are biopesticides.

- 28** Main objective of production/use of herbicide resistant GM crops is to [CBSE AIPMT 2008]

- (a) eliminate weeds from the field without the use of manual labour
(b) eliminate weeds from the field without the use of herbicides
(c) encourage eco-friendly herbicides
(d) reduce herbicide accumulation in food particles for health safety

Ans. (d)

The main objective of production/use of herbicide resistant Genetically Modified (GM) crops is to reduce herbicide accumulation in food articles for health safety.

The chemical substances, which are used to kill or repel pest are called pesticides. The chemical substance which are used to destroy weeds are called herbicides.

- 29** *Cry-I* endotoxins obtained from *Bacillus thuringiensis* are effective against [CBSE AIPMT 2008]

- (a) mosquitoes (b) flies
(c) nematodes (d) bollworms

Ans. (b)

Cry-I endotoxins obtained from *Bacillus thuringiensis* are effective against flies (insects). The *cry* gene of *Bacillus thuringiensis* produces a protein, which forms crystalline inclusion in the bacterial spores. These crystal proteins are responsible for the insecticidal activities of the bacterial strains.

- 30** Which one of the following proved effective for biological control of nemato diseases in plants? [CBSE AIPMT 2008]

- (a) *Pisolithus tinctorius*
(b) *Pseudomyces lilacinus*
(c) *Gliocladium virens*
(d) *Paecilomyces lilacinus*

Ans. (d)

Paecilomyces lilacinus has proved effective for biological control of nematodal disease in plants. It is easily produced *in vitro*. It attacks the eggs of several nematode species and highly effective treatment of plant matter, e.g. seed tuber.

31 Which one of the following proved effective for biological control of nematode diseases in plants?
[CBSE AIPMT 2008]

- (a) *Glicoladium virens*
- (b) *Paecilomyces lilacinus*
- (c) *Pisolithus tinctorius*
- (d) *Pseudomonas cepacia*

Ans. (b)

Paecilomyces lilacinus is a fungus which principally infects eggs of root knot nematode (*Meloidogyne* sp.) and cyst nematodes (*Gobodera* and *Heterodera* sp.) It has been considered to have greatest potential for application as a biocontrol agent in sub-tropical and tropical agricultural soils.

32 The most likely reason for the development of resistance against pesticides in insect damaging a crop is
[CBSE AIPMT 2004]

- (a) random mutations
- (b) genetic recombinations
- (c) directed mutations
- (d) acquired heritable changes

Ans. (a)

The most likely reason for the development of resistance against pesticides in insect damaging a crop is random mutations, because environmental stress, i.e. pesticides does not cause direct changes in genome, instead, it simply selects rather persisting mutations which result in phenotypes that are better adapted to the new environment in certain pesticides.

33 Biological control component is central to advanced agricultural production. Which of the following is used as a third generation pesticide?
[CBSE AIPMT 1998]

- (a) Pathogens
- (b) Pheromones
- (c) Insect repellents
- (d) Insect hormone analogues

Ans. (b)

Insect hormones, i.e. pheromones, are third generation pesticides. Pheromones are the chemical substances which when released into an animal's surroundings, influence the behaviour or development of other individuals of the same species. Inorganic substances, oils, plant extracts used as insecticides are called first generation pesticides and synthetic organic compounds as second generation pesticides.

34 What is agent orange?
[CBSE AIPMT 1998]

- (a) A biodegradable insecticide
- (b) A weedicide containing dioxin
- (c) Colour used in fluorescent lamp
- (d) A hazardous chemical used in luminous paints

Ans. (b)

Agent orange is a weedicide containing dioxin. It is so, called because of distinctive orange stripe on its packaging, combines equal parts of 2, 4-D and 2, 4, 5-T was later on found to contain a highly poisonous chemical dioxin as impurity.

35 Suppression of reproduction of one type of organism by utilising some features of its biology or physiology to destroy it or by use of another organism is known as
[CBSE AIPMT 1996]

- (a) competition
- (b) predation
- (c) biological control
- (d) physiological control

Ans. (c)

Biological control is the suppression of reproduction of one type of organism by utilising some features of its biology or physiology to destroy it or by use of another organism.

36 One of the major difficulties in the biological control of insect pests is the
[CBSE AIPMT 1995]

- (a) practical difficulty of introducing the predator to specific areas
- (b) method is less effective as compared with the use of insecticides
- (c) predator does not always survive when transferred to a new environment
- (d) the predator develops a preference to other diets and may itself become a pest

Ans. (d)

The major difficulties in the biological control of insect pests is that the predator develops a preference to other diets and may itself become a pest. Biological control is mainly refers to the introduction of living organisms which destroy other harmful organisms.

TOPIC 4 Microbes in Biofuels and Sewage Treatment

37 Which of the following in sewage treatment removes suspended solids?
[NEET 2017]

- (a) Tertiary treatment
- (b) Secondary treatment
- (c) Primary treatment
- (d) Sludge treatment

Ans. (c)

In sewage treatment, suspended solids are removed during primary treatment. It is also known as physical treatment. It consists of shredding, churning, screening and sedimentation. Sequential filtration removes floating and large suspended solids.

38 Biochemical Oxygen Demand (BOD) may not be a good index for pollution in water bodies receiving effluents from
[NEET 2016, Phase II]

- (a) domestic sewage
- (b) dairy industry
- (c) petroleum industry
- (d) sugar industry

Ans. (c)

Biochemical Oxygen Demand (BOD) is not a good index for checking the pollution levels of water bodies receiving effluents from petroleum industry. This is because such effluents contain waste which is non-biodegradable.

39 What gases are produced in anaerobic sludge digesters?
[CBSE AIPMT 2014]

- (a) Methane and CO₂ only
- (b) Methane, hydrogen sulphide and CO₂
- (c) Methane, hydrogen sulphide and CO₂
- (d) Hydrogen sulphide and CO₂

Ans. (b)

Methane, hydrogen sulphide and CO₂ are gases that are produced in anaerobic sludge digesters. These gases are

produced during biogas production by the activity of bacteria called methanogens.

- 40** During sewage treatment, biogases are produced, which include
[NEET 2013]

- (a) methane, hydrogen sulphide and carbon dioxide
- (b) methane, oxygen and hydrogen sulphide
- (c) hydrogen sulphide, methane and sulphur dioxide
- (d) hydrogen sulphide, nitrogen and methane

Ans. (a)

During sewage treatment biogas is produced which include methane, hydrogen sulphide and carbon dioxide. Biogas is a mixture of gases (mainly methane) produced by the microbial activity and which may be used as fuel.

- 41** Which of the following is mainly produced by the activity of anaerobic bacteria on sewage?
[CBSE AIPMT 2011]

- (a) Propane
- (b) Mustard gas
- (c) Marsh gas
- (d) Laughing gas

Ans. (c)

Marsh gas (methane) is mainly produced by the activity of anaerobic bacteria on sewage.

- 42** Organisms called methanogens are most abundant in a
[CBSE AIPMT 2011]

- (a) cattle yard
- (b) polluted stream
- (c) hot spring
- (d) sulphur rock

Ans. (a)

Organisms called Methanogens are most abundant in a cattle yard. Methanogens are present in the gut of several ruminants animals such as cows and buffaloes and they are responsible for the production of methane (biogas) from the dung of these animals.

- 43** Secondary sewage treatment is mainly a
[CBSE AIPMT 2011]

- (a) mechanical process
- (b) chemical process
- (c) biological process
- (d) physical process

Ans. (c)

In secondary or biological treatment of municipal waste, the organic matter is decomposed with the help of microbes.

Decomposition of organic matter occurs by one of the three methods—water hyacinth pond, trickling filter method and activated sludge method. After decomposition the treated water is sterilised through chlorination and recycled.

- 44** Select the correct statement from the following
[CBSE AIPMT 2010]

- (a) Biogas is produced by the activity of aerobic bacteria on animal waste
- (b) *Methanobacterium* is an aerobic bacterium found in rumen of cattle
- (c) Biogas, commonly called gobar gas, is pure methane
- (d) Activated sludge—sediment in settlement tanks of sewage treatment plant is a right source of aerobic bacteria

Ans. (d)

Out of the following statements (d) is correct because activated sludge is a process dealing with the treatment of sewage and industrial waste waters. Atmospheric air or pure oxygen is introduced to a mixture of primary treated or screened sewage (or industrial waste water) combined with organisms to develop a biological flock, which reduces the organic content of the sewage. Sediment in settlement tanks of sewage treatment plant is a rich source of aerobic bacteria because small amounts are used as inoculum in secondary treatment or biological treatment stage of sewage treatment.

- 45** Which one of the following is being utilised as a source of bio-diesel in the Indian countryside?
[CBSE AIPMT 2007]

- (a) *Euphorbia*
- (b) Beet root
- (c) Sugarcane
- (d) *Pongamia*

Ans. (a)

Euphorbia is being utilised as a source of biodiesel in the Indian countryside. Some plants like *Euphorbia*, *Asclepias*, *Capiafera* accumulate hydrocarbons in the form of latex which are used as biodiesel.

- 46** During anaerobic digestion of organic waste, such as in producing biogas, which one of the following is left undegraded?
[CBSE AIPMT 2003]

- (a) Hemicellulose
- (b) Cellulose
- (c) Lipids
- (d) Lignin

Ans. (d)

During biogas formation, digestion of cellulose is slow (rate-limiting) and most of the lignin is not decomposed. After cellulose lignin is the most abundant plant polymer. It forms 20 to 30% of the wood of the tree. Lignin is a complex polymeric molecule, made up of phenyl propanoid units. Cellulose is a large chained polymer of glucose molecules which are linked with each other by glycosidic bonds. Hemicellulose are branched polymers of glucose, xylose, galactose, mannose and arabinose.

TOPIC 5 Microbes as Biofertilisers

- 47** Among the following pairs of microbes, which pair has both the microbes that can be used as biofertilisers?
[NEET (Odisha) 2019]

- (a) *Aspergillus* and *Rhizopus*
- (b) *Rhizobium* and *Rhizopus*
- (c) *Cyanobacteria* and *Rhizobium*
- (d) *Aspergillus* and *Cyanobacteria*

Ans. (c)

Biofertilisers are organisms that enrich the nutrient quality of the soil.

For example, *Cyanobacteria* and *Rhizobium*. *Aspergillus* and *Rhizopus* are not used as biofertilisers.

- 48** Which one of the following microbes forms symbiotic association with plants and helps them in their nutrition?
[CBSE AIPMT 2012, 11]

- (a) *Azotobacter*
- (b) *Aspergillus*
- (c) *Glomus*
- (d) *Trichoderma*

Ans. (c)

Several species of *Glomus*, including *G. aggregatum*, are cultured and sold as mycorrhizal inoculant for agricultural soils. Being endomycorrhiza, it helps the plants in the absorption of nutrients especially phosphorus from soil.

- 49** A nitrogen-fixing microbe associated with *Azolla* in rice fields is
[CBSE AIPMT 2012]

- (a) *Spirulina*
- (b) *Anabaena*
- (c) *Frankia*
- (d) *Tolypothrix*

Ans. (b)

Anabaena azollae is a free-living nitrogen fixing blue-green alga or

cyanobacterium but it may also live symbiotically in the leaf cavities of *Azolla*, an aquatic, free floating, freshwater pteridophyte (fern). This cyanobacterium has nitrogenase enzyme, therefore can fix nitrogen. If this fern is grown in paddy (rice) fields, a remarkable 50% increase in yield can be noticed.

50 An organism used as a biofertiliser for raising soyabean crop is

[CBSE AIPMT 2011]

- (a) *Azospirillum* (b) *Rhizobium*
(c) *Nostoc* (d) *Azotobacter*

Ans. (b)

Rhizobium leguminosarum is a symbiotic bacteria found in root nodules of legume. This bacterium has nitrogen fixing *nif* gene. Soyabean is a legume. Thus, *Rhizobium* is used as a biofertiliser for raising soyabean crop.

51 Which one of the following is not a biofertiliser? [CBSE AIPMT 2011]

- (a) *Rhizobium* (b) *Nostoc*
(c) Mycorrhiza (d) *Agrobacterium*

Ans. (d)

Out of the following only *Agrobacterium* is not a biofertiliser. It is a Gram-negative bacterium that causes tumours in plants. It is well known for its ability to transfer DNA between itself and plants, and for this reason it has become an important tool for genetic engineering.

A tumefaciens causes crown-gall disease in plants. It has Ti-plasmid.

52 The free-living, anaerobic nitrogen-fixer is [CBSE AIPMT 2010]

- (a) *Beijerinckia* (b) *Rhodospirillum*
(c) *Rhizobium* (d) *Azotobacter*

Ans. (b)

Rhodospirillum is a free-living, anaerobic, nitrogen fixer. Both *Beijerinckia* and *Azotobacter* are free-living, nitrogen-fixing, aerobic microbes. *Rhizobium* is a symbiotic, nitrogen fixer.

53 The common nitrogen-fixer in paddy fields is [CBSE AIPMT 2010]

- (a) *Rhizobium* (b) *Azospirillum*
(c) *Oscillatoria* (d) *Frankia*

Ans. (b)

Azospirillum is a nitrogen fixing bacterium in paddy fields. It is very useful soil and root bacterium. It is an associative symbiotic N_2 -fixing bacteria.

When it is added to the soil, it multiplies in millions and can supply 20-40 kg of nitrogen per hectare per season.

54 Which one of the following is not used in organic farming?

[CBSE AIPMT 2010]

- (a) *Oscillatoria* (b) Snail
(c) *Glomus* (d) Earthworm

Ans. (b)

Except snail, all these are used in organic farming-

- Glomus* - Endomycorrhiza
Oscillatoria - BGA
Earthworm - Vermicompost

55 Which one of the following statements is correct?

[CBSE AIPMT 2007]

- (a) Extensive use of chemical fertilisers may lead to eutrophication of nearby water bodies
(b) Both *Azotobacter* and *Rhizobium* fix atmospheric nitrogen in root nodules of plants
(c) Cyanobacteria such as *Anabaena* and *Nostoc* are important mobilisers of phosphates and potassium for plant nutrition in soil
(d) At present it is not possible to grow maize without chemical fertilisers

Ans. (a)

Out of the following statement (a) is correct as eutrophication is caused by run off water from fertilised fields, sub-urban lawns, feed lots and detergent rich sewage. It is phenomenon of nutrient enrichment of a water body.

56 A free-living nitrogen-fixing cyanobacterium which can also form symbiotic association with the water fern *Azolla* is

[CBSE AIPMT 2004]

- (a) *Tolypothrix* (b) *Chlorella*
(c) *Nostoc* (d) *Anabaena*

Ans. (d)

Anabaena is a free-living nitrogen fixing cyanobacterium which can form symbiotic association with water fern *Azolla*.

57 Which of the following plants are used as green manure in crop fields and in sandy soils?

[CBSE AIPMT 2003]

- (a) *Saccharum munja* and *Lantana camara*
(b) *Dichanthium annulatum* and *Azolla nitotica*

(c) *Crotalaria juncea* and *Alhagi comelorum*

(d) *Calotropis procera* and *Phyllanthus niruri*

Ans. (c)

Crotalaria juncea (sunhemp) and *Alhagi comelorum* are among the plants which are used as green manures in India. These green manures help the soil through increasement of area, water holding capacities and fertility.

58 The aquatic fern, which is an excellent biofertiliser is

[CBSE AIPMT 2001, 1999]

- (a) *Azolla* (b) *Pteridium*
(c) *Salvinia* (d) *Marselia*

Ans. (a)

Azolla leaves harbour *Anabaena* colonies which fix atmospheric nitrogen. The nitrogen rich *Azolla* is used as biofertiliser.

59 Farmers have reported over 50% higher yields of rice by sing which of the following biofertiliser?

[CBSE AIPMT 2000, 99, 98]

- (a) Mycorrhiza
(b) *Azolla pinnata*
(c) Cyanobacteria
(d) Legume-*Rhizobium* symbiosis

Ans. (b)

Anabaena azollae, a cyanobacterium living in the cavities of fern *Azolla*, fixes atmospheric nitrogen and releases it into the leaf cavity of the fern. Farmers have reported over 50% higher yields by using *Azolla pinnata*.

60 Which of the following is non-symbiotic biofertiliser?

[CBSE AIPMT 1998]

- (a) VAM
(b) *Azotobacter*
(c) *Anabaena*
(d) *Rhizobium*

Ans. (b)

Free-living (non-symbiotic) bacteria like *Azotobacter* and *Bacillus polymyxa* fix atmospheric nitrogen and make it available to crop plants. VAM (Vasicular Arbuscular Mycorrhizae) is an endosymbiosis between fungi and roots of higher plants.

Anabaena is a cyanobacterium (blue-green algae) which live solitary or in association with other plant and can fix atmospheric N_2 .

Rhizobium bacterium makes symbiotic association with leguminous plants.