

## Chapter 9. Microbes in Human Welfare

### Microbes in Household Products, Industrial Products and in Sewage Treatment

#### 1 Mark Questions

**1. Give the scientific name of the source organism from which the first antibiotic was produced. [Foreign 2014]**

**Ans.** The scientific name of organism, i.e. mould from which first antibiotic was produced is *Penicillium notatum*.

**2. Which of the following is the baker's yeast used in fermentation? *Saccharum barberi*, *Saccharomyces cerevisiae* and *Sonalika*. [All India 2011,2009,2012]**

**Ans.** *Saccharomyces cerevisiae* is the baker's yeast used in fermentation.

**3. Write the scientific name of the microbe used for fermenting malted cereals and fruit juices.[Delhi 2011]**

**Ans.** *Saccharomyces cerevisiae* also, commonly called brewer's yeast is the microbe used for fermenting malted cereals and fruit juices.11]

**4. Mention the information that the health workers derive by measuring BOD of a waterbody. [All India 2010]**

**Ans.** Higher the BOD of water body, more is its polluting potential and vice-versa. BOD indicates the presence of organic matter in the water.

**5. Why is sewage water treated until the BOD is reduced? Give a reason. [Delhi 2010c]**

**Ans.** The greater the BOD of sewage water, more is its polluting potential. So, the sewage water is treated, till its BOD is reduced to reduce the organic matter present in it.

**6. Milk starts to coagulate when Lactic Acid Bacteria (LAB) is added to warm milk as a starter. Mention any other two benefits LAB provides.[All India 2009]**

**Ans.** Two benefits of LAB:

- (i) They improve the nutrient quality of curd by increasing the vitamin-B12 content.
- (ii) LAB also check the growth of disease causing microbes in the stomach.

**7. BOD of two samples of water A and B were 120 mg/L and 400 mg/L, Which sample is more polluted? [Foreign 2009]**

**Ans.** Sample B(BOD 400 mg/L) is more polluted as higher the BOD, more is the polluting potential

**8. Given below are a few impurities in urban wastewater. Select two colloidal impurities : ammonia, faecal matter, silt, bacteria, calcium. [All India 2009c]**



**Ans.** Faecal matter and silt are the colloidal impurities in urban wastewater.

## 2 Marks Questions

**9. Name two groups of organisms which constitute 'flocs'. Write their influence on the level of BOD during biological treatment of sewage. [Delhi 2014c]**

**Ans.** The groups of organisms that constitute mesh like structures called 'flocs' are bacteria and fungi.

These bacterial masses associated with fungal filaments called flocs, consume the major part of organic matter present in effluent, thereby reducing the BOD of the waste significantly during biological or secondary treatment of sewage.

**10. Why is 'starter' added to set the milk into curd? Explain. [All India 2014c]**

**Ans.** When a small amount of curd as starter is added to fresh milk, millions of Lactic Acid Bacteria (LAB) present in the starter grow in milk and convert it to curd. During this process, acids are produced by LAB that coagulate and partially digest the milk proteins (casein). LAB increases vitamin-B<sub>12</sub> content along with other vitamins in the curd

**11. Name the bacterium responsible for the large holes seen in swiss cheese. What are these holes due to? [All India 2013, Delhi 2008C]**

**Ans.** Swiss cheese is produced by the bacterium *Propionibacterium shermanii*. The large holes in swiss cheese are due to the large amount of CO<sub>2</sub> production

**12. Name the source of streptokinase. How does this bioactive molecule function in our body. [Delhi 2012]**

or

**Name the enzyme produced by Streptococcus bacterium. Explain its importance in medical sciences. [All India 2011]**

**Ans.** Streptokinase enzyme is produced by the bacterium *Streptococcus*. It is modified by genetic engineering and is used as a clot buster for removing clots from the blood vessels of patients who have suffered from myocardial infarction.

**13. Mention the importance of lactic acid bacteria to humans other than setting milk into curd. [Delhi 2012]**

**Ans.** (i) Lactic Acid Bacteria (LAB) are used to produce an acid called lactic acid that is an important industrial product. It is also used in beverages, meat products, confectionary, dairy products, etc.

(ii) It also checks disease causing microbes in stomach.

**14. Name the source of cyclosporin-A. How does this bioactive molecule function in our body? [All India 2012]**

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

**15. Name the source of statin and state its action on the human body. [Foreign 2012]**  
or



**Give the scientific name of the microbes from which cyclosporin-A and statin are obtained. Write one medical use of each one of these drugs. [Foreign 2011]**

**Ans.** Statin is produced by yeast *Monascus purpureus*. It is used as blood cholesterol lowering agent.

It acts by competitively inhibiting the enzyme responsible for synthesis of cholesterol.

or

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

Statin is produced by yeast *Monascus purpureus*. It is used as blood cholesterol lowering agent. It acts by competitively inhibiting the enzyme responsible for synthesis of cholesterol.

**16. Why are some molecules called bioactive molecules? Give two examples of such molecules. [All India 2011]**

**Ans.** Bioactive molecules are produced from living organisms and are useful in other living organisms. Examples are streptokinase, cyclosporin-A, statins.

**17. How does addition of a small amount of curd to fresh milk help formation of curd? Mention a nutritional quality that gets added to the curd. [Delhi 2010]**

or

**Explain the change fresh milk undergoes when a small amount of curd as starter is added to it and kept at suitable temperature. [Delhi 2009c]**

**Ans.** When a small amount of curd as starter is added to fresh milk, millions of Lactic Acid Bacteria (LAB) present in the starter grow in milk and convert it to curd. During this process, acids are produced by LAB that coagulate and partially digest the milk proteins (casein). LAB increases vitamin-B<sub>12</sub> content along with other vitamins in the curd

**18. During the secondary treatment of the primary effluent. How does the significant decrease in BOD occur? [Delhi 2009]**

**Ans.** During the secondary treatment, the aeration allows vigorous growth of useful aerobic microbes into flocs (masses of bacterial cells in association with fungal filaments forming mesh-like structures). As they grow, the microbes consume a major part of the organic matter in the effluent, so BOD is significantly reduced.

**19. Identify A, B, C and D in table given below: [All India 2009C]**

Microorganisms	Product	Biological activity	Medical oilment/ Procedure
A	Streptokinase	Clot buster	D
<i>Trichoderma polysporum</i>	B	C	Transplant surgery

**Ans.**A- Streptococcus

B- Cyclosporin-A

C- Immunosuppressive agent

D-Myocardial infarction

**20. Name the blank spaces A, B, C and D in the table given below: [Delhi 2008]**



Type of microbe	Name	Commercial product
Fungus	A	Penicillin
Bacterium	<i>Acetobacter aceti</i>	B
C	<i>Aspergillus niger</i>	Citric acid
Yeast	D	Ethanol

**Ans.**A- *Penicillium notatum* B- Acetic acid  
C- Fungus  
D- *Saccharomyces cerevisiae*

**21. Name the blank spaces A, B, C and D given in following table:[All India 2008]**

Type of microbe	Name	Commercial product
Bacterium	A	Lactic acid
Fungus	B	Cyclosporin-A
C	<i>Monascus purpureus</i>	Statin
Fungus	<i>Penicillium notatum</i>	D

**Ans.**A- *Lactobacillus*  
B- *Trichoderma polysporum*  
C- Yeast  
D- Penicillin

**22. Name the blank spaces A, B, C and D given in the following table:  
[All India 2008]**

Type of microbe	Scientific name	Commercial product
Bacterium	A	Clot buster enzyme
B	<i>Aspergillus niger</i>	Citric acid
Fungus	<i>Trichoderma polysporum</i>	C
Bacterium	D	Butyric acid

**Ans.** A- *Streptococcus*  
B- Fungus  
C- Cyclosporin-A  
D- *Clostridium butylicum*

**23. Name the blank spaces A, B, C and D from the table given below:  
[All India 2008]**

Type of microbe	Scientific name	Product	Medical application
Fungus	A	Cyclosporin-A	B
C	<i>Monascus purpureus</i>	Statin	D

**Ans.**A- *Trichoderma polysporum*  
B- Immunosuppressive agent  
C- Yeast  
D- Blood cholesterol lowering agent

**24. State the use of following enzymes/acids produced by the microbes**  
(i) lipase (ii) lactic acid

(iii) streptokinase (iv) pectinase

[Foreign 2008]

**Ans.** The use of following products formed by microbes are:

(i) **Lipase** is used in detergent preparation and in removal of oil stains from clothes.

(ii) **Lactic acid** produced by *Lactobacillus* converts milk into curd.

(iii) **Streptokinase** is used as a 'clot buster' for removing blood clots from blood vessels in patients of myocardial infarction.

(iv) **Pectinase** is used to clear (bottled) fruit juices.

**25. How has fungus *Trichoderma polysporum* proved to be very essential to organ transplant patients? [Delhi 2008C]**

**Ans.** This fungus produces a bioactive molecule, called cyclosporin-A, which is used as an immunosuppressive agent in organ transplant patients.

### 3 Marks Questions

**26. Identify A, B, C, D, E and F in the table given below: [Foreign 2014]**

Scientific name of the organism	Product produced	Use in human welfare
<i>Streptococcus</i>	Streptokinase modified	A
B	Cyclosporin-A	C
<i>Monascus purpureus</i>	D	E
<i>Lactobacillus</i>	F	Sets milk into curd

**Ans.** The codes are identified as

A- Clot buster in patients who underwent myocardial infarction.

B- *Trichoderma polysporum*

C- Immunosuppressive agent in organ transplantation

D- Statins

E – Blood cholesterol lowering agents

F – Lactic acid

**27. Name the two different categories of microbes naturally occurring in sewage water. Explain their role in cleaning sewage water into usable water. [Delhi 2012]**

**Ans.** Bacteria and fungi are the two categories of naturally occurring microbes in sewage. The bacteria along with the fungal mycelia form the flocs. These flocs are utilised during the secondary treatment of sewage. The primary effluent after separation of the grit and debris is taken to the secondary treatment.

Here, the effluent is passed to an aeration tank, where it is constantly agitated and air is pumped into it. This leads to vigorous growth of bacteria and floc formation. The bacteria in these flocs consume organic matter, thus decreasing the BOD of the sewage.

**28. Explain the different steps involved in sewage treatment before it can be released into natural water bodies. [Foreign 2011]**

**Ans.** Sewage treatment includes following steps:





### (i) Primary Treatment

- It is a physical process of removal of small and large particles through filtration and sedimentation.
- The first step is to remove the floating objects (like polythene bags) by letting the sewage to pass through wire mesh screens of sequential smaller pore sizes.
- Sewage is then passed into the grit chamber, where grit is sedimented.
- Sewage is then allowed to pass into the settling tank, where the suspended materials settle down to form primary sludge.
- Effluent is then taken for the secondary treatment.
- (ii) Secondary Treatment
- It is a biological process in which bacteria naturally occurring in sewage are used.
- Effluent obtained from the primary treatment is passed into large aeration tank. Here, it is constantly agitated and air is pumped into it.
- Due to this, rapid growth of aerobic bacteria occur into flocs. These consume the organic matter of the sewage and reduce the BOD.
- Effluent is passed into settling tank, where the flocs are allowed to settle forming the activated sludge.
- A small amount of activated sludge is pumped back into aeration tank as inoculum.
- The remaining major part of the activated sludge is pumped into anaerobic sludge digesters, where the anaerobic bacteria digest the organic matter and produce methane, hydrogen sulphide and carbon dioxide.
- Effluent is then allowed to pass into the water body.

### 29. Identify A, B, C, D, E and F in the table given below:

Organism	Bioactive molecule	Use
<i>Monascus purpureus</i> (yeast)	A	B
C	D	Antibiotic
E	Cyclosporin-A	F

**Ans.** A-Statins, B-They are used as blood cholesterol lowering agent, C-Penicillium notatum, D-Penicillin, E-Trichoderma polysporum, F-Used as an immunosuppressive agent in organ transplant patients.

### 30. Mention the product and its use produced by each of the microbes listed below:

- **Streptococcus**
- **Lactobacillus**
- **Saccharomyces cerevisiae** [All India 2010]

**Ans.(i) Streptococcus** Product is streptokinase. It is used as a clot-buster for removing the clots from the blood vessels of patients suffering from myocardial infarction.

**(ii) Lactobacillus** Product is lactic acid. It is used to convert milk into curd and improves nutrient quality of curd by enriching it with vitamin-B12.

**(iii) Saccharomyces cerevisiae** Product is ethanol and also used for bread making and beverages.

### 31. Describe how biogas is obtained from the activated sludge? [Foreign 2010]

**Ans.** Biogas formation from activated sludge:



(i) A small part of activated sludge is pumped into the aeration tank to serve as inoculum. It grows into flocs and consume organic matter to reduce BOD.

(ii) The remaining major part of sludge is pumped into large tanks called anaerobic sludge digesters.

(iii) Here, anaerobic bacteria digest the organic material of the sludge.

(iv) During this digestion, the bacteria produces a mixture of gases like carbon dioxide, methane and hydrogen sulphide which form the biogas.

**32. (i) How does activated sludge get produced during sewage treatment?**

**(ii) Explain how this sludge is used in biogas production? [All India 2009]**

**Ans.**(i) (a) The primary effluent is passed into large aeration tanks. Due to the constant agitation flocs formation occur, which are masses of bacteria associated with fungal hyphae.

(b) These microbes consumes sufficient quantity of organic matter and there by reduce BOD.

(c) Once, the BOD of sewage water gets reduced significantly, the effluent is passed into a settling tank, where the bacterial flocs undergo sedimentation and the sediment is called activated sludge.

(ii) Biogas formation from activated sludge:

(i) A small part of activated sludge is pumped into the aeration tank to serve as inoculum. It grows into flocs and consume organic matter to reduce BOD.

(ii) The remaining major part of sludge is pumped into large tanks called anaerobic sludge digesters.

(iii) Here, anaerobic bacteria digest the organic material of the sludge.

(iv) During this digestion, the bacteria produces a mixture of gases like carbon dioxide, methane and hydrogen sulphide which form the biogas.

**33. How are flocs produced in the secondary treatment plant of the sewage?**

**Explain their role. [All India 2009C]**

**Ans.** The effluent obtained from primary treatment is passed into large aeration tanks, where it is constantly agitated and air is pumped into it. This allows rapid growth of aerobic microbes into flocs.

Flocs consume organic matter of the sewage and reduce the Biochemical Oxygen Demand (BOD). When BOD of sewage is reduced, the effluent is passed into a settling tank, where the flocs are allowed to form the activated sludge.

**34. (i)Expand BOD.**

**(ii) At a particular segment of a river near a sugar factory, the BOD is much higher than the normal level. What is it indicative of? What will happen to the living organism in this part of the river?**

**(iii) Under what conditions will the BOD be lowered in the river? How will it affect the aquatic life? [HOTS; Foreign 2008]**

**Ans.** (i) Biochemical Oxygen Demand.

(ii) The higher BOD indicates high organic matter in river. Microbes involved in the biodegradation of organic matter in water body consume a lot of oxygen.

Due to this, a sharp decline occurs in the amount of dissolved oxygen. This leads to killing of fish and other microorganisms in that part of river.

(iii) BOD of water body decreases when the amount of organic matter decreases. Thus, microbes do not need oxygen for its decomposition.

Due to the decreased BOD, aquatic life will start flourishing.

## 5 Marks Questions

**35. Explain the process of sewage water treatment before it can be discharged into natural water bodies. Why is this treatment essential? [All India 2014]**

**Ans.** The process of sewage water treatment before being discharged into natural water bodies.

Sewage treatment includes following steps:

(i) Primary Treatment

- It is a physical process of removal of small and large particles through filtration and sedimentation.
- The first step is to remove the floating objects (like polythene bags) by letting the sewage to pass through wire mesh screens of sequential smaller pore sizes.
- Sewage is then passed into the grit chamber, where grit is sedimented.
- Sewage is then allowed to pass into the settling tank, where the suspended materials settle down to form primary sludge.
- Effluent is then taken for the secondary treatment.
- (ii) Secondary Treatment
- It is a biological process in which bacteria naturally occurring in sewage are used.
- Effluent obtained from the primary treatment is passed into large aeration tank. Here, it is constantly agitated and air is pumped into it.
- Due to this, rapid growth of aerobic bacteria occurs into flocs. These consume the organic matter of the sewage and reduce the BOD.
- Effluent is passed into settling tank, where the flocs are allowed to settle forming the activated sludge.
- A small amount of activated sludge is pumped back into aeration tank as inoculum.
- The remaining major part of the activated sludge is pumped into anaerobic sludge digesters, where the anaerobic bacteria digest the organic matter and produce methane, hydrogen sulphide and carbon dioxide.
- Effluent is then allowed to pass into the water body
- This sewage treatment is essential before being released into water bodies as it leads to water pollution and as a consequence increase in water borne diseases.

**36. (i) Name the category of microbes naturally occurring in sewage and making it less polluted during the treatment.**

**(ii) Explain the different steps involved in the secondary treatment of sewage. [Foreign 2014]**

**Ans.** (i) The category of microbes naturally occurring in sewage and making it less polluted are bacteria and fungi, wherein masses of bacteria get associated with filaments of fungi to form mesh like structure called flocs.





(ii) The different steps involved in secondary or biological treatment of sewage.

#### Secondary Treatment

- It is a biological process in which bacteria naturally occurring in sewage are used.
- Effluent obtained from the primary treatment is passed into large aeration tank. Here, it is constantly agitated and air is pumped into it.
- Due to this, rapid growth of aerobic bacteria occur into flocs. These consume the organic matter of the sewage and reduce the BOD.
- Effluent is passed into settling tank, where the flocs are allowed to settle forming the activated sludge.
- A small amount of activated sludge is pumped back into aeration tank as inoculum.
- The remaining major part of the activated sludge is pumped into anaerobic sludge digesters, where the anaerobic bacteria digest the organic matter and produce methane, hydrogen sulphide and carbon dioxide.
- Effluent is then allowed to pass into the water body

## Microbes in Production of Biogas as Biocontrol Agents and Biofertilisers

### 1 Mark Questions

**1. Name the type of association that the genus *Glomus* exhibits with higher plants. [All India 2014]**

**Ans.** The genus *Glomus* exhibits symbiotic association with higher plants.

**2. State one reason for adding blue-green algae to the agricultural soil. [Delhi 2014C]**  
**or**

**Mention two advantages of adding blue-green algae to paddy fields. [All India 2011C]**

**Ans.** Blue-green algae are added to agricultural soil because they add organic matter to the soil and also increase its fertility.

**3. Mention the role of cyanobacteria as biofertilisers. [All India 2012]**

**Ans.** Role of cyanobacteria as biofertilisers Cyanobacteria fix atmospheric nitrogen and increases the organic matter of the soil through their photosynthetic activity,

**4. Name any one symbiont, which serve as biofertiliser. Mention its specific role. [All India 2010C]**

**Ans.** *Rhizobium* is a symbiont bacteria that serve as biofertiliser  
The bacteria fix the atmospheric nitrogen into organic forms, which is used by the plants as nutrients.

**5. Which of the following is a free-living bacteria that can fix nitrogen in the soil? *Spirulina*, *Azospirillum* and *Sonchika*. [Delhi 2009]**

**Ans.** *Azospirillum*



**6. Which of the following is a cyanobacterium that can fix atmospheric nitrogen? Azospirillum, Oscillatoria and Spirulina. [All India 2009]**

**Ans.** Oscillatoria

**7. How is the presence of cyanobacteria in the paddy fields beneficial to rice crop? [Delhi 2009C]**

**Ans.** In the paddy fields, cyanobacteria such as blue-green algae fix atmospheric nitrogen to enrich the nitrogen content of soil. Therefore, the entire need of nitrogen to rice crop can be supplied by blue-green algae, leading to increase in yield.

**8. Name the group of organisms and the substrate that act on to produce biogas. [Delhi 2009]**

**Ans.** Methanogens are the group of organisms that acts on cellulosic materials/cow dung to produce biogas.

## 2 Marks Questions

**9. How do mycorrhizae act as biofertilisers? Explain. Name a genus of fungi that forms a mycorrhizal association with plants. [Delhi 2012]**

**Ans.** Fungi form symbiotic association with plants, which is called mycorrhiza. The fungal symbiont in these associations absorbs phosphorus from soil and passes it to the plant. Thus, acts as a biofertiliser. The fungi belonging to the genus Glomus form mycorrhizal associations with plants.

**10. How do methanogens help in producing biogas? [Delhi 2012]**

**Ans.** Methanogens grow anaerobically on cellulosic material and produce large amount of methane along with  $\text{CO}_2$  and  $\text{H}_2$ . Since, biogas is a mixture of methane and  $\text{CO}_2$ , methanogens helps in its production

**11. Why is Rhizobium categorised as a symbiotic bacterium? How does it act as biofertilisers? [Delhi 2012]**

**Ans.** The nodules on the roots of leguminous plants are formed by Rhizobium bacteria for their survival. These bacteria fix atmospheric nitrogen into organic form, which is used by the plant as nutrients. Since, Rhizobium forms symbiotic association with leguminous plants these are considered as symbiotic bacteria, (I) Rhizobium fixes the atmospheric nitrogen into organic form, i.e. nitrates which can be utilised by the plant as nutrient. So, it is used as biofertilisers.

**12. How do plant benefit from having mycorrhizal symbiotic association? [Foreign 2010]**

**Ans.** The plants get benefits from mycorrhizal symbiotic association in the following two ways:

(i) The fungal symbiont in mycorrhizal associations absorb phosphorus from soil and passes it to the plant.

(ii) It also provides resistance to root borne pathogens and increases plant growth and development.



**13. What are methanogens? Name the animals in which methanogens occur and the role they play there.[Delhi 2014]**

**Ans.** Methanogens are groups of anaerobic bacteria, that produces large amount of methane. Methanogens are found in rumen of cattle and intestine of humans. The methanogens present in intestine of animals and humans act on cellulosic part of food and digests them, thereby releasing methane along with  $\text{CO}_2$  and  $\text{H}_2$ .

**14. How are baculoviruses and Bacillus thuringiensis used as biocontrol agents? Why are they preferred over readily available chemical pesticides? [2014c]**

**Ans.** Bacillus thuringiensis as biocontrol agent

- (i) Through genetic engineering, the gene coding for the toxic protein is introduced into crop plants, which make them resistant to insect pests.
- (ii) When they are eaten by the larvae, the toxin becomes active in the gut of larvae and kills the larvae.
- (iii) They are available in sachets as dried spores, which have to be mixed with water and sprayed onto vulnerable plants.

Baculovirus (Nucleopolyhedrovirus) as biocontrol agents:

- (i) These are excellent candidates for species-specific, narrow spectrum insecticidal application.
- (ii) They show no negative impact on plants, mammals, birds, fish or even non-target insects.
- (iii) These are especially desirable when beneficial insects are being conserved to aid in an overall Integrated Pest Management (IPM) programme.

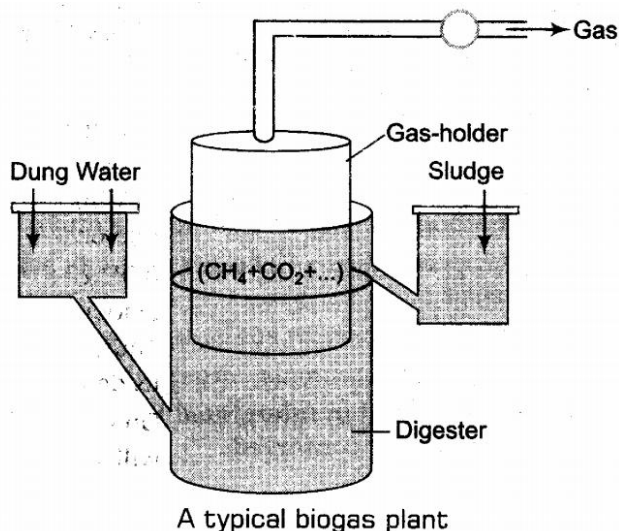
**15. Draw a labelled sketch of a typical biogas plant. [2014c]**

**Ans.** Biological control of pests and pathogens must be preferred over conventional use of chemical pesticides because

- (i) the chemicals cause pollution to soil, ground water and agricultural products.
- (ii) the chemicals are toxic and harmful to both human being and animals.
- (iii) overuse of chemical fertilisers make soil infertile.



(iv) kills harmful as well as useful organisms indiscriminately.

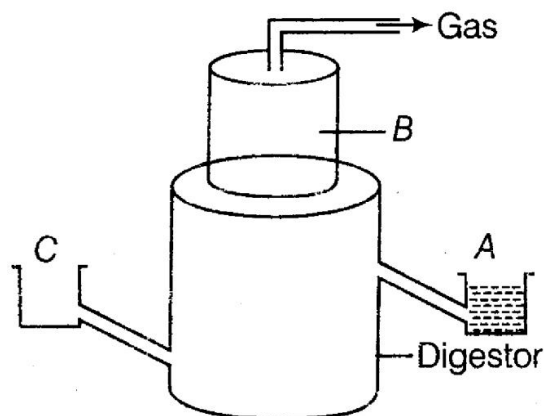


### 3 Marks Questions

**16. How is the Bt cotton plant created as a GM plant? How is it protected against bollworm infestation? [Delhi 2013C]**

**Ans.** Bt cotton is created by using some strains of a bacterium known as *Bacillus thuringiensis*. This bacterium produces protein that kills certain insects such as Lepidopterans, Coleopterans and Bt gene is cloned from this bacteria and had been expressed in cotton plant to provide resistance to the insects without the need for insecticides.

It is protected against corn borer disease by encoding cry protein with the gene cryIAb. These genes produces Bt toxins which are released in the gut of insects, who feed upon them, thus killing them and protecting the plant from the pests.



**17. The diagram above is that of a typical biogas plant. Explain the sequence of events occurring in a biogas plant. Identify A, B and C. [Delhi 2011]**

**Ans.** The sequence of events occurring in a biogas plant are as follows:

(i) The biogas plant tank is fed with a slurry of dung.

(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) Methanogens like Methanobacterium grows anaerobically on cellulosic plant material in cow dung to produce large amount of methane,  $\text{CO}_2$  and  $\text{H}_2$ .

(iv) The plant has an outlet, which is connected by a pipe to supply biogas in nearby houses.

(v) The spent slurry is removed through another outlet and used as biofertilisers.

A-Sludge tank

B-Gas holder

C-Dung water

**18.(i) Why do farmers prefer biofertilisers to chemical fertilisers these days? Explain, (ii) How do Anabaena and mycorrhiza act as biofertilisers? [Delhi 2011]**

**Ans.** (i) A farmer relies on biofertilisers then chemical fertilisers because

(a) Chemical fertilisers significantly increase the soil pollution and reduce quality of soil, as well as water pollution, when it drains into nearby water bodies, after rain.

(b) Overuse of chemical fertiliser makes the soil infertile.

(ii) Anabaena fix atmospheric nitrogen, thus enriching the nitrogen content of the soil, as well as the organic matter.

In mycorrhiza, the fungal symbiont absorbs phosphorus from the soil and passes it to the plant and provides resistance to root borne diseases. Since, they fulfil the nitrogen and phosphorus requirement they act as biofertilisers.

**19. (i) Why do organic farmers not recommend eradication of insect pests? Explain giving reasons.**

**(ii) How do ladybird beetles and dragonflies act as biocontrol agents? [Delhi 2009C]**

**Ans.** (i) The organic farmers do not recommend eradication of insect pests as without them, the beneficial predatory and parasitic insects which depend upon pests as food or hosts would not be able to survive.

(ii) The ladybird beetles and dragonflies feed upon aphids and mosquitoes respectively. Hence, they act as biocontrol agents by helping to get rid of them.

**20. Name the genus to which baculoviruses belong. Describe their role in the integrated pest management programme. [Delhi 2011; Foreign 2011]**

**Ans.** Baculoviruses belongs to the genus Nucleopolyhedrovirus.

Baculovirus (Nucleopolyhedrovirus) as biocontrol agents:

(i) These are excellent candidates for species-specific, narrow spectrum insecticidal application.

(ii) They show no negative impact on plants, mammals, birds, fish or even non-target insects.

(iii) These are especially desirable when beneficial insects are being conserved to aid in an overall Integrated Pest Management (IPM) programme.



**21. An organic farmer relies on natural predation for controlling pests and diseases. Justify giving reasons, why this is considered to be a holistic approach? [Foreign 2010]**

**Ans.** Organic farming is a holistic approach that seeks to develop an understanding of the webs of interaction among the myriads of organisms that form the flora and fauna of the field.

(i) An organic farmer works to create a system, where the insects are not eradicated, but kept at manageable level by a complex system of checks and balance within a living and vibrant ecosystem.

(ii) Organic farmer states that the eradication of pests is not only possible but also undesirable, because many beneficial predatory and parasitic insects cannot survive without them.

(iii) This use of bicontrol methods reduces the use of chemical pesticides and thereby pollution.

**22. (i) Baculoviruses are excellent candidates for integrated pest management in an ecologically sensitive area. Explain giving reasons.**

**(ii) What is organic farming? Why is it suggested to switch over to organic farming? [Foreign 2008]**

**Ans.**(I) Baculoviruses belongs to the genus Nucleopolyhedrovirus.

Baculovirus (Nucleopolyhedrovirus) as biocontrol agents:

(i) These are excellent candidates for species-specific, narrow spectrum insecticidal application.

(ii) They show no negative impact on plants, mammals, birds, fish or even non-target insects.

(iii) These are especially desirable when beneficial insects are being conserved to aid in an overall Integrated Pest Management (IPM) programme.

(II) The use of biofertilisers and biopesticides to improve the crop yield is called organic farming.

It is advised to switch over organic farming due to the following reasons:

(a) Use of excess chemical fertilisers make the soil unsuitable for cultivation.)

(b) Natural resources get depleted due to the manufacturing of chemical fertilisers.

(c) Avoids killing harmful as well as useful life forms or organisms indiscriminately, thus maintains ecological balance.

**23. Why should biological control of pests and pathogens be preferred to the conventional use of chemical pesticides? Explain how the following microbes act as biocontrol agents?**

**(i) Bacillus thuringiensis (ii) Nucleopolyhedrovirus. [Delhi 2008]**

**Ans.** Bacillus thuringiensis as biocontrol agent

(i) Through genetic engineering, the gene coding for the toxic protein is introduced into crop plants, which make them resistant to insect pests.

(ii) When they are eaten by the larvae, the toxin becomes active in the gut of larvae and kills the larvae.





(iii) They are available in sachets as dried spores, which have to be mixed with water and sprayed onto vulnerable plants.

Baculovirus (Nucleopolyhedrovirus) as biocontrol agents:

(i) These are excellent candidates for species-specific, narrow spectrum insecticidal application.

(ii) They show no negative impact on plants, mammals, birds, fish or even non-target insects.

(iii) These are especially desirable when beneficial insects are being conserved to aid in an overall Integrated Pest Management (IPM) programme.

**24. Explain the role of baculoviruses as biological control agents. Mention their importance in organic farming. [All India 2008]**

**Ans.** (i) Baculovirus are pathogens that attack insects and other arthropods.

(ii) The majority of baculoviruses used as biocontrol agents are in genus Nucleopolyhedrovirus.

(iii) These viruses are excellent for species-specific, narrow spectrum insecticidal applications.

(iv) They do not show negative impacts on plants, mammals, bird, fish or even non-target insects. Therefore, they play an important role as biocontrol agents.

Importance in organic farming:

(i) It is desirable when beneficial insects are being conserved to aid in an overall Integrated Pest Management (IPM) programme.

(ii) It is used to conserve beneficial insects and kill harmful ones.

