

Microbes in Household Products, Industrial Products & 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-B₁₂ 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 CO₂ 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-B₁₂ 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

-----29-----

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:

- 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.
- The remaining major part of sludge is pumped into large tanks called anaerobic sludge digesters.
- Here, anaerobic bacteria digest the organic material of the sludge.
- 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:

- 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.
- The remaining major part of sludge is pumped into large tanks called anaerobic sludge digesters.
- Here, anaerobic bacteria digest the organic material of the sludge.
- 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 gets 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