

7. Introduction to microbiology

1. Rewrite the following statements using correct of the options and explain the completed statements:

a. Process of Coagulation of milk proteins occurs due to lactic acid.

Ans. Coagulation:

Explanation: The lactobacilli are the bacteria carrying out fermentation of the milk. In this process, the lactose sugar in the milk is converted into lactic acid. This lactic acid causes coagulation of the proteins present in the milk.

b. Harmful bacteria in like Clostridium in the intestine are destroyed due to probiotics.

Ans. Clostridium:

Explanation: In probiotics, there are lactobacilli which are useful. They control other bacteria present in the alimentary canal and also their metabolism.

These bacteria thus stop the action of Clostridium which is a harmful bacteria.

c. Chemically, vinegar is 4% acetic acid.

Ans. 4% Acetic acid:

Explanation: Chemically vinegar is 4% acetic acid. It is a good preservative of the food and thus while using it as additive to the food, it is called vinegar.

d. Salts which can be used as supplement of calcium and iron are obtained from Gluconic acid acid.

Ans. Gluconic acid:

Explanation: The microbe Aspergillus niger is used on the source material of glucose and corn steep liquor to produce amino acid called Gluconic acid, Gluconic acid is used for the production of minerals used as supplement for calcium and iron.

2. Match the pairs.

A group	B group (Answers)
(1) Xylitol	To impart sweetness
(2) Citric acid	To impart acidity
(3) Lycopene	- Pigment
(4) Nycin	- Microbial restrictor.

3. Answer the following.

a. Which fuels can be obtained by microbial processes? Why is it necessary to increase the use of such fuels?

Ans. (1) Microbial anaerobic decomposition of urban agricultural and industrial waste forms the gaseous fuel in the form of methane gas.

(2) Alcohol is another clean form of energy which is used in the form of ethanol. It is obtained by the fermentation of molasses by treating it with Saccharomyces-yeast.

(3) By photoreduction of water with the help of bacteria, hydrogen gas is released in the process of bio-photolysis of water. This hydrogen gas is said to be the fuel of the future.

(4) The conventional fuels are exhaustible. After few hundred years, they will be over completely

Moreover, these fossil fuels cause lot of air pollution due to emission of carbon dioxide. The fuels obtained by the microbial processes are not polluting Therefore, it is necessary to increase the use of ecofriendly fuels.

b. How can the oil spills of rivers and oceans be cleaned?

Ans. (1) The oil spills are caused by crude oil or petroleum hydrocarbons. The oil spills take place in rivers or oceans due to several reasons.

(2) This crude oil is highly toxic to the flora and fauna of the aquatic environment.

(3) By using mechanical means the oil spill can be removed, but this is very difficult.

(4) The biological way to remove this pollution is done by using culture of microbes like *Pseudomonas* spp. and *Alcanivorax borkumensis*.

(5) They have the ability to destroy the pyridines and other chemicals present in the hydrocarbons.

(6) These bacteria are called as hydrocarbon clastic bacteria (HCB) which decompose the hydrocarbons and bring about the reaction of carbon with oxygen.

(7) In the process CO₂ and water are formed. In this way the oil spills are cleaned, by releasing them at the place of oil spills.

c. How can the soil polluted by acid rain be made fertile again?

Ans. (1) The soil polluted by the acid rain is made fertile again by using bacteria.

(2) *Acidophillum* spp. and *Acidobacillus ferroxidans* are the bacteria which have the capacity to use sulphuric acid as their energy source.

(3) Since this sulphuric acid is present in the acid rain, the bacteria become the right choice to control the same.

(4) In this way, bacteria can control the soil pollution occurring due to acid rain, making the soil fertile again

d. Explain the importance of biopesticides in organic farming.

Ans. (1) By using bio pesticides, soil pollution is minimized. Otherwise by using chemical pesticides and fertilizers there is large scale soil pollution.

(2) When chemical pesticides are used in agriculture, there is contamination of soil by fluoroacetamide-like chemicals.

(3) These are harmful to other plants, animals as well as for human beings. They may cause skin diseases in humans.

(4) By using bacterial and fungal toxins the pests and pathogens can be destroyed. Such toxins are directly incorporated in the plant materials.

E.g. Spinosad is a biopesticide produced as a by-product of fermentation.

e. Which are the reasons for increasing the popularity of probiotic products?

Ans. (1) Probiotic substances are mostly milk products containing live bacteria. Such probiotics are very good for health.

(2) The useful colonies of bacteria are produced in the alimentary canal of human beings due

to the probiotics.

(3) Probiotics decrease the population of harmful microbes like *Clostridium* from our digestive tract.

(4) The immunity is enhanced due to regular intake of probiotics in the diet.

(5) The ill-effects of harmful substances formed during metabolic activities are reduced by the probiotics

(6) If someone takes the antibiotic treatment, then his or her useful intestinal bacterial flora becomes inactive or is eradicated. In such cases, probiotics restore the bacterial flora and make the person well again. All these facts have made probiotics a popular choice for people.

f. How the bread and other products produced using baker's yeast are nutritious?

Ans. (1) In order to make the bread the baker's yeast – *Saccharomyces cerevisiae* is added to the flour for the fermentation process.

(2) In commercial bakery, compressed yeast is used while in domestic settings dry, granular form of yeast is used.

(3) The flour prepared by using commercial yeast contains various useful contents like carbohydrates, fats, proteins, various vitamins, and minerals.

(4) The anaerobic fermentation also increases the nutritive content of the flour.

(5) Due to this, bread and other products produced with the help of yeast become nutritive.

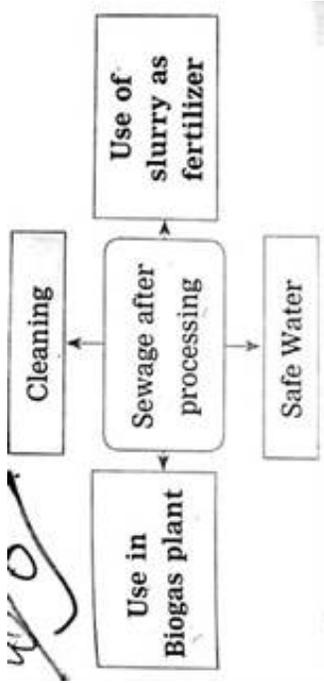
g. Which precautions are necessary for proper decomposition of domestic waste?

Ans. The domestic waste should be properly segregated into biodegradable (wet waste) and non biodegradable (dry waste). After segregation, these wastes should be stored separately into two different containers. The non-biodegradable substances should be either reused or sent for recycling. The biodegradable substances are decomposed naturally. The decomposition process can be done at house hold level too in a pot or a tank. This decomposition

h. Why is it necessary to ban the use of plastic bags?

Ans. will yield a rich manure. The pot should be covered by a thin layer of soil and it should be kept in a dark but airy place. The non-biodegradable things such as plastic articles, glass pieces, metal objects, unused medicines, e-waste should never be thrown in wet wastes. The toxic substances and the insecticides if added to wet waste, will never allow the natural decomposition process. Therefore, only after taking proper precautions we can aim at proper decomposition of domestic wastes.

4. Complete the following conceptual Picture. (Rotate your phone)



5. Give scientific reasons.

a. Use of mutant strains has been increased in industrial microbiology.

Ans. By using industrial microbiology, the commercial use of microbes is done. In such experiments, various economic, social and environment related processes and products are included. Various processes using different microbes are done. In this, fermentation processes are used to make bread, cheese, wines, enzymes, nutrients, etc. Different types of antibiotics are also made by using processes of industrial microbiology. In pollution control and solid waste management, the industrial microbiology becomes helpful. In farming too biotechnology is used to produce BT crops.

b. Enzymes obtained by microbial process are mixed with detergents.

Ans. When detergents are mixed with microbial enzymes, they start working more efficiently. The cleaning process takes place at lesser temperatures. Therefore, for better results, enzymes obtained by microbial process are mixed with detergents.

c. Microbial enzymes are used instead of chemical catalysts in chemical industry.

Ans. Instead of using chemical catalysts in the chemical industry, using microbial enzymes is beneficial for the following reasons: (1) Microbial enzymes are active at low temperature, pH and pressure.

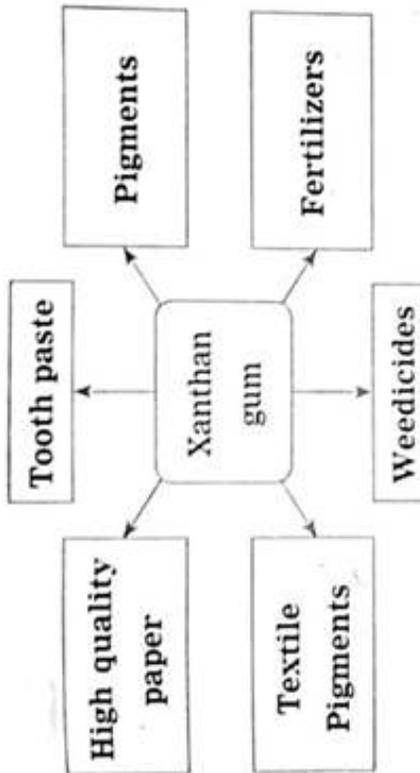
(2) Due to this property, the energy is saved. The costlier erosion-proof instruments need not be used.

(3) In enzymatic reactions, the unnecessary byproducts are not formed as the reactions are highly specific.

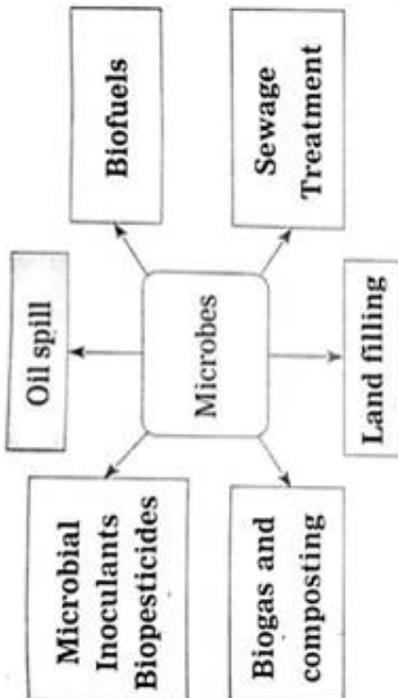
(4) The expenses on purification of the product are minimized as no unnecessary products are formed.

(5) The elimination and decomposition of waste material is avoided and enzymes can be reused again. Hence, microbial enzymes are said to be ecofriendly.

6. Complete the following conceptual picture with respect to uses.



7. Complete the following conceptual picture related to environmental management.



8. Answer the following.

a. What is role of microbes in compost production?

Ans. (1) Microbes can bring about natural decomposition of the organic compounds.

(2) During the biodegradation, some bacteria and fungi bring about such decomposition and release the inorganic constituents back into the nature.

(3) Compost is formed in such a way by recycling process.

b. What are the benefits of mixing ethanol with petrol and diesel?

Ans. When only diesel or petrol is used as fuel, there is increased air pollution. Moreover, since these are non-renewable and exhaustible fuels, they will be finished in next some years. When petrol and diesel is mixed with ethanol, the proportion of CO₂, CO, and hydrocarbons which are emitted in the atmosphere becomes lesser. The particulate pollutants which otherwise are emitted through combustion of petrol and diesel are not formed when fuels are mixed with ethanol. By adding ethanol to the fuels, the cost of expensive petrol or diesel also becomes less. The ethanol burns more efficiently hence ethanol is mixed with petrol and diesel.

c. Which plants are cultivated to obtain the fuel?

Ans. (1) The ethanol is obtained from wheat, maize, beet, sugarcane and molasses of sugarcane.

(2) For biodiesel, the soybean, rapeseed, jatropha, mahua, flaxseed, mustard, sunflower, palm, jute and some types of algae are cultivated.

d. Which fuels are obtained from biomass?

Ans. From biomass, the biogas and biodiesel are mainly obtained. The biogas is obtained from dung of cattle. The fermentation of cattle dung gives rise to methane. From methane, methanol is obtained. Ethanol is obtained from molasses of sugarcane, Some crops also give ethanol. In some countries, special crops are cultivated for the biodiesel.

e. How does the bread become spongy?

Ans. (1) When the dough for bread is prepared, the baker's yeast - *Saccharomyces cerevisiae* is added to it.

(2) This yeast carries out anaerobic fermentation.

(3) This results in formation of CO₂ and ethanol.

(4) The CO₂ formed tries to escape out of the flour and thus the dough rise. When such dough is baked, it produces spongy bread.