

Chapter 6. Biotechnology Applications

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Solution 1:

Biotechnology is the study and use of techniques using living organisms or their products for the benefit of human race. It is the controlled use of biological agents such as microorganisms or cellular components for beneficial uses.

Solution 2:

Yes.

Solution 3:

Since ancient times, microbes have been exploited for fermentation, baking etc. even without any idea of the mechanism behind them.

The various ways in which microbes were utilized in ancient times are:

1. In ancient times (before 2500 B.C.), the Aryans used to prepare 'Soma' as offering to God.
2. Preparations of curds, cheese, paneer, butter etc. from milk are age-old techniques.
3. In Roman times, cheese was processed from milk and its nutritive value was recognized.
4. For baking, leftover dough was applied from a previous batch of bread on leavened bread.

Solution 4:

Some food items prepared using microbes are bread, idli and dosa (South India), soya sauce, koji (Japan), temph (Indonesia), curd, cheese, butter and gari (West Africa)

Solution 5:

Two pioneer institutes in the field of Biotechnology in India are:

1. Bhabha Atomic Research Centre, Mumbai
2. Council of Scientific and Industrial Research, New Delhi

Solution 6:

Four industrial applications of biotechnology are:

1. Biotechnology is used to produce various alcoholic beverages like wine, beer, whisky, brandy and rum. For this purpose, brewer's yeast is used for fermenting malted cereals and fruit juices. Depending on the type of the raw material used for fermentation and the type of processing, different types of alcoholic drinks are obtained.
2. Biotechnology also helps in the commercial production of non-alcoholic beverages like tea and coffee. Here microbes are used in a fermentation process called curing.
3. Vinegar i.e. acetic acid is obtained by the fermentation of fruit juices.
4. A number of organic acids like citric acid, lactic acid, butyric acid etc. are obtained by biotechnological methods by employing several acid producing microbes.

5. Biotechnological techniques help in the production of certain enzymes for industrial use. For example proteases, lipases and amylases are obtained from cultures of yeasts like *Saccharomyces* and *Torula* and certain bacteria.
(Write any 4)

Solution 7:

1. **Biofertilisers** are organisms that enrich the nutrient quality of the soil. The main sources of biofertilisers are bacteria, fungi and cyanobacteria. Certain bacteria and blue-green algae fix atmospheric nitrogen and make it available to plants.
2. **Certain microorganisms** control or prevent spread of other organisms. They are utilized as bio-control agents. Example – Certain fungi which kill agricultural weeds are utilized as bio-weedicides.

Solution 8:

- (a) In sewage treatment plants, microbes are utilized as scavengers to remove organic matter from sewage. Bacteria, algae and fungi play important roles in sewage treatment.
- (b) Gobar gas or biogas is obtained from cowdung, garbage etc. when it is placed in biogas plants where anaerobic bacteria produce methane etc. The waste slurry is used as manure.

Solution 9:

Five applications of biotechnology in the field of medicine are:

1. **Antibiotics** – Antibiotics are chemical substances, which are produced by some microbes and can kill or retard the growth of other pathogenic microbes, without harming the host. Biotechnology has helped us to obtain pure and large amounts of antibiotics from microbes. Examples of antibiotics obtained from microbes are penicillin, tetracycline, streptomycin etc. The world's first discovered antibiotic penicillin is produced by *Penicillium* species of fungi. It destroys bacteria causing tonsillitis, sore throat, gonorrhoea, local infections and pneumonia.
2. **Vaccines** – Vaccines are killed or weakened pathogens employed to provide immunity against the diseases caused by them. Using biotechnology, we have been able to produce cheaper, purer, safer and more potent vaccines.
3. **Antibodies** – Antibodies against disease causing pathogens can be obtained through clone cultures. These help to provide immunity against diseases.
4. **Hormones** – Using recombinant DNA technology, humans have succeeded in producing several important hormones. For example – The bacteria *E.coli* have been successfully used to produce large quantities of human insulin. This is a boon to the many diabetic patients who are deficient in insulin and hence are unable to control their blood sugar. Also this was an improvement over the earlier used animal insulin which was expensive and allergic to many people.
5. **Diagnostic kits** – Today many diagnostic kits are available for detecting many diseases especially those caused by parasites. These kits give more reliable and quicker results easily.

Solution 10:

Koji – Japan

Gari – Africa

Temph – Indonesia

Vinegar – Fermentation
Baking – Yeast

Solution 11:

- (a) Idli, dosa
- (b) Wine, beer
- (c) Insulin
- (d) Criminals
- (e) biological sciences, technology

Solution 12:

1. (d) all of the above
2. (b) acid fermentation
3. (b) Soma
4. (a) weakened pathogens
5. (a) acetic acid