

APPLICATIONS OF ENZYMES

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- ❑ Enzymes that are proteinaceous in nature can be extracted from biological systems/ living tissues, purified as well as crystallized.
- ❑ Under controlled conditions of isolation, these enzymes preserve their original activity as well as in few cases even depict an enhanced enzymatic activity.
- ❑ A purified enzyme can be exploited to perform a particular biochemical reaction outside the cell. This feature enable enzymes to exploit in laboratory experiments and towards the industrial production of many value-added biochemical compounds, drugs as well as industrial products.

- Owing to aforementioned facts, enzyme research has been turn out to be an important field of biotechnology.

(A) Medical and Clinical Applications of Enzymes

- In human genome, a huge number of genes found to encode enzymes, which are required towards different metabolism in the cells.
- These enzymes differ in different tissues as well as systems of the body, so that if something happens erroneous owing to gene mutation, etc., then the enzymes have to be provided outwardly. Several enzymes with medical as well as clinical applications are as follows:

- **Enzymes as drugs for digestive disorders:** Several digestive enzymes like amylases, proteases and lipases are frequently exploited as constituents of drugs so as to treat digestive disorders.
- **Enzyme as deworming medicines:** The plant proteases such as papain from papaya as well as ficin from fig are exploited as deworming medicines towards humans and domestic animals. Such enzymes are not stopped as a result of secretions of the worms and cause digestion of the worms.
- **Enzymes for inhibiting bleeding:** The enzyme known as thrombin derived from beef plasma is exploited to inhibit bleeding during operations as well as after tooth operations. This enzyme transforms fibrinogen into fibrin as well as small peptides, thereby resulting in insolubilization, which finally cause blood to clot.

- **Enzymes as surface disinfectants:** Enzyme trypsin has been exploited for cleaning away thick, purulent (full of pus) masses in surface infection as well as in emphysema (enlargement of vesicles of lungs) accompanying with pleural pneumonia.
- The area cleaned with the digestive action of trypsin heals very fast as compared to untreated area.
- **Enzymes as diagnosis of diabetes:** The enzyme called glucose oxidase in association with peroxidase is exploited towards colorimetric determination of blood glucose.
- The aforementioned assessment is usually performed for determining the blood sugar level and, therefore assist in diagnosis of diabetes.

(B) Industrial applications of enzymes

- ❑ **Enzyme application in textile industry:** The enzyme known as amylases extracted from bacteria, fungi, pancreas as well as malt are exploited in textile industry for softening agents towards starched clothes.
- ❑ Starch is frequently supplemented to cotton fibres as stiffening agent, before weaving the fibre into cloth.
- ❑ Starched cloth doesn't accept good colour, the cloth is to be destarched before dyeing it. This is performed with the help of amylase enzymes that cause hydrolysis of starch.

- **Enzyme application in leather industry:** Proteolytic enzymes derived from bacterial and fungal strains are utilized towards the production of leather.
- The proteolytic enzymes digest collagen or connective tissues that hold the hairs and, thus result in dehairing of the skin
- **Application of enzyme in detergents production:** The alcalase as proteolytic enzyme is supplemented in several detergents that assists towards removal of proteinaceous stains from the cloth.
- **Use of enzyme for production of organic compounds:** Several bacterial enzymes are exploited towards the commercial production of acetone, butanol, lactic acid, citric acid, etc., via fermentation of carbohydrate rich carbon sources.

- **Use of enzyme in paper industry:** Generation of paper from wood needs separation of wood fibres from each other (pulping) followed by reforming them to a sheet.
- In trees, the wood fibres are attached together owing to lignin that requires to be disintegrated for obtaining chemical pulp.
- The residual lignin is removed from the chemical pulp through bleaching in order to obtain brighter pulp.
- As chlorine is traditionally exploited in bleaching, effluents from bleaching often possess toxic chlorinated compounds and thus cause threat to the environment.
- As a result of above-mentioned fact, new approach has been introduced towards pulp bleaching in which cellulase free endoxylanases are exploited. Lignin-xylan complexes are present in hardwood as well as softwood and can be disintegrate by cellulose free xylanases; association of cellulase is avoided as it can damage the fibres.

(C) Application of enzymes in food and feed industry

- **Meat and beer processing:** The enzyme papain from papaya or bromelain from pineapple are exploited to tenderize meat through hydrolysis of peptide linkages. It is also utilized for stabilizing chill proof beer.
- **Application of enzyme for cheese production:** Enzyme renin derived from the calf stomach is exploited for the production of cheese as it transforms calcium- casein of milk into calcium paracaseinate that is curd like in look. The curd is solidified as well as processed as cheese after inoculation with suitable mixture of microbes.
- Lipase is supplemented during cheese processing for production of flavour.

- **Use of enzyme in beverage industry:** The enzymes obtained from yeast are exploited towards alcoholic fermentation for beverage industry.
- **Exploitation of enzyme in juice & wine processing:** The enzyme known as pectinases are often supplemented to canned fruit juices as well as in wine as this enzyme carry out the hydrolysis of pectin and thereby enabling the juice/ wine clear.
- **Use of enzymes for production of chocolate and candies:** The enzyme called invertase is exploited for the production of chocolate covered berries and other like candies.
- The enzyme called glucose isomerase is utilized for the manufacture of fructose as well as high fructose syrups from hydrolysed maize starch to be used in soft drinks.
- The enzyme lactase is used towards the inhibition of lactose crystals in ice cream.

References

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