B.Sc. Botany (Hons) – 2ND SEM
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Properties of Enzymes

Enzymes are proteins that act as biological catalysts in their respective biological reactions. A substrate is a molecule upon which an enzyme can function, and a product is a molecule produced by the enzyme after the enzyme has converted the substrate into another molecule. In 1878, Wilhelm Kuhne coined the term "enzyme." Enzymes are macromolecules that are extremely precise in their function. Enzymes are required for all metabolic activities in our bodies because they catalyse reactions at a quicker rate. In contrast to catalysts, enzymes are naturally created by living cells.

In the presence of extreme heat, the enzyme's activity is drastically reduced. In contrast to globular proteins, some RNA molecules are found in the majority of enzymes. It is more difficult to work with enzymes than with substrates since they are larger. Activated enzymes are found in hydrophilic colloids that are found in the protoplasm.

It is the inactive protein part of the enzyme that is known as **apoenzyme**. The inactive, non-protein component of an enzyme, on the other hand, is made up of coenzymes (organic molecules) and cofactors (inorganic ions) respectively. As a result, the chemical makeup of cofactors and coenzymes is the primary distinction between them. When these two enzymes are combined, they produce the catalytically active holoenzyme (complete enzyme).

The enzyme has a tendency to take on a shape that is complementary to the structure of the transition state. As a result, specificity is determined by the structural similarity between the enzyme and the substrate.

Enzymes as Biocatalysts

The following are some of the reasons why enzymes are referred to as "Biocatalysts":

Enzymes, like catalysts, increase the rate of a reaction by shortening the time it takes for the substrate to become the product of the reaction.

Additionally, enzymes govern reaction specificity, which is the ability of an enzyme to produce a given product only when a specific substrate adheres to its active site.

Like catalysts, enzymes just participate in the biological reaction and do not consume any resources or alter the equilibrium state of the system in which they function.

The activation energy of a biological reaction is reduced by enzymes, and the transition energy from substrate to product is increased by enzymes.

Properties of Enzymes can be classified into:

1. Physical properties
2. Chemical Properties
3. General properties

Physical Properties of Enzymes

Enzyme activity

The mechanism of enzyme action is highly dependent on parameters such as temperature, pH, and the concentrations of enzyme and substrate present in solution. The maximum enzyme activity is observed at the optimal temperature (37 degrees Celsius) and pH. (7.2). The enzymatic reaction will be slowed down if the enzyme and substrate concentrations are too low.

A larger concentration of enzyme, on the other hand, will result in faster enzymatic activity because more substrates will interact with the enzyme's active site, resulting in the creation of more products.

The enzymatic reaction would not change after the reaction velocity achieves its maximum value, even after the addition of enzyme and substrate were both added.

Colloidal Nature

Because of their huge size or high molecular weight, enzymes act like colloids. As a result, the enzymes have little or no inclination to dialyze or pass the semi-permeable membrane. Unlike proteins, coenzymes are inactive non-protein components with a low molecular weight and a high degree of dialyzability.

Enzyme precipitation

Because enzymes are amphoteric, they can be precipitated by acidic and alkaline solutions.The presence of ethanol as well as a high concentration of inorganic salts such as ammonium sulphate aid in the precipitation of enzymes.

Molecular weight

Enzymes are big protein macromolecules that contain a polypeptide chain that contains amino acids from a variety of amino acid sequences. The amino acids are held together by approximately 200 to 300 peptide linkages. As a result, enzymes have a rather large molecular weight.

Enzyme solubility

Enzymes are soluble in a variety of solutions including water, NaCl, diluted glycerol, and alcohol.

Enzyme Denaturation

A variety of factors, including high temperatures (over 40 degrees Celsius), pH fluctuations (both too low and too high), heavy metal ionisation, and a high salt concentration, among others, can denature an enzyme by disrupting noncovalent connections between and within the enzyme molecules. After a period of time, it causes structural and functional changes in the enzyme, ultimately leading to the loss of enzyme activity.

Chemical Properties of Enzymes

- **Catalytic Properties:** Biological catalysts are enzymes. The greater amounts of compounds are catalyzed by a small number of enzymes. This means that enzymes are highly capable of turning giant amounts of the substrate into a substance. Enzymes improve the reaction rate and remain unaffected by the reaction they catalyze.

- **Enzyme Specificity:** Enzymes are extremely variable in nature, which means that a specific enzyme can catalyze a specific reaction. For example, only sucrose hydrolysis can be catalyzed by Enzyme sucrase.

General properties of enzymes

Enzymes are responsible for the initiation and acceleration of the reaction.

Enzyme activity is dependent on the pH of the environment.

An enzyme contains a highly precise area (the active site), with which the substrate interacts specifically in order to produce the desired products.

Enzymes become unstable when exposed to extreme heat, high temperatures, and pH variations.

It is believed that enzymes are proteinaceous and have features that are similar to those of proteins.

It just takes a minimal amount of enzyme to catalyse the degradation of substrates.

The activity of an enzyme is often characterised by absolute, relative, group, and stereo-specificities.

Some enzymes have a regulatory function in their activity.

Its major role is to reduce the amount of energy required for activation.

The enzymes do not change during or after the product creation process, and they can even be re-consumed if necessary.

In addition to an active site, an enzyme may contain an allosteric site, which is where cofactors or regulators can interact with the enzyme.

Both water and NaCl have been shown to be compatible with enzymes.