Surface Chemistry

Characteristics of enzyme catalysis

The important characteristics of enzyme catalysis are:

1. Enzyme catalysis is highly specific in nature. I.e., each enzyme is specific for a given reaction or an enzyme that catalyses a particular reaction does not catalyse another reaction.
2. Enzyme activity is highly efficient. i.e., one molecule of an enzyme may transform one million molecules of the reactant per minute.
3. The rate of an enzyme reaction becomes maximum at a definite temperature, called the optimum temperature. The optimum temperature range for enzymatic activity is 298-310K.
4. The rate of an enzyme-catalyzed reaction is maximum at a particular pH called optimum pH, which is between pH values 5-7.
5. The enzymatic activity is increased in the presence of certain substances, known as co-enzymes.
6. Enzymes activity is inhibited or poisoned by the presence of certain substances.

Mechanism of enzyme catalysis

There are a number of cavities present on the surface of colloidal particles of enzymes. These cavities have characteristic shape and possess active groups such as $-NH_2$, -COOH, -SH, -OH, etc. These are the active centers on the surface of enzyme particles. The molecules of the reactant (substrate) fit into these cavities just like a key fits into a lock. So an activated complex is formed, which then decomposes to yield the products. This theory is known as ***lock and key theory***. Thus, the enzyme-catalysed reactions may be considered to proceed in two steps.

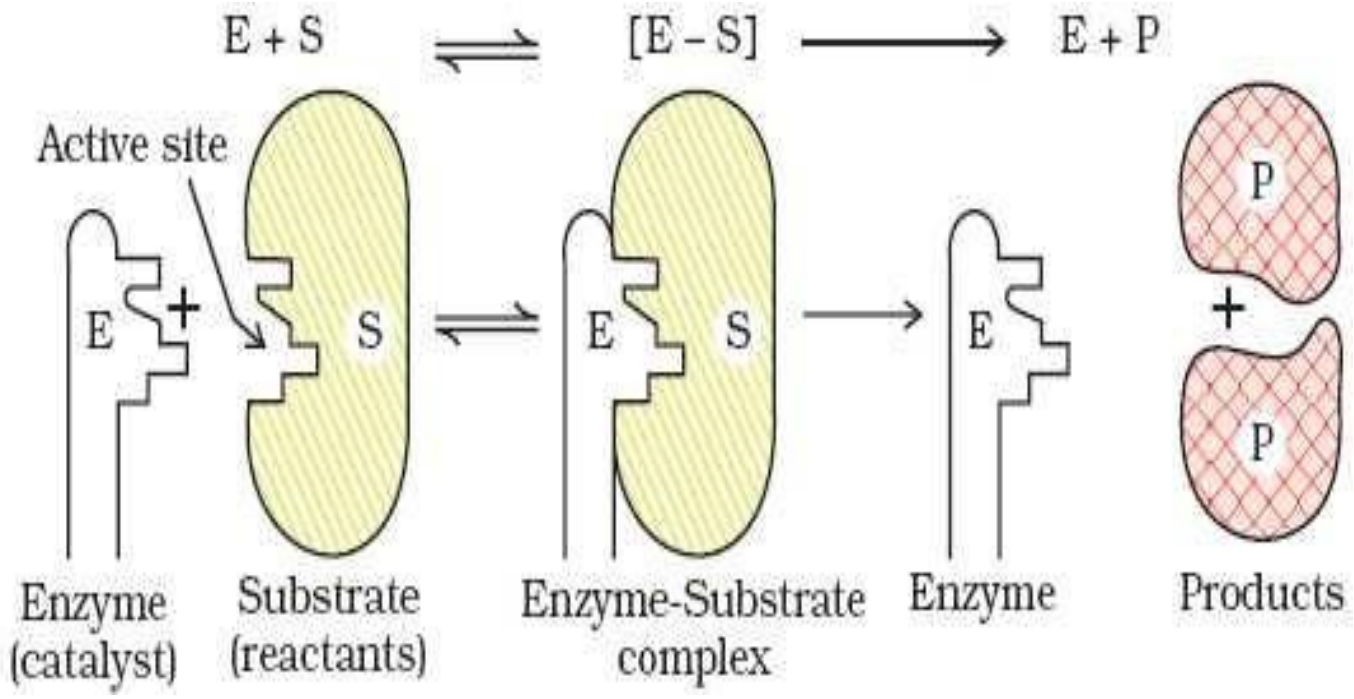
Step 1: The enzyme combines with the substrate to form an activated complex.

$$E + S \rightarrow ES^*$$

Step 2: Decomposition of the activated complex to form product.

$$ES^* \rightarrow E + P$$

The schematic representation of the mechanism of enzyme catalysis is as follows:



THE COLLOIDAL STATE

Colloid is an intermediate state between true solution and suspension. In a true solution, the size of the particles is < 1nm. The particles do not settle down under the influence of gravity or by any method and they cannot be filtered by a filter paper. A true solution is homogeneous and transparent.

In a suspension the size of the particles is > 1000nm. The particles settle down under the influence of gravity. They can be filtered by an ordinary filter paper. It is heterogeneous and opaque.

In colloids, the particle size is in between ***1 nm and 1000nm***. The particles do not settle down under the influence of gravity. They cannot be filtered by ordinary filter paper, but can be filtered by ultra filters. They are heterogeneous and translucent.

Colloids are heterogeneous systems containing two phases – *dispersed phase and dispersion medium*. The substance which is dispersed (distributed) is called *dispersed phase* and the medium in which the particles are dispersed is called *dispersion medium*.

e.g.: In starch solution, starch is the dispersed phase and water is the dispersion medium.

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