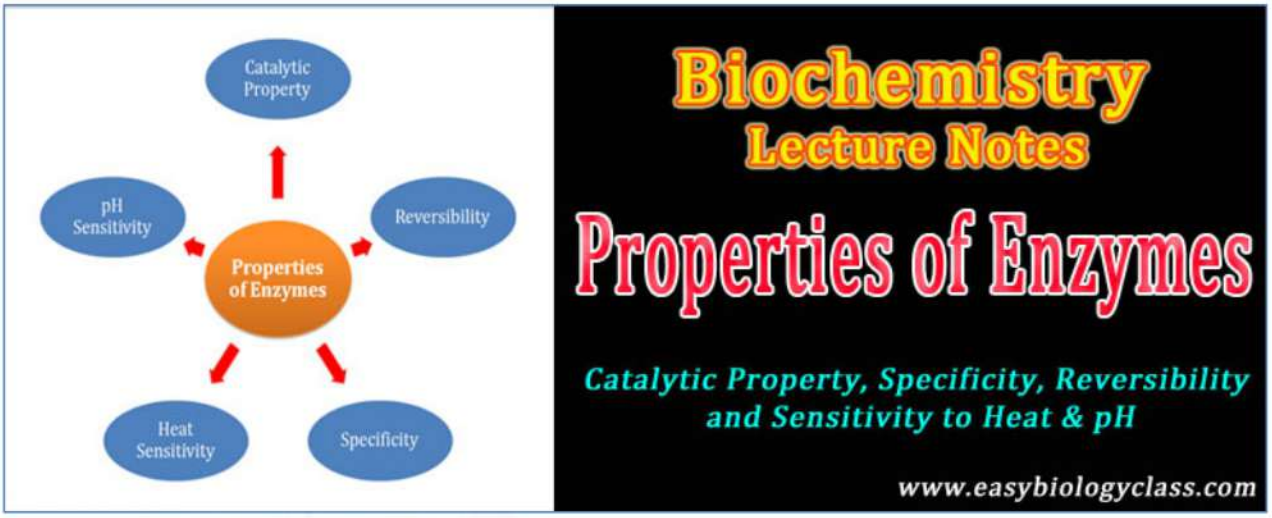


PROPERTIES OF ENZYME

Enzymes are biological catalysis. They are specialized proteins (except ribozymes) capable of catalyzing specific reactions in the cells. In the previous post, we have discussed the Structure and Functions of Enzymes. In the present post, we will discuss the Properties of Enzymes.

What are the Properties of Enzymes?

The properties of an enzyme can be summarized as:

1. **Catalytic Property**
2. **Specificity**
3. **Reversibility**
4. **Sensitiveness to Heat and Temperature**
5. **Specific to Hydrogen Ion Concentration (pH)**

(1). Catalytic property:

- Enzymes have extra-ordinary catalytic power.
- They are active in **very small quantities.**
- A small amount of enzyme is enough to convert a large quantity of substrates.
- The enzymes remain unchanged after the reaction.
- The turn over number of enzymes ranges from 0.5 to 600000.
- **Turn over number:** *The number of substrate molecules converted by one molecule of enzyme per second when its active site is saturated with the substrate.*

Enzyme Turnover Number: Examples		
	Enzyme	**Turnover Number** *(per second)*
1	Carbonic anhydrase	600000
2	Acetylcholinesterase	280000
3	Penicillinase	2000
4	Chymotrypsin	100
5	DNA Polymerase I	15
6	Lysozyme	0.5

(2). Specificity:

- Enzymes are very **specific** in their action.
- Particular enzyme acts on a particular substrate only.
- Enzymes are also **specific** to a particular type of **reaction.**
- In some rare cases, the specificity may not be too strong.
- Enzymes show different types of specificity such as Bond Specificity, Group Specificity, Substrate Specificity, Stereoscopic specificity, Geometric Specificity and Cofactor Specificity.

- **Bond specificity:** It is also called as relative specificity. Here the enzyme is specific for a bond. Example: Peptidase is specific for Peptide Bond, Lipase is specific for ester bond in a lipid.

- **Group specificity:** It is also called as structural specificity. Here the enzyme is specific for a group. Example: Pepsin (an endopeptidase) hydrolyze the peptide bonds in with the amino group belongs to aromatic amino acids (phenylalanine, tyrosine and tryptophan) (n+1 ≠ proline)

- **Substrate specificity:** It is also called absolute specificity. Here the enzyme acts only on a particular substrate. Example: Arginase acts only on arginine; Carbonic anhydrase acts only on carbonic acid.

- **Optical specificity:** It is also called stereospecificity. This is the highest specificity shown by an enzyme. Here the enzyme is specific not only to the substrate but also to its optical configuration. Example: L amino acid oxidase acts only on L-amino acids, not on D-amino acids. Similarly, the alpha-amylase act only on α-1-4 glycosidic linkage of starch and glycogen. It is not able to hydrolyse the β-1-4 glycosidic linkage of cellulose.

- **Co-factor specificity:** This shows that enzymes are not only specific to the substrate but also specific to its co-factors.

- **Geometric specificity:** Here the specificity is very less. Some enzymes will work with a small range of similar substrates having similar **structural geometry.** Example: Alcohol dehydrogenase can oxidize methanol and n-propanol to aldehydes

(3). Reversibility:

- Most of the enzymes catalyzed reactions are **reversible.**
- The reversibility of the reaction depends upon the requirements of the cell.
- In some cases, there are separate enzymes for forward and reverse reaction.
- Some enzyme-catalyzed reactions are not **reversible.**

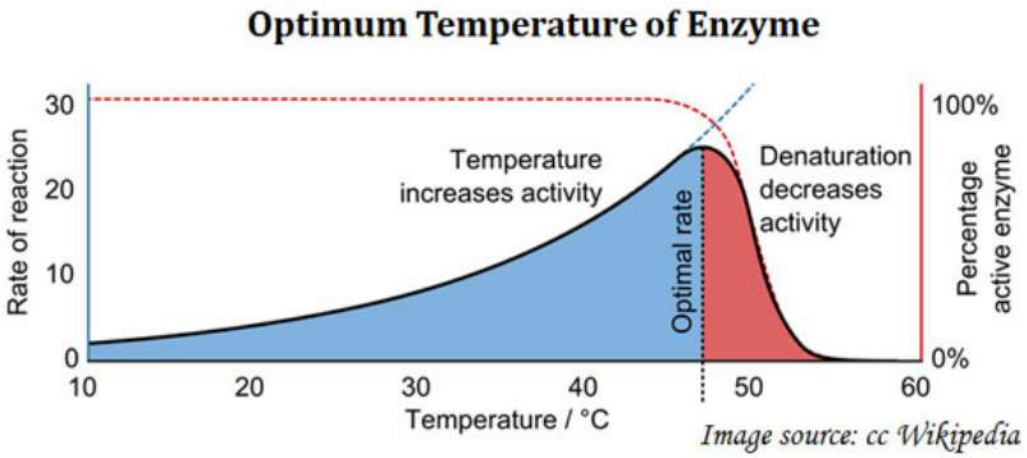
(4). Sensitiveness to heat and temperature:

- Enzymes are very sensitive to heat and temperature. (They are **thermo-labile.**)

- The maximum activity of an enzyme will be at normal temperature.

- Correct temperature for the maximum activity is called optimum temperature.

- Enzymes will be inactive at very low temperature. (This the reason for preserving food and vegetables in the refrigerator)



- The enzymatic activity increases with increase in temperature up to a certain level
- At higher temperature (60-70°C), the enzyme is destroyed or denaturated.
- *Do you know an enzyme active at very high temperature? It is Taq-Polymerase used in PCR reactions. The optimum temperature for Taq-polymerase is 75 to 80°C.*

(5). Sensitiveness pH:

- Enzymes are specific for their pH requirement.

Optimum pH values of Some Common Enzymes			
Enzyme	**Substrate**	**Optimum pH**	**Location**
Pepsin	Peptide Bond	1.5 to 2.0	Stomach
Sucrase	Sucrose	6.2	Small Intestine
Amylase	Amylose	6.7 to 7.0	Pancreas
Urease	Urea	7.0	Liver
Trypsin	Peptide Bond	7.7 to 8.0	Small Intestine
Lipase	Lipids	8.0	Pancreas

- Some enzymes are active in acidic pH (pH below 7), some are active in basic pH (pH above 7) and some others are in neutral pH.

- The correct pH of an enzyme is denoted as **Optimum pH.**

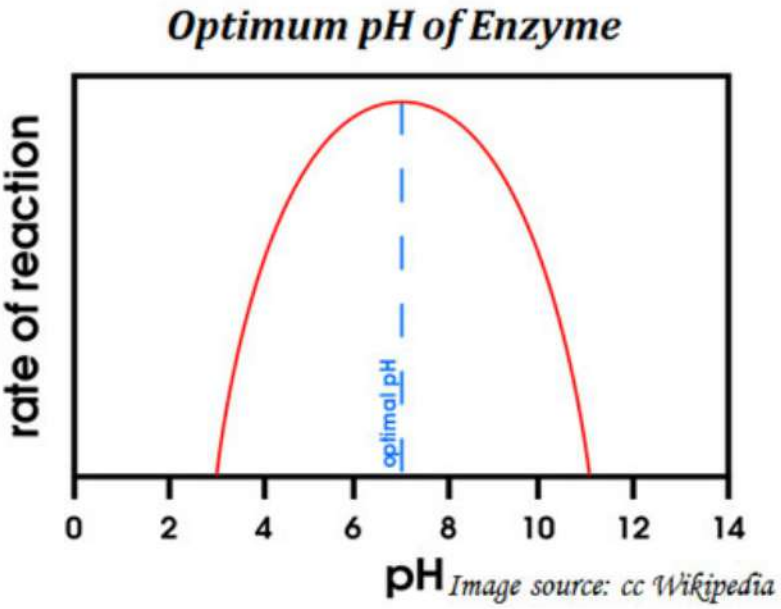


Image source: cc Wikipedia