

Enzyme

Enzyme may be defined as biocatalyst, synthesized by living cells. They are proteinous in nature, colloidal, thermolabile in character and specific in their action.

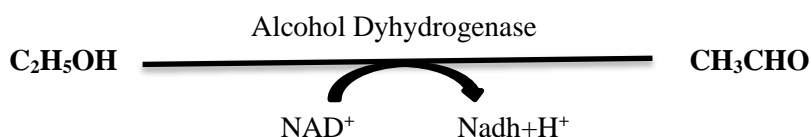
Classification of enzymes:

Enzymes are classified into six major classes. Each class on its own represents the general type of reactions brought about by the enzyme of that class.

1. Oxido-reductases:

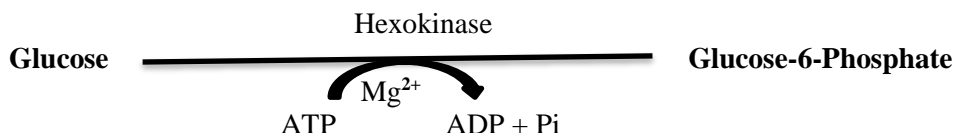
Enzyme involved in oxidation reduction reaction.

Example: alcohol dehydrogenase, cytochrome oxidase.



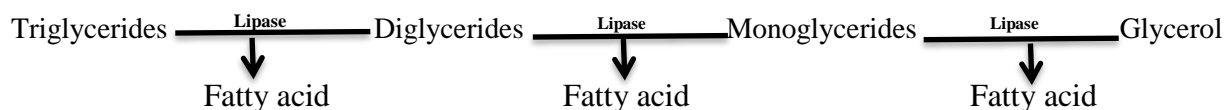
2. Transferase:

Enzyme that catalyze the transfer of functional group e.g. Hexokinase.



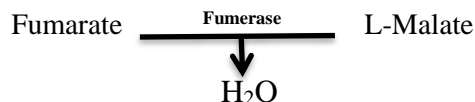
3. Hydrolases:

These enzymes catalyze the hydrolysis of various substrate e.g. acid phosphatase, pepsin & lipase.



4. Lyases:

Enzyme specialized in the addition or removal of water, ammonia, CO₂ etc. e.g. Aldolase, fumarase.



5. Isomerases:

Enzyme involved in all the isomerization reactions e.g. Phospho hexoisomerase, Phosphotrios isomerase.



Isomerase

6. Ligases:

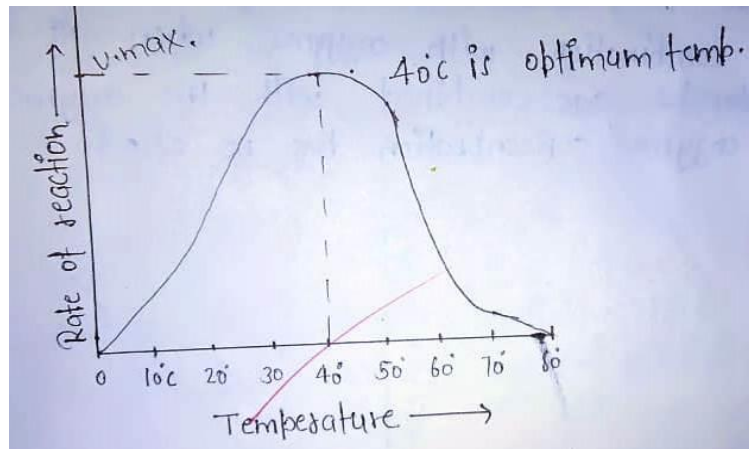
Enzyme catalyzing the synthetic reaction when two molecules are joined together and ATP is used. E.g. Glutamate synthetase,
Succinase thiokinase.

FACTOR AFFECTING ENZYME ACTIVITY

There are various factors which affect the enzyme activity.

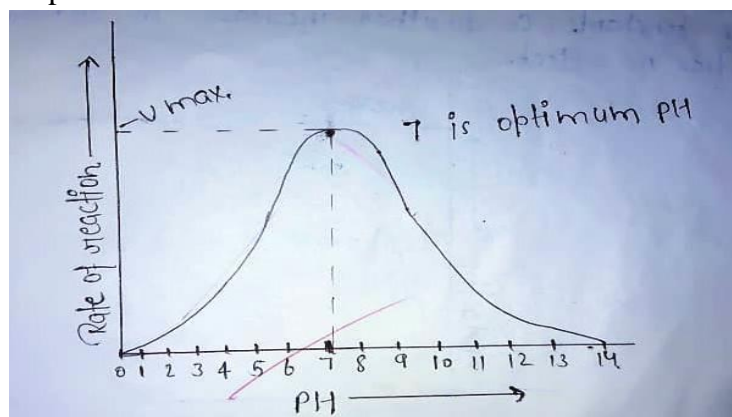
- **Temperature:** the enzyme action increase with increase in temperature. But this happen only up to 40 °C to 45 °C beyond this temperature the enzymes gets denatured. The rate of enzyme action decrease when the temperature reaches beyond 40 °C.

Optimum temperature: the temperature at which the enzyme activity is maximum is called optimum temperature.

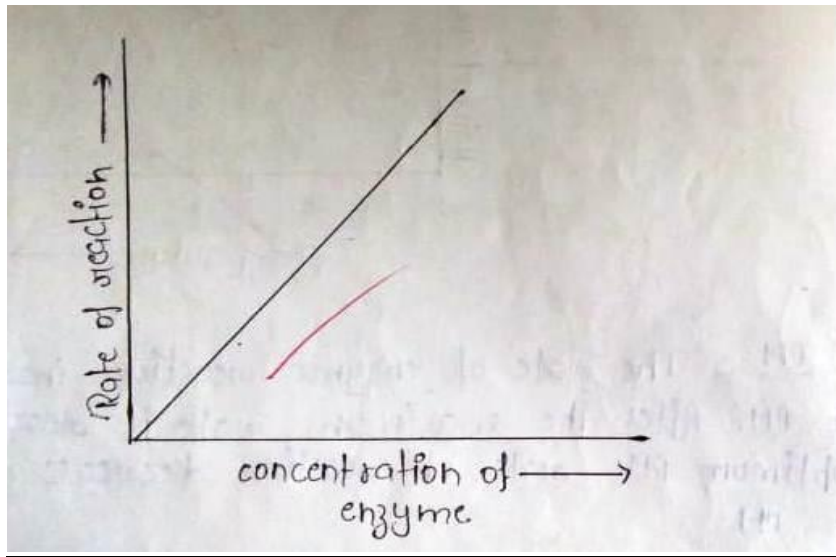


- **pH:** The rate of enzyme reaction increase with increase in pH. After the maximum rate is reached or after the optimum pH, the rate of reaction decrease with further increase in pH.

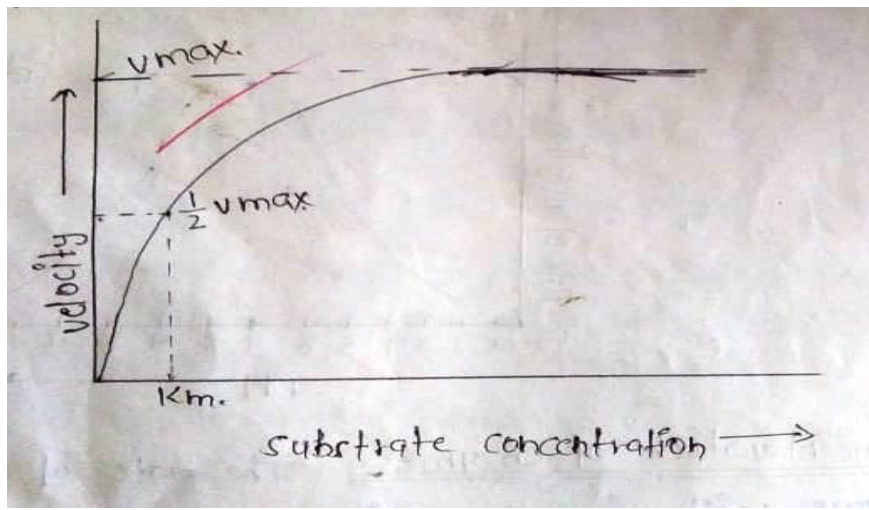
Optimum pH: the pH at which the rate of reaction is maximum is called optimum pH.



- **Concentration of Enzyme:** The rate of enzyme reaction increase with increase in enzyme concentration. This is true only when sufficient substrate molecules are available for combination with enzymes. When all the substrate or molecules are combined with the enzyme, further increase in enzyme concentration has no effect.



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- **Concentration of Substrate:** the rate of reaction increase with increase in substrate concentration. After a certain limits, it becomes constant. So further increase in substrate concentration has no effect.



- **Concentration of Products:** The rate of reaction decrease with increase in concentration of product.
- **Activators:** Some enzymes need some specific co enzymes or activators for their activity. E.g. Mg^{+} , Cu^{+2} , K^{+} etc.
- **Radiations:** Radiations affect enzyme activity by forming peroxide or free radicals. E.g. UV-radiations

- **Inhibitors:** Inhibitors are substance which lowers down the rate of enzyme reaction.

ENZYME INHIBITION

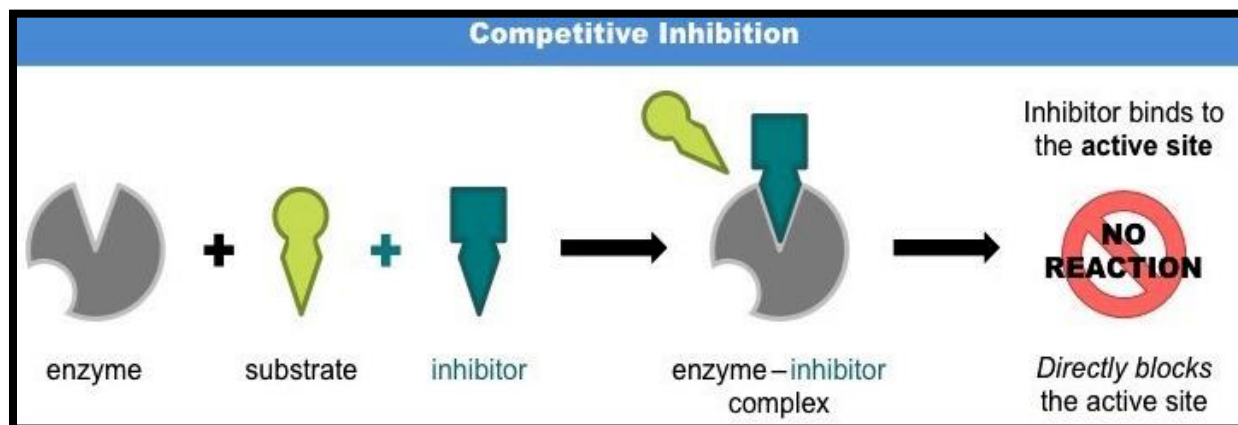
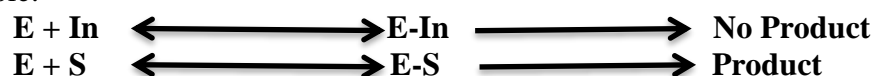
Enzyme inhibition is classified as follow:

- Competitive inhibition
- Non-competitive inhibition

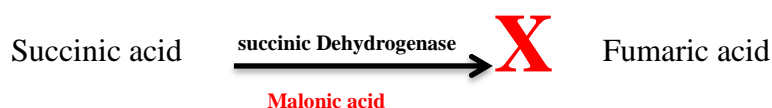
a. Competitive inhibition:

In this type of inhibition, the inhibitor and the substrate have structural similarity. So they both compete with each other to bind with the enzyme. The inhibitor is successful in this competition. So an enzyme inhibitor complex is formed. This complex cannot leads to the formation of a product.

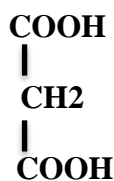
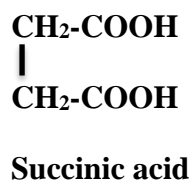
Example:



Example:



This reaction is inhibited by Malonic acid which has structural similarity to succinic acid.



Malonic acid

Competitive inhibition is a reversible type of reaction.

b. Non-competitive inhibition:

There is no structural similarity between the inhibitor and the substrate. The inhibitor binds at the other site than the active site. The inhibitor binds at the other site than the active site. The inhibitor affects the enzyme substrate complex and prevents its dissociation to release the product.



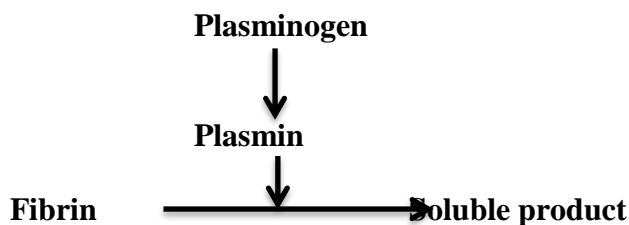
APPLICATION OF ENZYMES

Certain enzymes are used as therapeutic agents, analytical reagents, in genetic engineering and for industrial application and diagnostic purpose.

I. Therapeutic application of enzyme:

Streptokinase:

Streptokinase enzyme prepared from streptococcus bacteria is useful clearing the blood clots. Streptokinase converts inactive plasma plasminogen to active plasmin which in turns converts insoluble fibrin into soluble product.



Asparaginase enzyme:

The enzyme Asparaginase is used in the treatment of leukemia (WBC cancer). Tumor cells are dependent on asparagine protein of host plasma for their multiplication. By administering Asparaginase enzyme, the host, plasma levels of asparagine is drastically reduced. This leads to depression in the viability of tumor cells.

Trypsin:

Trypsin is used for diffusion of a number of drugs.

Hyaluronidase enzyme:

It is used for diffusion of number of drugs

Enzymes like pepsin, papain, and amylase are administered to improve digestion.

DIAGNOSTIC APPLICATION OF ENZYMES

Disease can be diagnosed by the estimation of blood level of certain enzymes.

1. ***Amylase enzyme:*** (normal 80-180 50 mohyi unit/ dl) it is an enzyme secreted in the pancreas. Its increased level in the blood denotes acute pancreatic.
2. ***Alkaline phosphatase:*** its level increased in certain bone and liver disease. It is useful for the diagnosis of rickets, carcinoma of bone and oeteomalacia.
3. ***Acid phosphatase:*** it is present mainly in the prostate gland. An increase in its blood level help in the diagnosis of prostate cancer.
4. ***Creatinie phosphokinase:*** It is enzyme present in heart and skeletal muscles. An increase in its blood level helps to diagnosis of myocardial infraction and muscular dystrophy.
5. ***Lactate dehydrogenase:*** LDH level of serum increase in leukemia, myocardial infraction, infective hepatitis.
6. ***Lipase:*** plasma lipase levels are increased in acute pancreatitis and carcinoma of pancreas. This disease can be diagnosed by estimating plasma lipase level.
7. ***Isocitrate dehydrogenase:*** it is an enzyme of kreb cycle. Its level increased in hepatitis and malignancy of liver.