ENZYMES

Enzymes are biological catalysts (biocatalyst) which bring about chemical reactions in living cells. They accelerate the rate of the reaction and are usually present in very small amount in various cells. They can also exhibit their activity when they have been extracted from the source. They are organic compounds and a number of them have been obtained in crystalline form. **Today, more than 840 enzymes are known.**

GENERAL PROPERTIES OF THE ENZYMES

Enzymes possess the following general properties.

(1) Substarate specificity : Unlike the inorganic catalysts, enzymes mostly act only on some specific type of substrate and convert them into certain specific products.

(2) Temperature and pH optima : Every enzyme has got an optimum temperature and an optimum pH at which it shows its maximum activity. An increase in temperature increases the enzyme activity but at the same time also increases enzyme denaturation. The temperature at which these two processes balance each other showing maximum activity is known as its **optimum temperature**. Enzyme activity decreases as a result of decrease in temperature, but simultaneously, the rate of denaturation also decreases. Thus at lower temperatures, enzyme activity can be better preserved for longer periods.

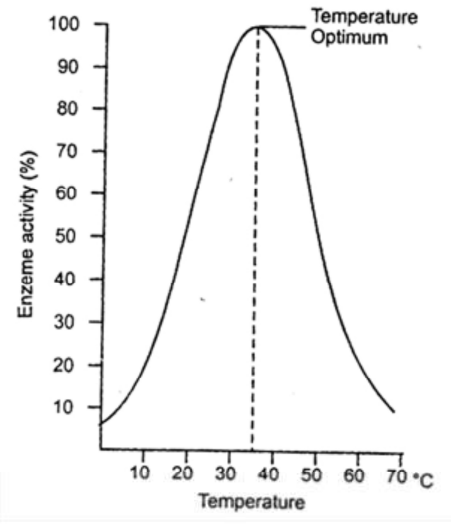


Fig. 5.1 Effect of Temperature of Enyzme Activity

A pH at which maximum activity is observed with least destruction of the enzyme is known as its **optimum pH**. Different enzymes have got specific optimum pH values which usually fall in the pH range of 5.0 to 9.0 However, a few enzymes such as pepsin, have their optimum pH values outside this range. Extremely high or low pH values result into extensive denaturation of the enzyme proteins and hence rapid loss of enzyme activity.

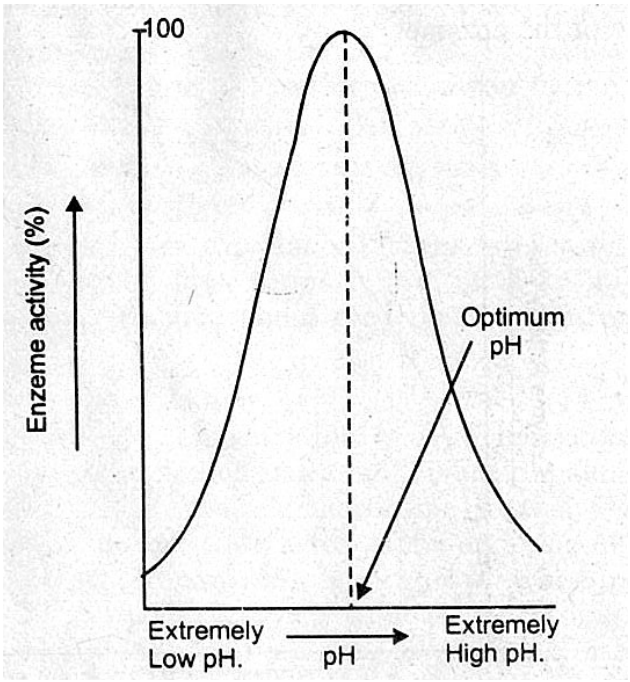


Fig. 5.2 Effect of pH on Enzyme Activity

(3) Effect of Substrate Concentration : For a given amount of the enzyme, the rate of reaction is influenced by the concentration of the sustrate. If the substrate concentration is gradually increased keeping the enzyme concentration constant, the rate of reaction also increases but after attaining a certain levels, increase in the substrate concentration does not increases the reaction rate. This is due to the fact that enzyme molecules possesss a limited number of active site to which the substrate molecules get attached. Increase in the concentration of the substrate goes on saturating the active site. A stage comes when all the active sites existing in a particular

amount of enzyme are saturated. Increase in the substrate concentration increases enzyme activity upto reaching such a stage, but after attaining the saturation point, excess substrate does not find any active site free on the enzyme molecule, and hence, excess substrate is not acted upon by the enzyme till the active sites become free. Hence, the rate of enzyme activity remains unaffected after attaining the saturation point. In certain cases, further increase of substrate concentration might inhibit the enzyme activity.

(4) Denaturation : If the natural conditions are changed, the enzyme proteins undergo denaturation which is accompanied by a parallel loss of enzymic activity. Enzymes may be denatured by acids, high salt concentrations, heavy-metal salts, alkaloidal reagents, or ultraviolet light treatment. The loss of enzyme activity on denaturation is due to certain changes in secondary, tertiary and quaternary structures of the enzyme protein which involve partial or complete breakdown of weak ionic or nonpolar bonds responsible for maintaing natural structure of the enzyme.

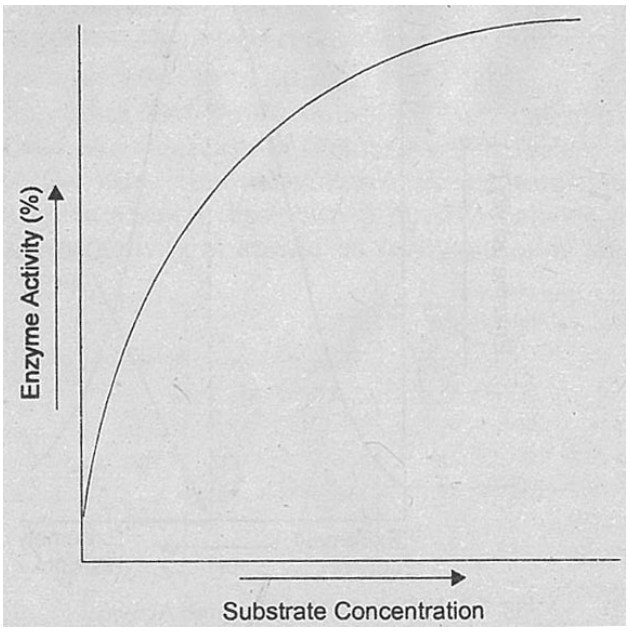


Fig. 5.3 Effect of substrate concentration of Enzyme Activity

(5) Activation : Most of the enzymes can be activated by addition of certain specific agents. In the absence of such factors, enzymes become inactive or sluggish. Such agents are known as **enzyme activators**.

(6) Inhibition : Enzyme activity may be inhibited by addition of some specific agents which are known as **inhibitors**. The mechanism and importance of enzyme inhibition has been discussed ahead.