Factors that affect enzymes activity

Introduction

Enzymes are biological catalysts. A catalyst is a substance which speeds the rate of reaction but remains unchanged in the reaction. Catalysts reduce the activation energy needed for a reaction. Enzymes are proteins and occur naturally in living biological systems, acting in many metabolic pathways. The activity of enzymes is affected by pH, temperature, enzyme concentration and substrate concentration. Enzymes have optimum pH and optimum temperatures, at which they experience maximal activity. Enzymes are highly specific, acting upon a single substrate or group of related substrates. Enzymes have an active site - a small portion of the molecule which is complementary in shape to a portion of the substrate. The substrate binds to the active site of the enzyme forming the enzyme-substrate complex. Strain is induced in the bonds causes them to cleave and the the products leave the active site, leaving it available for further reactions. The reaction of enzymes is reversible.

Inhibitors are substances that slow down or stop enzymes. Competitive inhibitors are molecules that are very similar to the substrate, so they can bind to the enzyme but cannot react. They compete with the substrate for the active site of the enzyme.

Some enzymes require co-factors - non-protein components which bind to the enzyme and modify its active site to its ideal configuration for formation of the enzyme-substrate complex. Co-factors may simply increase the activity of the enzyme or may be necessary for its action.

1. Effect of Enzyme Concentration

1. Principle.

During catalysis, the first step is the substrate (S) binding to the enzyme (E), giving an enzyme-substrate complex (ES). This is an equilibrium reaction, and will be favored by a high concentration of enzyme and/or substrate. After the substrate is bound, the reaction takes place, and then the product is released.

$$E+S \rightleftharpoons ES \longrightarrow P+E$$

2. Procedure.

1. Prepare amylase enzyme solution by mixing 2 ml of saliva with 20 ml distilled water in a 50 ml beaker and keep it in 37°c water bath.
2. Label three dry clean test tubes from 1 to 3 and add 3 ml of 1% starch in each test tube.
3. Keep these tubes in 37°c water bath for 5 minutes.
4. Add 3 drpos of amylase solution for tube 1, 6 drops for tube 2 and 10 drops for tube 3.
5. Keep back the tubes for water bath in the same temprature for 10 minutes.
6. Examine the tubes by iodine test for the presence of starch, the tube 1 will contains more starch than the others because the concentration of amylase added is less than the other tubes, therefore the blue colre in this tube will be darker.
7. Examine the prsence of glucose in tube 3 by bendict reagent.

2. Effect of temprature

1. Principle.

All reactions are faster at a higher temperature. However, enzyme-catalyzed reactions become slower or stop if the temperature becomes too high, because enzymes become denatured at high temperatures. Therefore, enzymes have an optimum temperature that corresponds to maximum activity. (At higher or lower temperatures, the activity of the enzyme is lower.) The optimum temperature is usually around body temperature (37°C).

2. Procedure.

1. In two clean dry test tubes, add for each tube 4 ml of amylase solution which is prepared by mixing 2 ml of saliva with 20 ml distilled water.
2. Label the tubes as 1 and 2, keep the tube 1 in boiling water bath for 10 minutes and the tube 2 in 37°C water bath for 10 minutes.
3. Add for each tube 4 ml of 1% starch and mix well.
4. Turn back the tubes 1 and 2 in 37°C water bath for 10 minutes.
5. Examine the tubes for the presence of starch by iodine test. Tube 1 will give positive result and contains starch because the enzyme is denaturated in boiling bath, whereas tube 2 have no or small quantity of starch because the enzyme hydrolyzed the starch.
6. Examine the tubes for the presence of glucose by benedict test, tube 1 gives negative result while tube 2 gives positive result for the same cause in step 6.