Effect of temperature on the enzyme lipase essay sample

The phenomenon of catalysis makes possible biochemical reactions necessary for all life processes. Catalysis is defined as the acceleration of a chemical reaction by some substance which itself undergoes no permanent chemical change. The catalysts of biochemical reactions are enzymes and are responsible for bringing about almost all of the chemical reactions in living organisms. Without enzymes, these reactions take place at a rate far too slow for the pace of metabolism. Enzymes are globular proteins which catalyse and regulate chemical reactions in all living organisms. Since they are not used up in reactions (but warn down), enzymes can be used over and over again. Enzymes posses an active site; which only recognizes a particular substrate. The shape of this site allows for a particular enzyme to bond with its substrate to form a temporary enzyme-substrate complex. The specificity is referred to as “ the lock and key theory”, but in practice works more like a “ hand and glove fit”. Once the reaction has occurred, the product(s) break free of the enzyme, leaving it free to catalyse more reactions. Enzymes lower the amount of energy necessary to make reactions occur, by lowering the activation energy of that particular reaction.

There many factors that affect the rate of enzyme catalysed reactions such as; temperature, the enzyme becomes thermodynamically denatured, pH some enzymes are pH specific, and concentration of the substrate or enzyme. As stated above enzymes are globular proteins. They are held into shape by weak hydrogen bonds. If the temperature is increased to high, there is sufficient energy to break the hydrogen bonds. If the hydrogen bonds are broken the globular proteins unravel, and the enzyme loses its shape. Since shape is essential to its ability to catalyse, enzymes, base on

the basic lock and key theory, if the shape is lost, the enzyme can no longer catalyse the reaction. Thus the increase in temperature causes the activity of the enzyme to stop. This process is known as thermal denaturation, and is therefore irreversible and permanent. Lipase is an enzyme that can be found in the pancreas, this enzyme, catalyses the breakdown of fat into fatty acids and glycerol. Milk contains fats which are susceptible to the action of lipase.

Bromothymol blue (also known as bromothymol sulfone phthalein, Bromothymol Blue, and BTB) is a chemical indicator for weak acids and bases. The chemical turns yellow as the mixture it is added to becomes more acidic. This pH indicator is a halochromic chemical compound that is added in small amounts to a solution so that the pH (acidity or basicity) of the solution can be determined visually. Bromothymol blue a pH indicator was used to determine whether or not the enzyme lipase broke down the milk this was noted by the colour change. Lipase breaks down milk into glycerol and fatty acids thus when the lipase catalyses this reaction acid will be produces and the pH will drop to below seven (7) therefore if the bromothymol blue turns yellow it can be identified to be an acidic mixture and thus the would have catalysed the reaction. MATERIALS/APPRATUS:

MATERIALS: Bromothymol blue, Lipase, Water, Milk
APPARATUS: seven (7) test tubes, freezer, Bunsen burner, Beaker, Forceps, Glass Rod, Measuring Cylinder, Syringe, Dropper , thermometer, Tripod stand, PROCEDURE:

First the water bath was set up, and three centimeters (3cm3) of milk was poured into a test tube five to seven (5-7) drops of bromothymol blue were

added and the mixture was shaken gently. The test tube was then placed into the water bath which allowed for equilibrium, this was done for various temperatures; that is, 5°C, 10°C , 20°C , 35°C , 40°C , 55°C, 70°C the temperatures that were below room temperate were place in to a refrigerator and temperatures over the room temperature the bath was placed over a heating source that is; a Bunsen burner while the temperature was maintained via various methods and the test tube was left for five minutes the test tube was removed from the bath and one centimeter (1cm3) of lipase was added to the mixture immediately using a syringe. The test tube was then placed into the water bath for five minutes once more. Finally the test tube was removed and shaken gently and via qualitative analysis the results were recorded. This process was done three times for accuracy.

RESULTS:

GRAPH 0. 9: SHOWING THE EFFECT OF TEMPERATURE ON ENZYME LIPASE

TABLE 9. 0: COLOUR CHANGE IN MIXTURE AFTER ADDING BROMOTHYMOL BLUE TO VARIOUS MIXTURES AT DIFFERENT TEMPERATURES TEMPREATURE (°C)TEST 1TEST 2TEST 3

5°CNo colour change (blue)No colour change (blue)No colour change (blue) 10°C No colour change (blue)No colour change (blue)No colour change (blue) 20°C No colour change (blue)No colour change (blue)No colour change (blue) 35°C Colour change (blue to yellow)Colour change (blue to yellow)Colour change (blue to yellow) 40°C Colour change (blue to yellow)Colour change (blue to yellow)Colour change (blue to yellow) 55°CNo colour change

(blue)No colour change (blue)No colour change (blue) 70°CNo colour change (blue)No colour change (blue)No colour change (blue)

DISCUSSION:

Chemical reactions speed up as temperature is increased, so, in general, catalysis will increase at higher temperatures. However, each enzyme has a temperature optimum, and beyond this point the enzyme's functional shape is lost. Boiling temperatures will denature most enzymes. Lipase is an enzyme that the body uses to break down fats in food so they can be absorbed in the intestines. Lipase is primarily produced in the pancreas but is also in the mouth and stomach. Bromothymol blue acts as a weak acid in solution. It can thus be in protonated or deprotonated form, appearing yellow and blue respectively. It is bluish green in neutral solution. Bromothymol blue is mostly used in measuring substances that would have relatively low acidic or basic levels (near a neutral pH).

In the results the optimum temperature of lipase can be assumed between 35 and 40 degrees Celsius this can be seen by the colour change in the bromothymol blue, from blue to yellow showing that the pH is now acidic or below 7. When the lipase breaks down the fats in milk into glycerol and fatty acids, the fatty acids allow for the bromothymol blue to change from blue to yellow. Thus the reaction shows that the lipase is active this colour change can be seen in 35°C and 40°C. However in the temperatures tested below and above the enzyme was inactive because no fats were broken down, despite the enzymes were inactive in temperatures above 40°C the enzymes were denatured or irreversibly damaged where as temperatures below 35°C were just dormant.

CONCLUSION:

The optimum temperature of the enzyme lipase is between the temperatures 35°C to 40°C.