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Correlation between the chemical activity of Amylase and change in temperature ABSTRACT This experiment focuses on how the change of temperature affects the rate of reaction of amylase. In the experiment there were four different environments that each contained 2 test tubes. Each test tube consisted of the same concentration and amount of starch and amylase. After having each test tube placed in these environments for several minutes a droplets of each mixture was placed onto each slot which contained liquid solution of iodine.

Each environment contained two different test tubes, one test tube was starch and the other was amylase. A droplet was placed in ten to thirty second intervals to see the different states of starch break up. When starch is present with iodine, the solution is a dark and transparent purple color, when there is less starch present the intensity of the color purple decreases. The the objective of this experiment was whether the change in temperature and the speed of reactivity of amylase is directly proportional or not.

The hypothesis was with the increase in temperature there would be an increase in the speed of reactivity of amylase with starch. Results showed that with the increase in temperature there is an increase in the speed but after 37? C the rate of reaction decreased. This proved that there is an optimum temperature point for the rate of reaction for amylase which was 37? C. INTRODUCTION Enzymes can effect the rate of reaction through catalysis. Enzymes help lower the activation energy required for a reaction which helps to speed the reaction that is taking place.

With enzymes structure is key to the proper function of a cell. Enzymes such as amylase go through a catabolyic cycle, allowing the substrates to bind to

the active site which is called an induced fit where the activation energy is lowered and the reaction is sped up(Reece, Urry, Cain, Wasserman, Minorsky, Jackson 2011). The substrate is then converted into the product and is released. The enzyme is not consumed during the reaction, therefore when exploring the effect of the rate of reaction with amylase, there was no concern for fluctuation of the concentration of amylase in each test tube.

The enzyme amylase is found in the saliva of an animal. Amylase is involved with the preliminary break up of glucose chains into disaccharides of glucose called maltose. When the glucose chains attach themselves to the active site of the enzyme, the glycocidic linkages are broken down through hydrolysis (Reece, Urry, Cain, Wasserman, Minorsky, Jackson 2011). In order for a human to digest certain materials the body needs to contain those specific enzymes, for one enzyme cannot lower the activation energy and break down every molecule that is present.

An example of this would be lactase which has the ability to break down lactose in the body. An enzyme must also be in the proper environment in order to function effectively which was reinforced to the class when the observation was made when there was an optimum temperature in which amylase operated in. In a peer-reviewed article titled The Effects of Temperature changes on salivary Amylase Activity by Leon H. Schneyer and another article titled Temperature Effects in Enzyme Kinetics By Keith J. Laidler and Branko F.

Peterman explains that there is an optimum temperature that amylase operates in and when the temperature becomes too high, then the enzyme becomes denatured and does not function properly. The reason for the

optimum reaction rate is because in an enzymatic reaction, there are in fact two separate reactions occurring; one being enzyme-substrate reaction which appears to be dominant and as long as the increase in temperature is in the range below the optimum, the rate of reaction continues to increase(Schneyer 1951).

When the reaction goes over the optimum temperature, then the denaturation-reaction dominates therefore decreasing the rate of reaction. If the temperature increases around the test tube which contains starch and amylase, then the rate of reaction between amylase and starch will increase because the frequency of chemical reaction through collision increases. With lower temperatures the rate of reaction between starch and amylase would decrease. MATERIALS AND METHODS

The lab acquired 8 different test tubes to be placed in 4 different environments, each environment containing two test tubes; 80? C, 37? C, 22? C, and 4? C. Each test tube in the given environment contained the same concentration and amount of starch. There were also a milliliter worth of 6. 8 pH buffer solution added in-order to prevent any formation of acidic solution or basic solution that could denature the amylase enzyme. The other 4 different test tubes in the different environment contained the same concentration of Amylase which were placed in the same environments as the starch.

After having the total of 8 test tubes placed in those environments for several minutes, a sample of the amylase is placed into the test tube with the starch which was then transferred to a plate that had multiple slots that each contained a solution of iodine. Each of the drops were added to the

iodine solution in thirty second increments, which were done for all 4 different environments. By doing this it became possible to see the different rates of reaction through the different shades of purple. When transferring the different solutions such as starch and amylase, there were dedicated pipettes that were used for the two reactants.

RESULTS Temperature Vs. Duration of time for complete reaction of starch with amylase The Graph shows that the temperature with the lowest time for complete reaction to take place was at 37? C. Temperatures beyond 37? C takes longer for complete reaction. The Table gives the exact value at the given temperature for the complete reaction to take place. As the temperature increases, the time it takes for the reaction to complete decreases, but once it surpasses 37? C the time for the reaction to complete increases.

In the graph and in the table is can be observed that there is an optimum temperature in which amylase can operate in. At 37? C the rate of reaction is fastest because the time it required for the solution to turn from a dark purple to the amber yellow was the shortest out of all the other temperatures. Everything before the optimum temperature the rate of reaction is increasing because the enzyme-substrate reaction is more prominent. At 4? C and 22? C, the enzyme is able to function properly but it was still not at the temperature in which the enzyme could operate at full capacity.

While everything higher than the optimum temperature the rate of reaction decreases and the time required for the purple to turn amber yellow increases. This is because the enzyme denaturation reaction becomes

dominant. The enzyme can no longer function properly at temperatures such as 80? C. DISCUSSION The increase in temperature then there should be an increase in the rate of reaction of Amylase with starch and with the decrease in temperature there should be a decrease in the rate of reaction. 4? C will have the slowest rate of reaction and 80? C will have the highest.

The prediction during this lab was, the increase in the temperature of the test tube would lower the time required for the solution to turn from dark purple to amber yellow would decrease because it would have a faster rate of reaction of amylase breaking down the starch. Results have shown that the hypothesis that was made was wrong due to the negligence of the existence of optimum temperature an enzyme could operate in. At 80? C, the test tube was left in the environment longer than 5 minutes yet no reaction occurred. 37? C had the lowest time at 20 seconds, while 22?

C had 30 seconds and 4? C had 1 minute and 55 seconds. If the temperature is too high then the enzyme will become denatured. Results have shown that the hypothesis was incorrect. Although in the hypothesis it was predicted that the environment with the highest temperature (80? C) would have the highest rate of reaction, evidence has shown other wise where it took more than 5 minutes for the reaction to show its effect. In conclusion, the prediction and hypothesis made were not entirely supported by the results but some concepts of enzyme activity were reinforced in the experiment.