To investigate the effect of temperature on the rate of reaction on trypsin enzym...

Literature, Russian Literature

I predict that the best temperature for the reaction to take place will be at around 40 degrees. I made this assumption on the basis that 40 degrees is the closest to body temperature, and so this would have to be the best temperature for the reaction to take place. It can also be said that below 40 degrees the enzymes will have less energy and hence will move around less.

Therefore there is less chance that they will collide into the photographic film, meaning the time that it takes for the enzyme to fully react with the photographic film will take longer. Also above 40 the enzyme will be affected by the high temperatures and will begin to denature. When an enzyme becomes denatured its active site changes shape and so it cannot break down any substances. Therefore at above 40 enzymes will be denatured, unable to break down the photographic film, and so the reaction will take longer.

The results from my preliminary experiment have shown me that the acclimatisation time should be 4 minutes, and that an end point of 10 minutes is enough time for us to be able to tell that no reaction will take place. We can therefore say that there will be the least activity at both the ends of the spectrum of temperatures, namely at 10C and 80C. This would produce a graph in the shape of the following sketch:

However, it should be noted that this is merely a sketch and thus is not accurate in terms of scale or accuracy in comparison with the end results table.

What are Enzymes?

Enzymes are biological catalysts; this means that they are used to speed up reactions. The function of enzymes is mainly to break down and digest proteins. Each enzyme is a complex three-dimensional structure. The centre of the structure is knows as the ‘ active site’, where the chemical reactions take place; whether it be proteins being put together or proteins being broken down. The actual physical reaction carries out as follows:

Properties of enzymes are:

* They reduce the amount of energy for molecules to react.

* They remain the same after chemical reaction.

* They are specific in the type of substrate molecule.

* They are affected by temperature, as is demonstrated by this experiment.

* They are affected by pH level.

Trypsin, the enzyme to be used in this experiment, is a protease and breaks down proteins and polypeptides to amino acids; it is found in pancreatic juice and is produced in the pancreas.

Apparatus list:

* 15 test tubes.

* 15 wood splints.

* Water bath.

* Thermometer.

* Trypsin enzymes.

* Water.

Method:

1. Prepare 15 wooden splints.

2. Prepare 15 test tubes in a test tube rack.

3. Measure 3cm of trypsin using a measuring cylinder, ensuring the measurement is taken from the bottom of the meniscus.

4. Place this volume into each test tube.

5. Repeat for other test tubes.

6. Cut a notch on the end of one side of all the splints.

7. Carefully place a 1cm piece of photographic film in each notch on the splints.

8. Place three test tubes in the water bath.

9. Set the thermostat on the water bath to 10C.

10. Wait 10-12 minutes for the water to settle at 10C.

11. Place a splint with photographic film into each of the test tubes.

12. Start timing using the stopwatch.

13. Wait for the film to dissolve away.

14. When the film has eventually dissolved away, stop the time and note it down.

15. Clean the test tubes and apparatus thoroughly.

16. Repeat this process from step 1 to 15 for temperatures 20C, 40C, 60C and 80C.

Diagram:

Fair test:

To ensure the experiment is a fair test:

* Ensure the same amount of trypsin in used throughout the experiment.

* Ensure the same size of photographic film is used throughout the experiment.

* Carry out the experiment three times to ensure the results are valid and are reasonable.

* Ensure the trypsin is acclimatised before the experiment.

* Ensure the same water bath is used.

* Ensure the same test tubes are used.

* Ensure the apparatus is all clean.

Safety notes / Risk assessment:

* Use eye goggles to prevent the risk of enzymes getting into the eye and digesting eye tissues.

* Use an apron and gloves to reduce the risk of contact between human skin and enzymes.

* Use a safety mat in the case of any trypsin being spilt.

Evaluation:

There were many ways in which the experiment carried out was not entirely fair, leading to a combination of mixed results, anomalies and inconsistent results:

* It is not proven that at the time the results were recorded, the gelatine layer of photographic film was completely dissolved, it was merely visually judged; this is inaccurate since there may have been microscopic traces of gelatine left.

* The gelatine was not completely submerged in water; the splint notch was partially covering the gelatine and thus this part was not exposed to the trypsin.

* The water bath thermostat was not entirely correct since thermometer readings proved that the temperature of the water was not always consistent with the temperature on the thermostat.

* The stopwatch has only a certain number of decimal places and the addition of room for human error and inaccuracy leads to the problem of overall inaccuracy for the reading of the time for the results.

* The optimum temperature, or the peak of the graph, is not at what is should be. The actual optimum temperature of the graph should be at 37C; however, this one is at 42C. Again, this is a result of not letting the enzymes acclimatise.

* If the water bath thermostat had a greater degree of accuracy, the results would in turn also have a greater degree of accuracy.

Although there are so many possible in accuracies that may have occurred, my main hypotheses was proven correct, As we have the exact same curve in the final experiment as predicted in my plan. In terms of accuracy, the results are reliable enough to depend on to conclude whether the predictions were correct or not. The anomalies were not too extreme and thus can still be considered in taking into account as a result.

I could have made many improvements during the experiment to make it fair and equal. An example of this is the range of temperature; if the experiment was carried out at 10C intervals, there would have been a more defined and accurate graph.

Conclusion:

By looking at my results I can conclude that the optimum temperature is near the average body temperature; 37C. This is because the enzymes are designed to work in the body where the temperature is around 37C.

We can also tell from the graph that the enzymes stop working at low temperatures, and denature at high temperatures. There were no real noticeable anomalies that can be noted as outside the conventional result and thus there were no results outside the expected results.