Effect of ph on amylase activity

Science, Chemistry

In my experiment I aimed to observe how ranging pH levels will affect the rate in which amylase will break down the starch molecules. I will be measuring the time it takes for the dark liquid to disappear and leave a yellow brown liquid to be shown, which would show that there is no starch present in the solution because it would have broken into maltose by adding amylase. Results did not fully demonstrate what we expected in our hypothesis, but did portray the pattern we expected, with the rate of reaction being highest nearer the middle of the pH scale. Enzymes are specific-type proteins that act as a catalyst by lowering the activation energy of a reaction. Each enzyme binds closely to the substrate; this greatly increases the reaction rate of the bounded substrate. Amylase enzyme, just like any other enzyme, has an optimum PH and temperature range in which it is most active, and in which the substrate binds most easily.

Introduction

Amylase is an enzyme that catalyzes the breakdown of starch to sugar. They are found in almost in almost all plants, animals and microorganisms. It is difficult to measure the reaction of amylase on starch as there is no clear reaction seeing as the substrate (starch) and the product (maltose) are colourless. This is why iodine must be used as starch appears as blue-black in its presence.

Method

Equipment used: -Five boiling tube racks -Stopwatch -Test-tube rack -30cm3 of 1% starch solution -Three 5cm3 syringes -10cm3 of 1% amylase solution -dropping pipette -5cm3 of 0. 05 mol dm-3 sodium carbonate solution -white

tile -10cm3 of 0. 1 mol dm-3 ethanoic acid -pH indicator paper -iodine solution -Eye protection

Firstly I labelled the 5 boiling tubes (from 1-5) and then placed 5cm3 of 1% starch solution into each of the tubes. Then with a new syringe I added 1cm3 of 0. 05 mol dm-3 sodium carbonate solution to tube 1. Then I added 0. 5cm3 of 0. 05 mol dm-3 sodium carbonate solution to tube 2. With a new syringe I placed 2cm3 of 0. 1 mol dm-3 ethanoic acid to tube 4 and 4cm3 of 0. 1mol dm-3 ethanoic acid to tube 5. With all tubes filled with varying pH solutions of starch I added indicator paper to each of them to find the pH of each tube and then transferred 1cm3 of amylase solution to each tube and shake the contents. Now the solutions are ready, start a stopwatch. I decided to remove a drop with a dropping pipette every two minutes from each tube and placed them on a clean white tile. After adding a drop of each iodine solution to test how much starch had broken down (what the colour of the solution was) I rinsed the pipette and continued to sample every two minutes. When a solution turned a yellow brown colour I noted the amount of time it had taken to do so.

Hypothesis

I would expect that the breakdown of starch solution would reach optimum rate of reaction when the pH is neutral and gradually decrease either side of this neutral point. Therefore I would expect that tube 3 with a pH of 7 would react and break down the fastest. I came to this hyphothesis under the assumption that enzymes work best when at a neutral pH. Therefore the more acidic and alkali startch solutions should not react as quickly. The change in pH would affect the ionisation of the side groups in the enzymes

amino acid residues this would then affect the overall shape of the enzyme molecule and would then affect the efficiency of formation of enzyme-substrate complexes.