An Investigation to Show the Effect of Changes in the Concentration of Hydrogen Peroxide Has On Enzyme Action

My Aim

My aim is to see if the concentration of hydrogen peroxide has any effect on the rate that the enzymes react. I will also measure the amount of oxygen bubbles given off and see if the concentration of the substrate (hydrogen peroxide) has any effect. Catalase (yeast) catalyses the breakdown of hydrogen peroxide into oxygen and water.

My Prediction

My prediction is that when the concentration of hydrogen peroxide increases, so will the amount of oxygen bubbles given off. This will occur because as the concentration increases there is then more of the hydrogen peroxide for the yeast to react with.

Equipment List

- Hydrogen Peroxide- 5, 10, 15 & 20% this will enable us to see if the difference in the strength of hydrogen peroxide has any effect on the rate of the reaction.
- Pipette- This will allow us to measure out accurately the correct amounts of hydrogen peroxide and water.
- Water- The water is to dissolve the yeast so we can get the same surface area of yeast to react with the hydrogen and also to read the amount of oxygen bubbles given off by the measuring tube full of water.
- Used ice-crème tub- Fill the tub half full of water and out the full measuring tube upside down so no oxygen escapes during the experiment.
- Measuring Tube- This must have measurements down the side so you can measure the amount of oxygen given off by the reaction.
- Test tube- The test tube is where the reaction takes place between the dissolved yeast and the peroxide.
- Yeast – Yeast is a catalase and will react with the hydrogen peroxide and cause a reaction.

- Scales- This will allow us to measure out the correct weight of yeast of yeast every time.
- Bung- This will allow us to start the experiment without losing any oxygen at the beginning of the reaction.

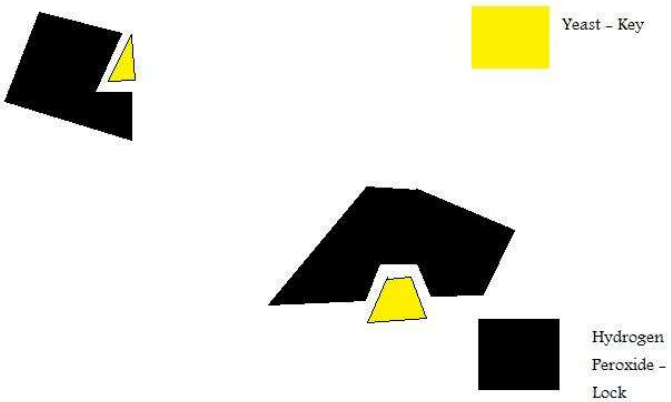
Method

- Clear work surface of any un-needed equipment e.g. bags and chairs.
- Make sure you are wearing safety goggles on at all times.
- Weigh out 0.2g of yeast and dissolve it in 2ml of water and stir until all of the yeast is dissolved. This will enable us to react the same surface area of yeast every time.
- Pour the dissolved yeast into the test tube
- Make sure that the bung you have chosen to use fit nicely into the test tube so it will not let any oxygen escape.
- Measure out 2ml of 5% hydrogen peroxide and add to the yeast in the test tube. Quickly place the bung in the top of the test tube so that no oxygen produced by the start of the reaction escapes.
- Take record of the amount of oxygen produced every 10 seconds until the reaction has stopped.
- Repeat each percentage 3 times so that we can take the average, therefore the results will be more accurate and reduce the risk of obtaining any outliers.
- Once you have taken all of the results for all 4 percentages of hydrogen you can then check the results tables for any outliers. You can also see if there are any changes with the different percentages of hydrogen.

Key Science

Enzymes speed up reactions, they are made of proteins. Enzymes require a lock and key system, this means that each enzyme will react only once with the hydrogen peroxide.

When enzymes heat up they travel faster, this will increase the chance of them colliding with each other. Howev er if they heat up too much this will change the shape of the active site, meaning that there will now not be the correct shaped catalase to react with the new shape of the hydrogen peroxide.



Each enzyme has its own key and lock system and therefore will only react once.

There are variables with this experiment, one of them being the percentage of hydrogen peroxide. This will allow us to see if the different percentages have different effects on the reaction. Another variable is the amount of yeas t used, this is important in order to keep a fair test throughout the experiment. If you change the amount of yeast being used this will either reduce or increase the chance of the yeast (catalase) finding the correct substrate (hydrogen peroxide). Also the amount of water that the yeast is dissolved in will affect the experiment as there will be excess water in the experiment so there will be less chance of the yeast reacting. The independent variable in this experiment is the percentage of the hydrogen peroxide. The dependent variable is the amount of oxygen produced. Some of the control variables of this experiment are: amount of water used to dissolve the yeast in, hydrogen peroxide concentration, amount of peroxide used in the experiment, amount of air in the measuring tube before the experiment and the surface area of the yeast used in the reaction.

After the preliminary results I realised that the experiment wasn't correct as the amount of O2 produced was only reaching 3/4. I realised that I was dissolving the yeast in too much water and then decided to come down from 5ml to 2ml. This then had an effect on the experiment with results reaching an average of 7 after the first 10 seconds.

I observed during the preliminary experiment that the higher the concentration of the peroxide the quicker the rate of the reaction, this is because there is more hydrogen peroxide for the yeast to react with. I also observed that if you use too much water to dissolve the yeast in the rate of the reactio n slows down considerably. After I changed the amount of water you can now see the difference between the two experiments when it is at its fastest 10 seconds.

	A	B	C
1	Percantage of Peroxid	Preliminary results (after 10 secs average)	Main Results (after 10 secs average)
2	5%	3	7
3	10%	8	13
4	15%	17	25
5	20%	21	35

My graph shows that between 0-10 seconds the reaction was at its fastest point. This is shown by how steep the lines for 5, 10, 15 & 20% peroxide all are. Between 10 -20 seconds the reaction starts to slow down but is still producing O2 reasonably fast. After 20 seconds the reaction started to come to a stop, this will have occurred as it woul d be harder to find the matching key and lock between fewer catalase and hydrogen peroxide to collide with each other. The error bars on my graph for 5% are very small as it is easier to get more accurate results; this is because the reaction is slower so you can take more accurate readings. As the percentage of peroxide increased, so did the size of the error bars, this backs up the idea of the results being harder to read as the reaction was faster and harder to read on the measuring tube. Therefore the e rror bars are the biggest during the 20% hydrogen peroxide experiment and smallest during the 5% hydrogen peroxide experiment.

The graph has reading ranging from the smallest of 5% -6 to the smallest of 20% - 31 this shows just how different the two strengths of hydrogen peroxide affect the yeast. The largest reading for 5% and 20% were just as far apart as the largest reading for 5% was only 10, but the largest reading for 20% was 44. However some of the higher error

bars from 15% overlap with the lower error bars from the 20% results, this shows that 15 and 20% had almost the same effect but 20% reacting a little bit more.

I conclude that the higher the concentration of hydrogen peroxide the more reactive it is with the yeast. This is because there is more of the substrate for the catalase to react with, the reaction is more furious but it only lasts for the same time before the reaction stopped. My conclusion also backs up my prediction of that the higher concentration of hydrogen peroxide the more oxygen bubbles are given off. This is backed up by my graph of results.

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