AIM

The aim of the experiment is to determine the effect on the rate of the reaction of the concentrations of the two substances, hydrogen peroxide (the substrate) and the yeast (the enzyme). The rate of reaction is determined by measuring how quickly the oxygen is produced.

INTRODUCTION

Many experiments have been carried out. Most people however tend to prefer the findings of Dr. Brain. Hydrogen peroxide is formed as a by-product in the metabolism of many organisms. It is very toxic and must therefore be removed rapidly from the cells. In living organisms, the enzyme catalase catalyses the decomposition of hydrogen peroxide to produce water and oxygen. Temperature is also a factor affecting the rates of reaction. Dr. Brain (1998)

METHOD

According to Dr. Brain, the tube was filled with water and inverts it in a bowl about ¾ full of water. The open end of the tube was approximately 2 cm below the surface of the water. Secure the tube in a vertical position with a clamp and stand. (It is not essential to fill the tube completely with water, but it makes subsequent processing of the experiment data easier if you do).

A 25cm round bottomed flask is connected to the flexible delivery tube

provided. The flask was secured with a second clamp and stand in such a position that the other end of the flexible tube lies 2-3 cm inside the immersed, open end of the vertical, graduated tube. Record the level of the water meniscus.

A graduated pipette was used to transfer 2.5 cm of well stirred yeast suspension into the 25cm flask.

Use a 10 cm measuring cylinder to measure out a solution containing 1.0cm hydrogen peroxide and 4.0 cm water. Organize yourselves to be ready to make readings on the tube at 10second intervals for 4 minutes then add the total volume of 5.0 cm of hydrogen peroxide solution that you have prepared to the yeast suspension, give it a quick swirl and quickly reconnect the flask to the delivery tube.

Start the stop watch when the first bubble of gas to the top of the tube. This is zero time. Record the level of the water in the tube every 10m seconds for 4 minutes in the appropriate column of the table.

Rinse out the flask, refill the tube and replace it in the stand and repeat steps 2 to 4 four more times adding

2cm3 H2O2 + 3.0 cm3 distilled water

3cm3 H2O2 + 2.0 cm3 distilled water

4cm3 H2O2 + 1.0 cm3 distilled water

5cm3 H2O2 + 0.0 cm3 distilled water

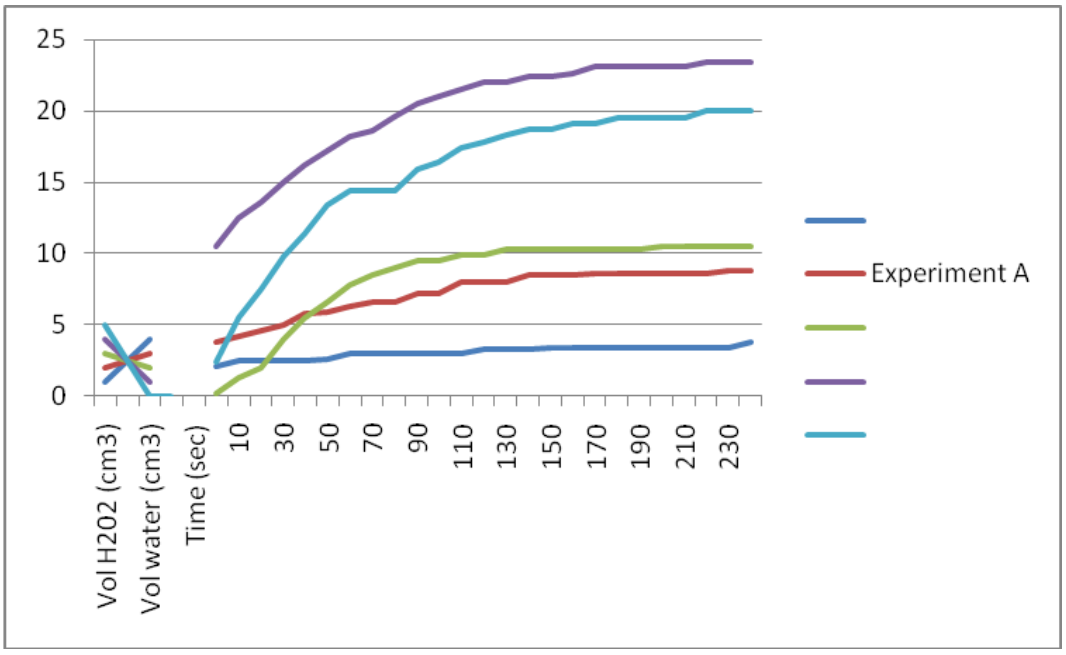
From the measuring cylinder to 2.5 cm3 of yeast suspension, instead of the 1.0 cm3 H2O2 and 4.0 cm3 added in the first run. Everything else must be kept exactly the same in each experiment.

NB: *In experiment A the amount of hydrogen peroxide and water are the ones that are varied while yeast is held constant while in experiment B, the volume of yeast and that of water are the ones that are varied while that of hydrogen peroxide is held constant. Dr. Brain warns (1998).*

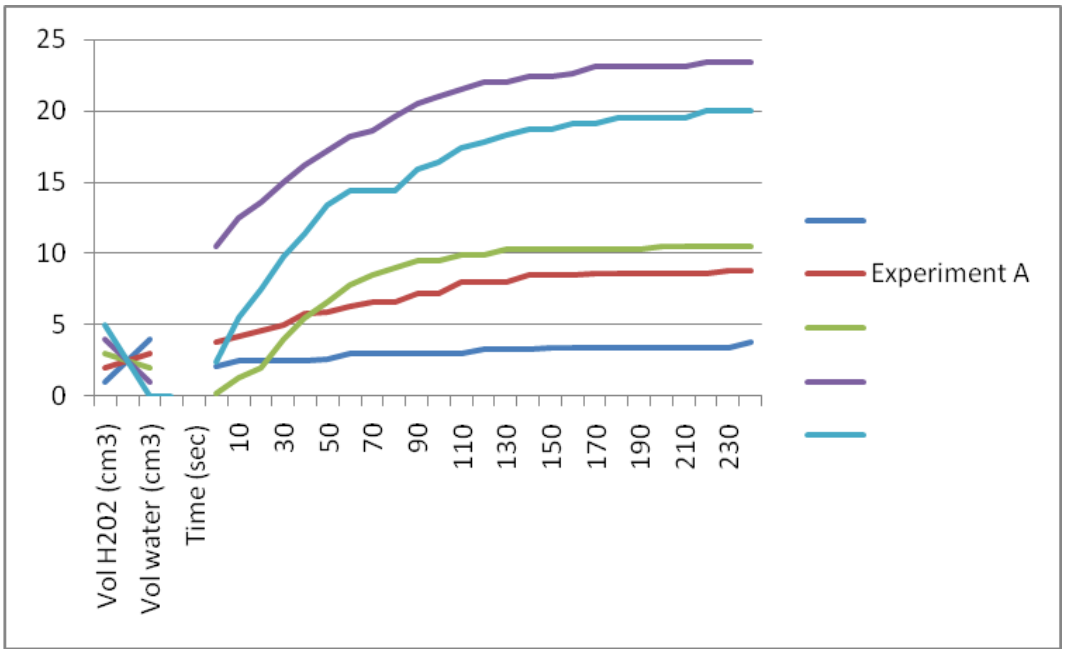
EXPERIMENT A		Experiment A						Experiment B			
Vol H202 (cm3)	1	2	3	4	5		5	5	5	5	5
Vol yeast (cm3)	2.5	2.5	2.5	2.5	2.5		0.5	1	1.5	2	2.5
Vol water (cm3)	4	3	2	1	0		2	1.5	1	0.5	0
					volume of gas 02 evolved						
Time (sec)						time (sec)					
0	2.1	3.8	0.2	10.5	2.4	0	1.7	0.7	0.6	1.1	1.2
10	2.5	4.2	1.3	12.5	5.5	10	2	3.1	1.8	2.6	2.4
20	2.5	4.6	2	13.6	7.5	20	2.5	4.4	3.6	4	3.4
30	2.5	5	4	15	9.8	30	3.3	5.3	5.1	5.7	4.2
40	2.5	5.8	5.5	16.2	11.4	40	3.7	7.1	5.6	6.9	4.2
50	2.6	5.9	6.6	17.2	13.4	50	4.6	8.2	7.1	7.9	5.7
60	3	6.3	7.8	18.2	14.4	60	5.2	9	8.1	8.3	6.1
70	3	6.6	8.5	18.6	14.4	70	6.2	10	9	8.9	6.6
80	3	6.6	9	19.6	14.4	80	6.5	10.4	9.8	9.8	7.1
90	3	7.2	9.5	20.5	15.9	90	7.2	10.9	10.6	10.2	7.1
100	3	7.2	9.5	21	16.4	100	7.9	11.9	11.4	10.7	7.5
110	3	8	9.9	21.5	17.4	110	8.5	12.2	11.9	10.7	7.5
120	3.3	8	9.9	22	17.8	120	8.9	12.4	12.5	11.2	7.8
130	3.3	8	10.3	22	18.3	130	9.3	12.7	13	11.6	8
140	3.3	8.5	10.3	22.4	18.7	140	9.7	13.2	13.4	11.6	8
150	3.4	8.5	10.3	22.4	18.7	150	9.7	13.6	13.8	12	8
160	3.4	8.5	10.3	22.6	19.1	160	10.2	13.9	14.5	12	8
170	3.4	8.6	10.3	23.1	19.1	170	10.6	13.9	14.9	12	8
180	3.4	8.6	10.3	23.1	19.5	180	11.1	14.3	14.9	12	8.2
190	3.4	8.6	10.3	23.1	19.5	190	11.5	14.3	15.3	12.4	8.2
200	3.4	8.6	10.5	23.1	19.5	200	11.5	14.6	15.7	12.4	8.2
210	3.4	8.6	10.5	23.1	19.5	210	11.9	14.6	15.7	12.4	8.2
220	3.4	8.6	10.5	23.4	20	220	11.9	14.6	16.2	12.4	8.2
230	3.4	8.8	10.5	23.4	20	230	12.3	15	16.6	12.8	8.2
240	3.8	8.8	10.5	23.4	20	240	12.7	15	16.6	12.8	8.6
time	1.4										
tempreture (0c)	23										

OBSERVATION

A graph was plotted on excel of the volume of gas evolved (vertical axis) against time (horizontal axis) for each experiment. Plot all the results for experiment A on one graph and all the results for experiment B on a second graph, both with the same scales. You should end up with one graph with five lines for varying concentrations of yeast and one graph with five lines for varying concentrations of hydrogen peroxide.



A tangent was drawn tangent to each curve at t=0 and measure the gradient in each case. These gradients represent the initial rates of the reactions; the rate at the start. Find out how initial rates of reaction vary with the starting concentration of hydrogen peroxide or yeast. Determine this out by plotting two graphs of tangent gradients (vertical axis) against H202 or yeast concentration (horizontal axis). Since the volume of the reacting mixture is the same (7.5cm3) in all experiments, the concentrations are all proportional to the volume of yeast suspension or hydrogen peroxide used.



Then you determine the order of the reaction with respect to yeast and H2O.

From experiment A, we denote that the amount of gas evolved first rises up steadily as different amounts of water and hydrogen peroxide are added. This is the case as the amount of gas produced rises steadily due to the decomposition of hydrogen peroxide rapidl. The gas produced is oxygen and the yeast is used as a catalyst. As time increases, the same pattern is observed and it maintains that way throughout the experiment. Robbins (2004).

From experiment B, the amount of gas produced exhibits a different behavior unlike the one seen in experiment A. The amount of gas produced first rises up steadily and then it unsteadily goes down as different amount of water and yeast are produced. This is because the hydrogen peroxide used is constant and therefore the decomposition of hydrogen peroxide is rapid at first hence the high production of oxygen at first but as the process continues the hydrogen peroxide remaining is little hence this explains why the steady fall of gas produced as the reaction is not rapid as when the hydrogen peroxide was still in large quantities.

Temperature – "As temperature increases, molecules move faster (kinetic theory). In an enzyme catalyzed reaction, such as the decomposition of hydrogen peroxide, this increases the rate at which the enzyme and substrate molecules meet and therefore the rate at which the products are formed." Little (2002). He further found out that, "As the temperature continues to rise, however, the hydrogen and ionic bonds, which hold the enzyme molecules in shape, are broken."

pH - Any change in pH affects the ionic and hydrogen bonding in an enzyme and so alters i shape. Each enzyme has an optimum pH at which its active site best fit.

ACCURACY

In order to make the investigation go to plan measurements should be as accurate as I can be so it must be measured to the correct measuring size. First, the volume should be measured in cm3 and measure the amount of potato in grams and then use it in the experiment. It would also be proffered to carry out the experiment at least 3 times to check for consistency after which average the results.

ERRORS

Errors came up due to the fact that the experiment was carried out the experiment once. If it were to be carried out again, then it could be possible to know where to adjust. It would be referred to as well use different and varied values to come up with more accurate results.