Celina Campo Biology IB

The Effect of Substrate Concentration on the activity of the Enzyme Catalase

Aim: Examine how the concentration of hydrogen peroxide affects the rate of reaction of the enzyme catalase.

Hypothesis:

I believe that as the concentration of the substrate i ncreases, the rate of reaction will also increase. However the reaction will stop when the solution is saturated with the substrate hydrogen peroxide.

Background:

Enzyme Catalase, are protein molecules found in all living cells. This type of enzyme is found in foods such as potatoe. Enzymes are natural catalyzers, and they are used to speed up reactions and are specific because each one performs one type of reaction.

This experiment will show how this enzyme breakdown the hydrogen peroxide molecule by speeding up the decomposition of it into water and oxygen.

Equation of this experiment:

$$\text{Hydrogen Peroxide} \xrightarrow{\text{Catalase}} \text{Water + Oxygen}$$

$$2H_2O_2 \xrightarrow{\text{Catalase}} 2H_2O + O$$

Variables

- Independent variable: **A**mount of enzymes
- Dependant variable: Is the amount of hydrogen peroxide used and the materials such as test tubes and measuring cylinders.
- Controlled variable: Temperature

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Materials:

- Yeast Catalase
- Hydrogen Peroxide
- Test tubes
- Beakers
- Test tube rack
- Stop watch
- Pipette
- Distilled Water
- Pipette filler
- Gas syringe
- Stand

Method:

1. Add 100% of hydrogen peroxide into the beaker. Connect this, to the gas syringe and measure the volume of oxygen produced every 30 seconds.

2. Every 30 seconds shake the beaker twice and then clean it.

3. Add 80% of hydrogen peroxide and 20% of distilled water into the beaker. Repeat instruction number 1.

4. Follow these instructions with 60% of hydrogen peroxide and 40% of distilled water. Finally with 40% of hydrogen peroxide and 60% of distilled water.

Table:

100%

30 60 90 120

AM	8	65	65	79
JM	36	55	52	65
VC	20	31	40	47
Nico	15	35	47	82
Ch	10	30	30	26
Average	18	43	47	60

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80%

	30	60	90	120
AM	12	55	62	78
JM	12	25	32	39
VC	38	51	71	83
Nico	10	23	30	32
Ch	15	30	52	38
Average	17	37	49	54

60%

	30	60	90	120
AM	14	49	60	70
JM	1	12	18	22
VC	9	12	16	20
Nico	15	28	35	40
Ch	5	25	37	42
Average	8.8	25	33	39

40%

	30	60	90	120
AM	7	14	40	44
JM	4	10	22	30
VC	11	22	51	60
Nico	22	40	52	57
Ch	22	40	46	50
Average	13	25	42	48

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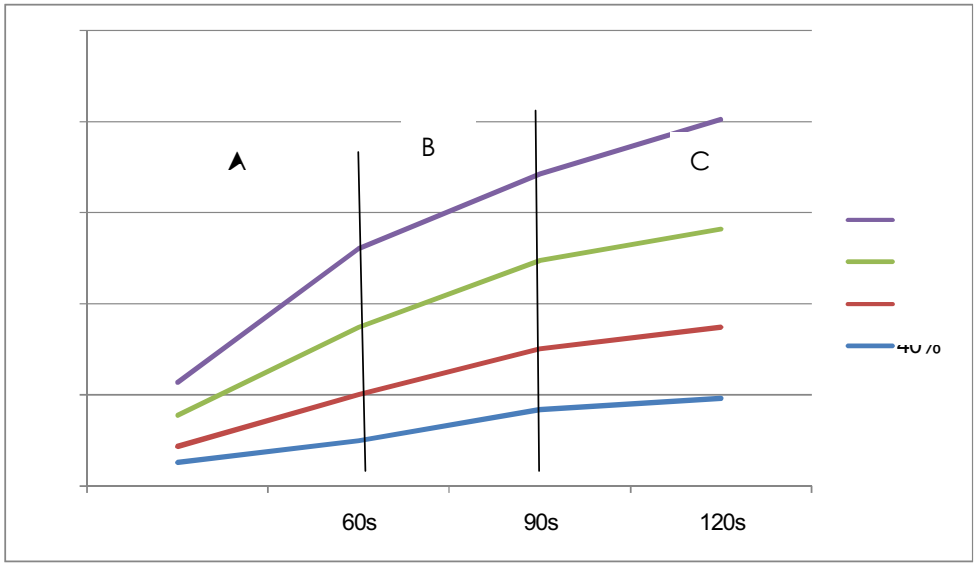
Graph:



Conclusion:

Our aim was completed, as we could examine how the concentration of hydrogen peroxide affects the rate of reaction of the enzyme catalase. The rate of reaction is increased until the con centration of hydrogen peroxide is saturated at 90s. The rate will increase proportional to the increase in concentration of hydrogen peroxide, for example if the rate of reaction is increased two times, the concentration of it will be also doubled. This i s because there is twice of substrate molecules which can join with the active site of the enzymes.

The graph presented above shows four different concentrations of hydrogen peroxide. All of them have the same direction. However, the four of them have different gradients which present the available substrate to join within the active site of the enzyme. This graph can be separated into three main sections: A, B and C. These sections represent what is happening to the substrate in terms of reaction with the active site. In section A, the graph presents the first stage of this experiment, where there are many substrate and many enzymes working at 100% of potential. The reaction is the fastest compared to the other two sections. Section B, there still reaction between them, however it slowed down. Section C, starts at the 90 seconds. I already mentioned that at this period of time the hydrogen peroxide becomes

saturated. By watching the graph, we can say that the rate of reaction takes more time to occur.

The independent variable, amount of enzymes, was different to the dependant, which was the amount of hydrogen. This was done so, to see the difference between them at the end of the experiment. These differences, has shown us that the more substrate in the rea ction, the more product that will be produce.

To reduce errors and obtain more accurate results, we maintained the independent variable always constant. Repetition means, reduce of errors. Therefore we should have repeated the experiment three times approximateley. However, there are some errors which, need to take into account. For example, our reaction in order, to start and stop the stopwatch in the correct time.