

Science Coursework – An Investigation to Show the Effects of changing temperature in Yeast Respiration.

Brief

Investigate one of the variables that effect respiration in yeast.

Background Knowledge

Yeast is one of the various single celled fungi that form masses of miniature circular or oval cells by budding. When placed in sugar solution the cells multiply and convert the sugar solution into alcohol and carbon dioxide. Yeasts are used as fermenting agents in baking, brewing and the making of wine and spirits. Brewers yeast is a rich source of vitamin B.

Respiration in yeast is the production of the energy in the mitochondria of the cells. There are 2 types of respiration, Anaerobic and aerobic. At first aerobic respiration will be present but only until the oxygen that is already dissolved in the water. When the oxygen is used up anaerobic respiration will be present which produces the alcohol. The word equation for anaerobic respiration in yeast is:



Anaerobic respiration is different in humans than it is in yeast because we break down glucose into lactic acid whereas yeast breaks it down into alcohol.

Input Variables

There are several different variables in this experiment such as:

The temperature of the water
Amount of Water
Amount of Yeast
Amount of sugar
The time it is left for

In this experiment I will be changing the temperature of the water.

Prediction

I predict that the hotter the water is the more carbon dioxide bubbles will be produced because the hot water will produce more kinetic energy so it increases the chance of collision. If we heat the sugar solution too much then the enzyme will change shape and it will become impossible for it to join with the sugar to form a complex. This is called denaturing the enzyme, I predict that this will happen at 70 – 80 C.

Plan

First I will set up the apparatus as show above. I will add 1.5 grams of sugar to 25ml of water and dissolve it. When we have the water at the correct temperature I will add the same amount of yeast to the sugar solution. When the water is at the correct temperature I will let it stand for 5 minutes. The first test I am going to do will be at normal tap temperature (20 C). I am going to increase the temperature by 15 C each time until I get to 80 C. I will measure the amount of respiration by counting the carbon dioxide bubbles entering the second test tube.

Fair Test

To keep this investigation fair I am going to:

- Keep the amount of sugar and yeast the same throughout the investigation
- Keep the amount of water the same throughout the investigation
- Let the solution stand for the same amount of time each time, five minutes
- Add the yeast only when the sugar solution is at the correct temperature

Safety

This investigation isn't very dangerous; I will only have to be careful when handling the hot water.

Analysis

From my results you can see that the yeast reacts better between 35-50 C. This is because at 20 C the water was too cold to give the enzyme any energy. At 65 C there was not much reaction, I recorded an average of 2.5 bubbles of carbon dioxide. This was because the water was too hot and when the water is too hot the enzyme deforms and changes shape as shown in my prediction diagram. It gave off a few carbon dioxide bubbles at the beginning before it changed shape so maybe at 50 – 60 C the yeast will react better as it didn't change shape straight away. At 80 C the water was far too hot, this would have changed the shape of the yeast straight away. I know this because we only counted one carbon dioxide bubble for the whole of the experiment.

Quality of Results

I think that my results were precise. I know this because I measured the yeast and sugar with electronic scales. The water was an accurate measurement as well as I used a measuring cylinder to measure it. Another measurement that was accurate was the temperature of the water as we used a thermometer so I knew when to add the yeast. The final results were another accurate measurement as I completed the same test three times.

Was It A Fair Test?

This test was fair because:

- I used the same amount of yeast for each test
- I used the same amount of water for each test
- I counted the bubbles for the same period of time each test.

The only thing that wasn't fair about the test was that I had to use different types of yeast. For the first and second tests I used yeast that was in small balls (not ground) and for the third test I used a powdered yeast but was still the same brand. I don't think this changed the outcome of my results much as we got similar results for the first, second and third test. The only difference that may have been was that the ground yeast started to respire earlier as it was smaller, therefore easier to dissolve! Another reason that could have made my test unfair was that when the yeast was first added it was dormant and dehydrated. I had to wait for it to start to respire, but this was the case in all the tests so in a way it was fair.

Accuracy of Measurements

All of my measurements were accurate. This was because I used an electronic set of scales to weigh the yeast and the sugar. Another reason why my test was accurate was that we used a thermometer to check the temperature that is an accurate means of measuring heat. It would have been even more accurate if we used an electronic thermometer.

Improvements to Plan

The only major improvement that I think would have been useful would be to increase the temperature by only 5 C each time instead of 15 C. This would help us to get a more accurate measurement of when the yeast respire best. If I had more time I would have done this and would have been able to find the optimum temperature for the yeast. Another improvement would have been to measure the amount of carbon dioxide given off instead of counting the bubbles. This would have been a good improvement as bubble sizes change, they are never the same size.