Investigation to Find the Optimum Rate of Anaerobic Respiration in Yeast

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Plan

I plan to find the optimum rate of anaerobic respiration in yeast by setting up an experiment where the yeast is heated in a glucose solution. When the yeast is heated it gives off gas so I will measure the amount of gas given off for my results.

I plan to do my experiment safely by firstly wearing safety goggles. When using the apparatus I will use a heat proof and leave the Bunsen burner on the safety flame when I am not using it.

I will make my experiment a fair test by keeping the following variables the same: the volume of water in the water bath, the amount of yeast and the volume of glucose solution used in the heated solution and the time the solution is left in the water bath.

I predict that as the temperature of the solution is increased the collision rate of enzymes will increase with the substrate until it reaches its optimum temperature, which is when the denaturing will start to take place. I think the optimum temperature will be 45°C, as most enzymes will stop working above the temperature. I found this out by doing preliminary research which states that 'Enzymes are proteins that control chemical reactions in living things. Temperatures below 0°C and above 40°C destroy proteins and reduce enzymes activity' (Source: Key Science Biology by David Applin pg. 174). So I have predicted that a temperature just above this will be its optimum rate before the enzymes begin denaturing

The apparatus that I will be using in this experiment are:

- Heat Proof Mat
- Tripod
- Bunsen Burner
- Gauze
- Beaker
- Boiling Tube
- Thermometer
- Delivery Tube with Bong
- Basin
- Measuring Cylinder
- Water
- Yeast Solution
- Glucose Solution

Diagram

When I do the experiment the variables I will not be changing are the volume of water in the water bath, the time the boiling tube is left in the water bath and the amount of yeast and glucose solution in the boiling tube. The variable I will be changing is the temperature that the solution is heated to.

I will be taking results at different temperatures these temperatures are 20°C, 30°C, 45°C, 60°C and 90°C. I will take each observation over 5 minutes recording how many bubbles are produced, and then I will find the average bubbles per minute.

Analysis

In my experiment I followed all the safety guidance's as I had laid out in my plan. From my results I can see that I have achieved enough results to give a reasonable answer the question.

My Results

Temperature (°C)	Bubbles After 5 min
20°C	0
30°C	13
45°C	44
60°C	31
90°C	12

Averages

Temperature (°C)	Bubbles per Minute
20°C	0
30°C	2.6
45°C	8.8
60°C	6.2
90°C	2.4

I do think my results are reliable, as we had done preliminary practise experiments in which we could correct any mistakes we were making. If I could do the experiment again I would change the range of results slightly I would do a broad range at first, then followed by a narrower range nearer to where it looks like the optimum temperature would be. But for what I have done I think there is enough results to make a valid statement.

Conclusion

From my results I can see the optimum temperature for anaerobic respiration in yeast is indeed around the 45°C mark.

So as you can see from the graph the denaturing starts to take place at around 45°C and so the respiration of the yeast slows down until it eventually stops. My prediction that I made was correct, but as I have said if I had done all my recordings around the 40°C-50°C mark then it might be a couple degrees out. I think my prediction was very narrow by stating the one temperature rather than a range of temperatures. Because I had done a recording on that temperature and it was the highest it makes it look perfectly right but if I had taken that smaller range around that temperature as I have said I could be a couple of degrees out.

Evaluation

Overall I think my experiment went really well but smaller changes could have been made which would make the results and the experiment more accurate. My results were quite good but probably not the best I could of achieved. The first set of the ones taken at 20°C could have been better, but as they were the first real ones we did something was bound to go wrong. Overall our results are pretty reliable as they stick to the right pattern. I don't think we got any very unusual results but , as I said the first set was slightly odd in that no bubbles were produced. I think this was because we had the delivery tube at a funny angle and so the gas was unable to get out.

If I was to do the experiment again I would make several changes. These would be to set up the equipment very accurately to get the best results possible. Also to make both and wide and narrow range of results to find an accurate optimum temperature. I think those would be the only things major I would change as I was quite pleased with everything else.