

Experiment to determine the effect of temperature on the permeability of a cell membrane .

Implementing

Safety.

To carry out the experiment fairly it was compulsory to ensure that the beetroot was diced into precisely one centimetre cubed segments. To obtain these segments we had to bore into the beetroot to obtain a cylinder shape with a constant diameter, to be sure that the borer couldn't harm us it was necessary to hold the beetroot securely making sure that your hand wasn't in the path of the borer, it was also important to screw the borer away from your body. The long cylinder had to then be dice using a sharp scalpel that caused less damage to the membranes, however it may have been dangerous if a person did not apply their full concentration when using. Users must be careful concerning how the scalpel was held and used.

Water baths were used to determine the effect of temperature on the permeability of the membrane; the water baths were set at varying temperature up to 61 degrees C the higher temperature may have been painful if splashed on the skin therefore it was essential to take care when placing the test tubes in to the baths.

There were very little risks of serious injury, any accidents which may of occurred would have been down to lack of concentration on their parts.

Results-

<u>Temperature oc</u>	<u>Test tube 1 % of light absorbed</u>	<u>Test tube 2 % of light absorbed</u>	<u>Average % of light absorbed</u>
2 (Ice)	1	0	0.5
31	1	0	0.5
40	2	4	3
52	5	1	3
61	2	6	4

Precautions taken.

To ensure that the experiment was as reliable as possible, there were many precautions taken, Such as controlling the many variables. It was important to monitor that the water baths were a constant temperature; otherwise the result for a certain temperature wouldn't have been accurate. Other measurements must have been taken accurately; such as the amount of distilled water used (10 Cm²) if the amount was higher than others the concentration would have been lower in the tubes with more water. The segments of beetroot were measured and cut accurately otherwise the larger cubes would contain more pigment meaning the concentration would be higher in tubes containing larger cubes.

Other factors which were monitored to ensure the reliability were things such as making sure the colorimeter was reset after each use, the same beetroot was used and the segments were placed in the test tubes at the same time taken out at precisely 5 minutes after, making sure it was not touched while extracting it. When the beetroot was being prepared we were certain that each cube was placed in the water at the same time and that the cubes were patted dry to ensure no damage was sustained by the beetroot.

To ensure that there was no chance of any of the above happening we repeated our experiment twice, recording both the individual result and the average of both.

Some but few changes were made to the original method, these changes were either made to ensure a fair test or to help experiment run more efficiently, but didn't exceed time limitations. Firstly we had to change our results so that we had a wide spectrum to analyse later, the temperatures we chose had to be set considering the optimum temperature. If we set the temperatures at above..... Then the results we obtained would be the same due to the denaturing of the cell membrane, causing the pigment to spill out everywhere.

In order for the experiment to be efficient, and not time consuming. We decided to stagger each experiment by five minutes, when the first tube had been in the water bath for five minutes it was extracted, and the next tube was ready to be placed in the ascending water bath. This process of having the next tube ready to be placed in the water bath after the prior tube had been taken out, made the experiment more efficient. Also it gave a larger turn over of results as two test tubes could be done at the same temperature at the same time, without causing mass confusion

Analysing and concluding

Interpreting data.

The graphs I have drawn shows some conflicting results between the results of test tube one and test tube two. Although both graphs did not increase until 40°C, when the results do increase test tube two increases more vigorously. At 40°C on graph one the percentage of absorbed is 2% whereas the percentage of light absorbed in test tube two was 4%. However the rise in light absorbed didn't continue to increase as by 50°C the percentage fell to 2% again then by 61°C had increased up to 6% absorbed. On the other hand the results of test tube one continued to increase from 40 to 52°C up to 5% then by 61°C fell to 2% of light absorbed.

However the graph that showed the average % of light absorbed had a positive correlation through out, although it does level out at some points. For example from 2 to 31°C the percentage stays at 0.5 percent. The final graph compares all three sets of results that were obtained and shows the differences between the results of test tube one and two.

Further calculations

Concluding

I conclude that increasing the temperature increases the permeability of the membrane, allowing more pigment to be released into the distilled water. See graph 3. The more the temperature is increased the higher the concentration of the solution and therefore the more light is absorbed. However if the temperature is increased past a certain optimum temperature the proteins in the cell membrane that surrounds the beetroot cells become denatured, the damage caused by the denaturing allows the pigment to flow out of the cell more freely. Therefore if the cell membrane became denatured the percentage of light absorbed would increase. If complete denaturing occurred to all the beetroot cells the percentage of light absorption would be the same for all the pieces of beetroot

Anomalous results

There are two results that I am concerned about, the first is on the graph showing absorption of light in test tube one. The result is for 61oC it shows that the light absorption is only 2% when for the previous temperature it was 5%. The different beetroot used in this experiment may have caused the decrease in % of light absorbed. The beetroot may have been treated differently in the preparation process it may have been left in the cleaning water too long causing it to have already lost some pigment.

The second result that concerned me was on the graph showing the percentage of light absorbed in test tube two, the results fell from 4% at 40oC to 1% at 52oC and then increased up to 6% at 61oC. This may also of been caused by the way that the beetroot was treated during the preparation period. Although it could have been caused by faulty equipment such as the colourimeter not being as accurate as possible causing our rough results.

Evaluating evidence and procedures

Limitations

There were few limitations of the apparatus or the method; however there were some factors that may of affected the accuracy of our experiment. Such as the time limitations if we had more time it may have been possible to of carried out more results, which also means a more accurate average and a larger scale of readings.

The limited supply of water baths meant that only a few temperatures could be investigated although we had ample results if the temperatures were 5oC apart then the readings will be more accurate and may change the results. The change in results would be caused by the less spaced out temperatures pin pointing the optimum areas:

E.g. if we set a water bath at every multiple of five up to sixty we may find that 35oC was the optimum temperature for this experiment, rather than if we increased by 10oC each time we may be caused to believe that the optimum temperature was nearer 40oC.

Also the temperature of the water baths were not set entirely accurately, which may have a similar affect as the one stated earlier. This may cause us to miss a vital reading.

The method we used slightly impaired our ability to carry out more than two repeats at once, if we had been more organised and worked as a larger group more repeats may have been done. Therefore boosting the amount of individual results and also making our average more accurate.

The Individuality of the beetroot may have caused our results to be different from other peoples in the class. Just like humans have different amounts of pigment in their skin so do beetroot, our specific beetroot may have contained less pigment. Therefore causing the % of light absorbed to be lower.

Effect of limitations

I don't believe that these limitations will have a great affect on the over all results of our experiment, due to the fact that the results we have obtained from the original and repeat were very similar in most cases. Although there are some anomalous results, this does not seem to have affected the average as it still increases with the increase of the temperature. Which would have been expected due to the temperature increasing the permeability of the beetroot cell membrane allowing more pigment to pass through. The wider range of temperatures would have enabled us to pin point the temperature at which the cell membrane becomes denatured, which would of made the experiment more accurate, however this didn't affect our experiment a lot because we were investigating the effect of temperature on a cell membrane which can be clearly seen by our results. The reliability of our apparatus didn't affect us either because the result increase as we would of expected. The accuracy of our results could be tested against other groups or against other repeats.