

How the Mass of Plant Tissue is Affected by a Range of Water Concentrations

I will make my investigation fair test by making sure that only the independent variable which is the water concentration changes. There are several control variables which I must ensure I keep the same:

- Light
- Temperature
- Oxygen level in the water
- Carbon dioxide level in the water
- Size and type of chip

I will make sure these remain the same throughout the experiment by:

~~Light~~: I will carry out the experiment in the same place in the room.

~~Temperature~~: I will carry out the experiment in the same position in the room.

~~Oxygen level in the water and carbon dioxide level in the water~~: These are not likely to change much, but I will get the water from the same source.

~~Size and type of chip~~: I will cut the chips all to the same size and get them from the same source.

Prediction

I predict that the lower the concentration of water that is in the test tube, the more mass the potato chip will lose.

Reasons for Prediction

I think that that the end mass will be higher when there is a higher concentration of water because the plant tissue will take in more water. Therefore the more water in the tissue the higher the mass will be.

The plant tissue will absorb the water through a process called Osmosis. Osmosis is the movement of water molecules from an area of high concentration to an area on low concentration through a partially permeable membrane. Osmosis does not need any energy because the water molecules can easily fit through the membrane. Osmosis will enable the plant tissue to take in water as there will be a lower concentration inside the cells than outside.

When there is a lower concentration of water in the test tube than inside the plant tissue cells I predict that the mass of the potato chip will stay the same or decrease because osmosis will move the water molecules from the chip and into the water. If the concentration of water is the same inside and outside the plant tissue this would not require the natural process of osmosis.

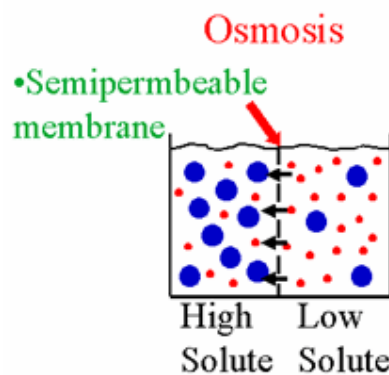


Diagram of osmosis from
www.soo.in/2808

How I will Collect the Evidence

For the plant tissue I will be using potato chips because potatoes are cheap, easy to obtain and have a semi-permeable membrane. I will use a cork borer and a scalpel to cut them all to a uniformed size of 5 cm. I will cut 5 of these chips as I will be taking 5 readings.

I will then measure and record the mass and of each chip using a weigh machine. This will be my 'Starting Mass'.

I will then place each of these chips into a test tube with different amounts of concentrations of sodium chloride. (0.0%, 0.05 M, 0.1 M, 0.2 M, 0.3 M) I will then label the test tubes appropriately with the according molars of sodium chloride.

I will leave these tubes for 5 days. After 5 days have passed I will remove the chips from the test tube and dry them on a paper towel to remove excess liquid. Then I will place them individually once again on the weighing machine and record their mass. This will be my 'End Mass'.

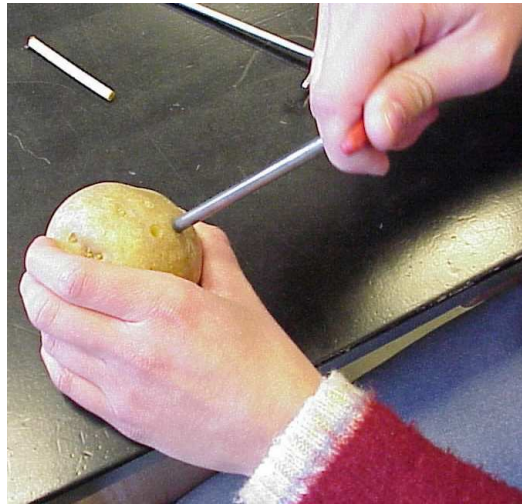
I will be using an electronic weighing machine to make sure the results are as accurate as possible. I will be recording the mass using 2 decimal places to make the results more precise.

I will then take the starting mass and subtract it from the ending mass. I will then divide this total by the starting mass. These are the figures I will be comparing and plotting on my graphs. As the number is very small I will be multiplying them all by 100 to make then more manageable.

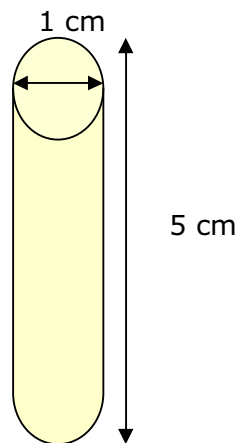
From earlier work I have learned to handle the potato chips with more care as they can split easily therefore I will be using tweezers. Secondly, I learned to label the test tubes better and more clearly so as not to get the samples mixed up.

Apparatus I will be using:

- 5 test tubes
- Cork borer
- Electronic weighing scale
- Knife
- Ruler
- Paper towels



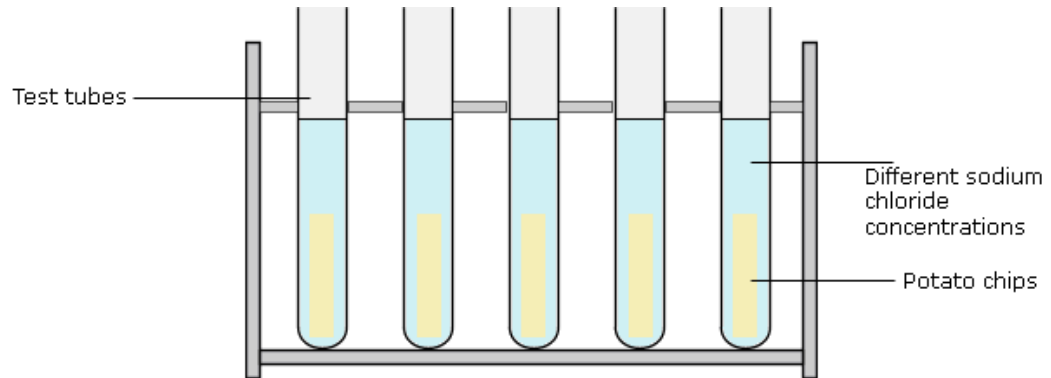
How I will cut the potato into chips
(Picture from www.eve.kean.edu/~breid/plantlab2/potato1.jpg)



How the potato chips will look

Biology Coursework
Osmosis

Below is a diagram of how my investigation will be set up:



Result Tables

Attempt 1

Concentration of Sodium Chloride (molar)	Starting Mass (g)	End Mass (g)	Difference in Mass (g)	<u>Start-End Startmass</u> X100
0.0	3.73	4.15	-0.42	-11.3
0.05	3.98	4.46	-0.48	-12.1
0.1	3.94	4.30	-0.36	-9.1
0.2	3.85	4.13	-0.28	-7.3
0.3	3.63	3.78	-0.15	-4.1

Attempt 2

Concentration of Sodium Chloride (molar)	Starting Mass (g)	End Mass (g)	Difference in Mass (g)	<u>Start-End Startmass</u> X100
0.0	3.92	4.35	-0.43	-11.0
0.05	4.04	4.39	-0.35	-16.1
0.1	3.95	4.09	-0.14	-3.5
0.2	3.85	3.23	0.62	16.1
0.3	3.98	3.13	0.85	21.4

Analysis

After the 5 days had passed and I removed the potatoes chips I noticed some had changed in texture, some looked slightly bulkier, some looks slighter smaller and some had stayed the same.

In my first attempt the chip consistently gained mass I in all the concentrations were as in theory the chips in the concentrations 0.1, 0.2 and 0.3 should have lost mass as the concentration of water was lower outside the cells. But the difference in mass did decrease as the concentrations of sodium chloride increased. This does not totally follow with my prediction but it has the same trend as the 2nd attempt which does follow with the theory.

From my 2nd set of results I can tell as the concentration of sodium chloride increases the mass decreases. I can also undeniably say osmosis has occurred as the chip in the pure water test tube has definitely increased in mass. This shows that the cells inside the chip have absorbed water and that the concentration of water was lower inside the chip then outside.

There also seems to be a concentration value where anything below it will gain mass due to there being I higher concentration of water outside the cells then inside. Above this concentration value, the chip will lose mass because the water will diffuse out of the plant cells. If the concentration is exactly on this value it will mean that there is the same concentration of water inside and outside the cells.

How my results compare to my prediction

My results do agree with my prediction I made. The chips in the 2nd attempt lose more mass when they are in a higher concentration of sodium chloride, however as I have said in my analysis, in my first attempt the chips all gain mass which does not follow the statement I wrote in my prediction.

Evaluation

I believe my sets of results are reliable because I have controlled all the variables that could effect the investigation.

However, I believe there are some areas where it could have been improved.

Firstly, I feel it would have been more reliable if I took both readings from the same potato instead of two different potatoes. Also, by leaving the potato chips in the test tubes longer, say 7 days instead of 5.

I did get a single anomaly on both readings that I have circled on my graph. There are many reasons why this could have happened. Firstly, on the first reading, one of the chips split inside the test tube. This would have increased the potatoes surface area. Also, when it came to weigh this chip there were a few potato flakes at the bottom of the tube which I could not weigh. The concentrations could also be incorrect at the beginning when we were given them.

Apart from these anomalies the graphs from the two readings look very similar with the line of best fit both going in the same direction.

Secondly, I believe I could have improved the precision of the investigation by using 3 or 4 decimal places instead of 1 while weighing.

Thirdly, I could have improved the accuracy by doing the experiment more than twice. This would have made my results closer to the 'true' mean.

Also, I think I did not control the variable of temperature as well as I could as the temperature was susceptible to changes in the weather and heating in the room.

Further Work

I feel that further work would give me additional relevant evidence.

Firstly, in both of my graphs the second point (0.05 molar) and the third point (0.1 molar) is gaining mass instead of losing it and does not follow the pattern. I think I would like more closely in this area to see what is causing.

I would also like to try higher concentrations than 0.3 and see if the line of best fit carries on being smooth or peaks at a certain concentration.

Lastly, I would like to try recording the mass every hour for a day and see if the graph has the same shape.

Conclusion

Overall, I think that I effectively achieved my aim. I believe I used my scientific knowledge to explain my results and analyse them. My investigation successfully proves that osmosis is affected by different concentrations of sodium chloride.