

The effect of NaCl solutions on the mass of potatoes

Osmosis is a type of diffusion. It requires a concentration gradient and a semi-permeable membrane and, where the molecules of the solute are too big to pass through the membrane. Instead, the water is going to pass through the membrane in order to equal out the concentration of the solute.

There are three types of solutions:

- Hypertonic solution
 - A solution that has higher osmotic pressure (higher amount of solute) than another solution to which is compared
- Hypotonic solution
 - Refers to any solution which has a lower osmotic (lower amount of solute) pressure than another solution
- Isotonic solution
 - One that has the same solute concentration in both solutions

With the help of this experiment, the best environment for the potatoes will be found. This experiment can be used on other vegetables as well, in order to increase the production of the fields.

Materials used:

- 1L beaker
- 6 40mL test tubes
- 1 100mL measuring cylinder
- Test tube rack
- Salt
- Electronic scale
- Two-Three potatoes
- Scalpel
- Ruler
- Distilled water
- Oil pen
- Paper towels
- Aluminum cover

Procedure:

1. Cut six potato pieces using the scalpel and ruler
 - a. Each piece should be rectangular
 - b. The size should be 5X1X1
2. Mass the six potato pieces
3. Make 6 solutions of NaCl (salt) with different concentrations
 - a. Set up a control group
 - i. 25mL of distilled water in one of the 40mL test tubes
 - ii. Label the test tube using the oil pen
 - b. Measure 45mL of distilled water using the 100 mL measuring cylinder and sip that water in the 1L beaker
 - c. Measure 1g of salt and put in the water in the beaker (2% solution)
 - d. Move the water in the beaker around, so that the salt dissolves faster

- e. After the salt is dissolved, pour it back to the measuring cylinder
 - f. Pour water until 50mL
 - g. Pour 25mL of the water into one of the test tubes
 - h. Label the test tube using the oil pen
 - i. Repeat the steps b-h using 2g, 3g, 4g and 5g of salt (4%, 6%, 8% and 10% solutions respectively)
4. Put one potato piece in each test tube
 5. Cover the top of each test tube with an aluminum cover in order to avoid evaporation
 6. After 24 hours, take out the potato pieces
 7. Gently dry the surface using paper towels
 8. Measure the mass of the potatoes

Variables:

Independent variable: % solution

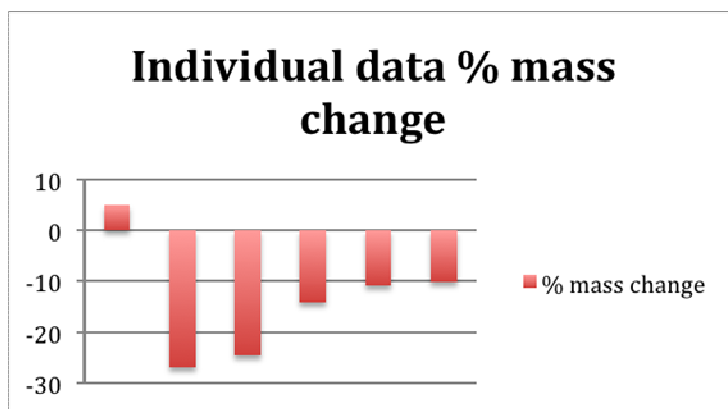
Dependent variable: % mass change

Controlled variable	How?	Why?
Potato piece size and shape	Every potato piece is 5X1X1 cm	The size and the shape of the potato will be big factors because of the surface area and the width of the potato
Temperature	Room temperature	Temperature is the biggest environmental factor, as it changes the speed of movement of molecules
Time	24 hours	If the potato pieces were soaked in water for a different amount of time, then the percent change is going to be different. As well, 24 hours is enough to ensure an effect on the potatoes

Data

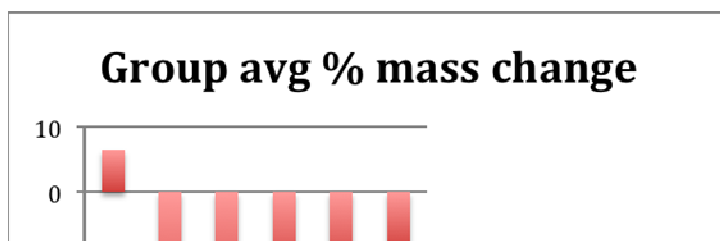
Individual data

NaCl solutions	% mass change
0%	5.04
2%	-27.04
4%	-24.45
6%	-14.1
8%	-10.9
10%	-10.2



Group average

NaCl solutions	avg % mass change
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0%	6.56
2%	-22.20
4%	-18.38
6%	-12.74
8%	-11.81
10%	-9.20

The potatoes gained most mass in 0% solution, and lost most mass in 2% solution. The % mass change decreased with the increase of the % salt solution.

Possible errors and improvements

- Possible errors
 - Potato pieces
 - First of all, not all of the pieces were perfectly rectangular, which could have affected the osmosis rate
 - Secondly, some pieces were not long/wide enough, some of them even had the peel on them
- Improvements
 - Larger and sharper knives could have been used, in order to cut more precisely, or, instead, smaller potato pieces could have been used for the experiment

Conclusion

The data of all individuals followed the same general pattern, where the potatoes gained most mass in 0% solution, and lost most mass in 2% solution. The % mass change decreased with the increase of the % salt solution. This means, that potatoes grow best in hypotonic solutions, and they lose mass in hypertonic solutions. There were not a lot of sources of error, and those possible errors were avoided by several individuals doing the experiment.