Osmosis: potato and blackcurrant squash

Science, Biology

In biology, osmosis Is defined as the diffusion of solvent molecules (usually water molecules) across a semi-permeable membrane from a region of lower solute concentration to a region of higher solute concentration. Osmosis Is of great importance In biological processes where the solvent Is water. The transport of water and other molecules across biological membranes is ssential to many processes In living organisms.

The pressure exerted by the molecules of the solvent on the membrane they pass through is called osmotic pressure. Osmotic pressure is the energy driving osmosis and is important for living organisms because It allows water and nutrients dissolved in water to pass through cell membranes. There are three types of condition that Involves osmosis which Is hypotonic, hypertonic and isotonic. In a hypotonic solution, the water will move into the cell due to the outside of the cell having a lower solute concentration than the inside of the ell.

When an animal cell Is placed In a hypotonic surrounding (lower solute concentration), the water molecules will move into the cell causing the cell to burst and haemolysed. When plant cell Is placed In a hypotonic solution, water molecules diffuse into the cell and the plant cells remain turgid because the cell wall prevents bursting. In a hypertonic solution, water will move outside of the cell due to the outside of the cell is having a higher solute concentration than the Inside of the cell.

When an animal cell, a red blood cells is exposed to a hypertonic surrounding (higher olute concentration) the water will leave the cell causing the cell to shrink and it Is said to undergoes crenation. If a plant cell is placed

in a hypertonic surrounding, the cell wall cannot prevent the cell from losing water as the water moves out from the cells. It results in cell shrinking, plasmolysis occurs (cell becoming flaccid), In an isotonic solution, there is no net movement of water as the interior and exteriorenvironmentof the cell Is having the same solute concentration.

RESEARCH QUESTION: How does the dfferent concentration of blackcurrant squash solution affects the ercentage change in mass of chipped potatoes after being immersed in solution for 15 minutes? HYPOTHESIS: The higher the concentration of blackcurrant squash solution, the lower the concentration of the solution getting bigger, water inside of the cells will move outside the cell and this is called hypertonic. The movement of water diffuse out of the cell causes the size of the potato to decrease and shrinking in size to crenate.

VARIABLES: TYPE OF VARIABLES VARIABLES UNIT WAYS TO CONTROL INDEPENDENT Concentration of blackcurrant squash solution Use different concentration of blackcurrant squash solution which is 0%, 20%, 40%, 0%, and 100%. DEPENDENT Percentage change in mass of chipped potatoes Weigh the potato using a weighing balance to get the initial mass. Then, immersed the potatoes in the different concentration of the solution for 15 minutes. Find the final mass to get the average mass. Calculate the percentage using the formula: XIOO% CONTROLLED 1 . Volume of solution cm3 Use 30 cm3 of solution for each boiling tube measured by measuring cylinder. . Type of potato Use the same type of potato 3. Time taken to immersed the potato in the solution min Fixed the time taken for the potato

to be immersed in the solution as 15 minutes by sing a stopwatch. 4. Temperature Conduct the experiment in the same room using a thermometer. 5. Initial length of the potato chips cm each. Table 1: Table of variables and method to controls it. MATERIALS AND APPARATUS: MATERIALS APPARATUS 1. Blackcurrant squash at a concentration of 556 g dm-3 , 100 cm3 2. Distilled water, 100 crn3 3. Large baking potatoes 1. Boiling tube, 6 2. White tile, 6 3.

Ruler, 1 4. Scalpel, 1 5. Measuring cylinder, 50 cm3 6. Cork borers, 1 7. Weighing balance, 1 Table 2: Table of Materials and Apparatus METHODOLOGY: PROCEDURE: 1. boiling tube is prepared and labelled as A, B, C, D, E and F. 2. 30 cm3 of distilled water is measured using a measuring cylinder and poured into test tube A. For test tube A, volume of blackcurrant squash is O cm3. For the rest of other test tubes, the volume of blackcurrant squash and volume of distilled water is measured as shown in column 4 and 5 in the table respectively using a measuring cylinder. 3.

The potato is cut up using a cork borer making it into small pieces to fit in the boiling tube. The potato skin is cut off and trimmed. 4. The potato chips are dried on a towel paper. . The potato chips are weighed using a weighing balance and the mass is recorded in a table as initial mass. 6. The chips are placed in the blackcurrant squash solution and leave it for 15 minutes. 7. Make sure the solution covered the chips completely so that the process of osmosis can occur efficiently. 8. After 15 minutes, the chips are taken out and dried using a paper towel. 9.

The potato chips are weighed using a weighing balance and the final mass is recorded in a table. 10. The change in mass of potato chips and the percentage change in mass of potato chips are calculated. 11. Steps 2 - 10 are repeated 3 times. 12. The graph of concentration of blackcurrant squash solution against percentage change in mass is plotted.

Graph above shows that as the concentration of the solution increases, the percentage change in mass of the potato will decreases. This is because at the highest concentration, less amount of water is present in the solution than the concentration of the sucrose. Based on the raph above, we can see that the graph of concentration of blackcurrant squash solution against percentages changes in mass is inversely proportional to each other. The percentage change in mass is constant throughout the experiment as the slope or the steepness of the graph wasn't extreme and it decreases in a consistent manner. 3.

At 0%, the percentage change in mass is in a positive value showing a hypotonic condition but as the concentration increases to 20%, 40%, 60%, 80% and 100%, the percentage change in mass has become a negative value. This shows that it is in a hypertonic condition. 4. As we can see on the graph, at 0% the lowest concentration it gives the highest value of percentage change in mass of 7. 60%. In this situation, hypotonic occurs as the concentration of water outside the potato chips is higher than inside the cell. Hypotonic solution is a solution with a lower solute concentration but high water concentration.

This causes the movement of water to diffuse into the sap of potato cells following the concentration gradient. The rate of water moves inside the cell is higher than the water moves outside the cell and this result to the increase of size of the potato. The potato cell had become turgid and firm. 5. While, at the highest concentration 100%, the percentage change in mass is -33. 30 is the lowest value. In this situation, the potato cells are in hypertonic solution which is a solution with a higher solute concentration but lower concentration of water.

Thus, water will move outside of the cell to the solution following the concentration gradient. The rate of water moves outside the cell is higher than the water moves inside the cell. As a result, the cell shrinks in sizes and become plasmolysed due to the water loss inside the cell. 6. At 20%, the graph loping downwards is showing a negative percentage changes in mass due to the difference than the 0%. But at 40%, the difference of percentage change in mass is bigger than the previous one with a value of -23. 20%.

This is because as the concentration is getting higher, the water will moves out more than it will moves into the cells. At 60%, the percentage change in mass is -28. 00%. At 80%, the value is -31. 40% and the difference with 100% is quite small. 7. The standard deviation is calculated and it is shown in the graph as error bars. The error bars in the graph is small and cannot be seen clearly. Based on the results, he error bars show that the data that had been collected is reliable as it is very small and it indicates less variable and closer to the mean.

The smaller the error bars gives you the more reliable data and accurate results. Limitation and Suggestions LIMITATIONS SUGGESTIONS 1 . When we do the dilution for the solution, the blackcurrant squash and the distilled water might not mix well. The apparatus we used here is measuring cylinder which cannot be turn upside down to get the homogenous mixture. - Volumetric flask can be used to replace measuring cylinder as it is the best apparatus to get the accurate esult. It has the most fixed values and it definitely can be turned upside down in order to mix the solution well. . The initial length of potato chips to be cut before we put it into the solution is measured using a measuring cylinder. This could affect the result because measuring cylinder has a big uncertainty which is 0. 05cm. - Instead, we can use vernier calliper that has a smaller uncertainty which is 0. 01 cm. This could give better and accurate result. 3. The volume of blackcurrant squash solution is measured using a measuring cylinder that has a bigger uncertainty of 1. cm and this could affect the result to be less accurate. To improve the results obtained, burette is used to replaced measuring cylinder as it has much more smaller uncertainty of 0. 05cm 4. The time for the potatoes left to immerse in the solution is too short which is 15 minutes. Such a short time is not sufficient for the osmosis to occur efficiently. - The duration of time should be longer to get the most accurate values. The potatoes should be left in the solution for at least 30 minutes so that the process of osmosis could happen efficiently giving out the best results. 5.

When the potato chips is taken out from the solution, it must be dabbed and dried by using a paper towel to remove any liquid from the surface before weighing it to get the final mass. But the process might not have done the

same way for every potato chip as maybe more liquid is removed from one of the potato chips but not the other. - We should at least try to dry the potato chips using the same paper towel and dried it carefully so all the liquid is removed of the potato chips so as the result will came out better. 6. The excess potatoes skin which wasn't taken out properly could give a slightly less