Osmosis lab assignment

Osmosis of Sucrose Solutions of Different Molarities Through Dialysis Tubing (a Semi-Permeable Membrane) I. DESIGN A. PROBLEM/RESEARCH QUESTION 1. How does increasing molarity of sucrose affect osmosis through dialysis tubing? B. VARIABLES 1. The independent variable in this lab is the molarity of sucrose each dialysis bag is filled with. The time (30 minutes), the temperature (23C) and the type of dialysis tubing used are all constants. 2. The dependent variable is the final mass of the dialysis bag. 3. The control in the experiment is distilled water, as it does not contain sucrose solution. C. MATERIALS NEEDED 4.

Five 30 cm strips of dialysis tubing 5. Five clear plastic cups 6. 10 pieces of yarn 7. Distilled water 8. Sucrose solutions (with molarities of: 0. 2, 0. 4, 0. 6, and 0. 8) 9. Calculator 10. Electrical balance 11. Clock 12. Beaker 13. Funnel 14. Graduate cylinder 15. Rag 16. Sharpie D. PROCEDURE 1. Obtain five 30 cm strips of presoaked dialysis tubing. 2. Tie a knot in one end of each piece of dialysis tubing with a small piece of yarn to form 5 bags. 3. Pour 20 mL of each of the following solutions into separate bags: A. Distilled water B. 0. 2 M sucrose C. 0. 4 M sucrose D. 0. 6 M sucrose E. 0. 8 M sucrose 4.

Remove air from each bag by drawing the dialysis bag between two fingers. Tie off the other end of the bag. Make sure to leave sufficient space for expansion of the contents in the bag. 5. Rinse each bag gently with tap water to remove any sucrose solution spilled during the filling. 6. Carefully blot the outside of each bag, find and record the initial mass of each bag. 7. Place each bag in an empty cup, and label the cup to indicate the molarity of the solution in the dialysis bag. 8. Fill each cup with distilled water. Be sure to completely submerge each bag. 9. Let cups of water with dialysis bags in

them stand for 30 minutes. 0. At the end of 30 minutes, remove the bags from the water. 11. Carefully blot the outside of each bag, find and record the final mass of each bag. 12. Record, process, and present data. II. DATA COLLECTION AND PROCESSING E. The raw data is compiled in order of increasing molarities in the first column. The initial mass and the mass after 30 minutes has been recorded in order to determine the effect of increasing molarity on mass. Mass of dialysis tubing bags before and after 30 minutes of submersion in water during which osmosis took place | Contents of Bag| Initial Mass (g) + 0. 100 g| Mass after 30 minutes (g) + 0. 00 g| Difference in mass of bags (g) + 0. 100 g[Mass after 30 minutes ??? Initial Mass]| Distilled Water (0. 000M)| 21. 70| 22. 20| 0. 500| 0. 200 M sucrose| 22. 88| 24. 60| 1. 800| 0. 400 M sucrose| 23. 15| 26. 15| 3. 000| 0. 600 M sucrose| 23. 20| 26. 80| 3. 600| 0. 800 M sucrose| 22. 53| 28. 25| 5. 720| The fourth column in the table, the difference in the mass of the bags (mass after 30 minutes ??? initial mass) is included so that the trend of increase can easily be seen. This displays that as molarity of sucrose increases, the mass of the bags, or the contents of the bag increases/expands. F.

Calculating the percent change will further prove that an increasing molarity, yields in a larger mass after 30 minutes of undergoing osmosis. Calculated percent change of mass in dialysis bags from initial mass to mass after 30 minutes| Contents of Bag| Percent change Formula [mass(g)] + 0. 100 g: Mass after 30 minutes ??? Initial Mass X 100Initial Mass| Percent change in mass of contents of dialysis bags| Distilled Water (0. 000 M sucrose)| 22. 20 ??? 21. 70 = 0. 500 X 100 = 21. 70 21. 70| 2. 30%| 0. 200 M sucrose| 24. 60 ??? 22. 88 = 1. 800 X 100 = 24. 0 24. 60| 7. 32%| 0. 400 M sucrose| 26.

15 ??? 23. 15 = 3. 000 X 100 = 23. 15 23. 15| 12. 96%| 0. 600 M sucrose| 26. 80 ??? 23. 20 = 3. 600 X 100 = 23. 20 23. 20| 15. 52%| 0. 800 M sucrose| 28. 25 ??? 22. 53 = 5. 720 X 100 = 22. 53 22. 53| 25. 39%| The final column in the above table (labeled Percent change in mass of contents of dialysis bag), shows an increase in the amount of percent change, as the molarities of the sucrose solutions in the dialysis bags increases.

The greater the percent change, the more mass is gained. The control group, distilled water, also shows an increase in percent change. This demonstrates that even with the absence of sucrose, osmosis would take place. G. Sucrose Solutions of Different Molarities Percent Change in Mass after 30 minutes of Submersion in Water The molarity of the solutions in each dialysis bag, and the percent change in mass are both included to best show effect of increasing molarities of sucrose and osmosis.

The percent change in mass exhibits the process of osmosis, because osmosis must take place for water molecules to transfer from one side of the semi-permeable (in the surrounding distilled cup) to another (within the dialysis tubing), in order to reach equilibrium. A linear line of best fit (calculated by the Microsoft Excel Program with the entered points) is included in the graph to show the increasing trend of percent change along with the increasing molarities of sucrose solutions. III. CONCLUSION AND EVALUATION H. CONCLUSION The calculations conclude that 0. 00 M of sucrose ??? or distilled water, the control ??? yields the least percent change (2. 30%), and that 0. 800 M sucrose yields the highest percent change (25. 39%). Therefore, it can be concluded that the greater the molarity of sucrose within the dialysis tubing, the greater the difference in mass of the contents

of the dialysis tubing, and therefore there is a greater effect on osmosis. The surrounding distilled water in the plastic cup was the hypo-osmotic solution, and the contents of the dialysis bag were the hyper-osmotic solutions.

Therefore, there was a higher concentration of solutes in the dialysis tubing bags. For this reason, water moved from the hypo-osmotic solution to the hyper-osmotic across the partially permeable membrane, the dialysis tubing which has a pore size of 25 Angstroms. This is why there is an increase in the mass of the hyper-osmotic solution, more water molecules have entered inside the dialysis bag. Ideally at the end of osmosis, both solutions would become iso-osmotic and equilibrium would be reached. Whether or not equilibrium was reached during the 30 minutes osmosis took place, cannot be determined.

I. EVALUATION The lab was designed to test the effect of increasing molarities of sucrose solutions on the process of osmosis. In order to test this, solutions with increasing molarities of sucrose (including a molarity of 0. 000 as the control) was filled into dialysis tubing bags and submerged in distilled water for 30 minutes. The percent change was then found to discover which molarity would yield the greatest difference, thus configuring the effect on osmosis. Because the lab was only constructed one time, the precision of the data cannot be determined.

This could cause error in the data, as there could easily have been an inconsistency during the procedure since it was only done once. A graduated cylinder was used to measure the amount of solution (20. 00 mL) to fill the bag. The graduated cylinder is a fairly accurate form of measurement,

however there is an uncertainty of + 0. 100 mL. An electrical balance was also a tool used for measurement, that has an uncertainty of + 0. 100 g. If there is any error in the accuracy of the measurement, it is due to the calibration of the balance.

An additional miscalculation in weight could be attributed to excess water surrounding the dialysis bag, and on the balance itself. There is also room for error in other aspects in the lab, aside from the equipment. One such possible error, is the presence of any microscopic tears in the dialysis tubing. Tears could have occurred during opening the dialysis tube, tying the dialysis tube, or blotting the dialysis tube. If there are any tears, then more molecules from either side could have passed through the semi-permeable membrane.

This could result in either lower or greater difference in mass of the dialysis bags after the 30 minutes. Also during the rinsing and blotting process, some of the sucrose solution that was supposed to be within the dialysis tubing, could have remained outside. This would mean that instead of distilled water or 0. 000 M sucrose solution on the outside of the dialysis tubing, there was a small molarity of sucrose. Another error could derive from the contents of the distilled water, as it was left out without a cover.

The problem in this, is that other air particles and molecules could have entered the what should be pristine distilled water, and effected the weight or process of osmosis. The presence of other molecules, may be an issue. Finally, one other error could come from the dialysis tubing not remaining completely submerged for the entire time. If all areas that contained the

sucrose solution was not submerged, then some areas of the dialysis tubing would not have been effected during osmosis. A couple modifications could be made to this lab to heighten its credibility.

A primary modification concerns further testing the precision of the data. This could be done by completing the procedure several more times. More than one trial aids to prove the precision. Another modification could be to ensure that the distilled water remained as pure as possible. For this to be done, the distilled water should be poured from the closed bottle into the beaker, and then into the graduated cylinder within a short period of time, opposed to leaving it in the beaker for a lengthy time period. Then, the distilled water should be poured into the plastic cups directly before the dialysis bags are placed in them.

And finally, during the 30 minutes that the bags remained submerged under water, the plastic cups should be covered. This would minimize the change of other molecules entering and obstructing the water processes. The other uncertainties mentioned would not be as large if the procedure was tested multiple times. SOURCES Damon, Alan. Biology: Standard Level : Developed Specifically for the IB Diploma. Harlow, Essex: Heinemann International, 2007. Print Allott, Andrew. Biology for the IB Diploma: Standard and Higher Level. Oxford: Oxford UP, 2007. Print.