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Bio 2311 Lab

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Osmosis and Diffusion: Using Sugar and Salt Solutions to Test Osmosis

Introduction:

Diffusion is the net movement of molecules from a high concentration to low. Osmosis is the movement of water molecules from a high to low concentration. In other words, osmosis is the diffusion of water. Osmosis can only occur if there is a selectively permeable membrane, but this is not the case for diffusion. In this experiment, sugar and salt solutions will be used to examine how solvents and solutes are allowed to move through nonliving selectively permeable membranes.

Purpose:

How will solvents and solutes move through selectively permeable membranes?

Hypothesis:

If the solution is mostly water, then the membrane will allow osmosis to occur because the water molecules would move from high to low concentrations.

Materials:

- 9 test tubes
- 4 beakers
- 4 dialysis sacs
- Hot plate for boiling water
- Distilled water
- 40% glucose solution
- 10% NaCl solution
- 40% Sucrose solution
- Dropper bottles of Benedict's solution and silver nitrate solution,
- Test tube rack
- Test tube holder
- A small funnel, a 25-ml graduated cylinder
- Fine twine or dialysis tubing clamps
- Paper towels

Procedure:

1. Four beakers are given. Beaker 1, 3, and 4 will be half filled with distilled water. Beaker 2 will be half filled with 40% glucose solution.
2. Four dialysis sacs will be given. Sac 1 and 2 will be filled with 20ml of 40% glucose solution. Sac 3 will be filled with 20ml of 10% NaCl solution. Sac 4 will be filled with 20ml of 40% sucrose solution.
3. Remove all air from the sacs and tie the sacs tightly. Weigh all sacs separately. Record the results.

4. Drop each sac into its matching beaker. Make sure each sac is fully saturated with the solution from the beaker.
5. Leave the sacs in the beakers for 1 hour without moving or touching the beakers and sacs.
6. After an hour, boil a beaker of water. Now is the time to gather the dropper bottles of Benedict's solution and silver nitrate solution, a test tube rack, test tubes, and a test tube holder.
7. Lightly remove excess solution from the top of sac 1 and weigh it. Do not squeeze the sac. Record the results.
8. Place 5 drops of Benedict's solution in each of two test tubes. Place 4 ml of the solution from the beaker into one test tube and 4 ml of the solution from the sac into the other. Put both test tubes into the beaker that contains boiling water for two minutes and allow to cool. If a green, yellow, or rusty red color forms, the test is positive for the presence of glucose. If the solution is still blue, the test is negative and glucose is not present. Record the data.
9. Continue this process with sac 2, 3, and 4.
10. Take a 5 ml sample of the solution in beaker 3 and put it in a new test tube. Add a drop of silver nitrate. If a white color or cloudiness appears, the solution will be positive for silver chloride. Record data presented.

Results:

Beaker	Contents of Sac	Initial Weight	Final Weight	Weight Change	Test for beaker	Test for Sac fluid

					fluid	
Beaker 1 ½ filled of distilled water	Sac 1 40% glucose 20ml	7.1 gm	8.0gm	+0.9gm	Benedict's test: Positive	Benedict's test: Positive
Beaker 2 ½ filled with 40% of glucose	Sac 2 40% glucose 20ml	6.9gm	6.9gm	No weight change	Positive	Positive
Beaker 3 ½ filled of distilled water	Sac 3 10% NaCl 20ml	7.2gm	7.8gm	+0.6gm	AgNO3 test: Positive	Positive
Beaker 4 ½ filled of distilled water	Sac 4 40% sucrose 20ml	7.1gm	8.0gm	+0.9gm	Benedict's test: Negative	Positive

All sacs exhibited a positive weight change except for sac 2, therefore the solution in beaker 2 did not pass through. Osmosis only occurred in sacs 1, 3, and 4. All test tubes tested positive for color change in Benedict's test except for beaker 4, meaning sucrose was too large and could not diffuse out of the sac. Beaker and sac 3 tested positive for the AgNO3 test, meaning NaCl was allowed to diffuse out.

Conclusion:

Osmosis and diffusion occurred in all sacs and beakers except for beaker 4, which means sucrose was too large and could not diffuse out of the sac. Therefore the hypothesis was incorrect because the sucrose solution was 60% water, but the contents still didn't pass through. This means that in order for osmosis to occur, the size of the molecule of the solute matters more than how much water the solution contains.