Osmosis Experiment using Potato Strips

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Introduction

Osmosis refers to a special form of transport of water molecules across the plasma membrane. It involves water molecules' movement through a selectively permeable membrane from a region having a high water potential to a region having a lower water potential. Therefore, water molecules move through a semipermeable membrane to a region containing a higher concentration of solute from a region containing a lower concentration of solute. The ability of water molecules to freely move in a particular system or environment is referred to as water potential. This can be facilitated by osmosis, framework impacts, gravity, or mechanical weight (Sperelakis, 1995). Normally, in defining osmosis, three kinds of solutions are mentioned: hypertonic, isotonic, and hypotonic solutions. A solution that has the same concentration of solutes both outside and inside of the cell is called an isotonic solution. A hypertonic solution is a solution that has a high solute concentration compared to the cells neighboring it; thus, more solvent molecules move from the cells toward it. Lastly, the hypotonic solution is characterized by a low concentration of solute molecules, and solvent molecules move from this solution to other regions that have high solute concentrations (Sperelakis, 2011).

The Aim of the Experiment

To determine the relationship between an increase in sucrose concentration and the resulting effect on the weight of potato strips.

Variables

For this experiment, the varying sucrose concentration solution is the independent variable. The final weight of potato strips at the end of the experiment is the dependent variable. Similarly, the original weight of the potato strip is the control variable.

Hypothesis

An increase in the concentration of the sucrose solution results in a subsequent decrease in the weight of potato strips.

Methods

Equipment

- Cork borer
- Balance
- Ruler
- Stirrer
- Pipette
- Measuring cylinder
- Razor blade
- Tile
- Flat wooden scapula
- Tissue roll
- Weighing boat
- Marker and pencil
- 6 beakers (200ml)
- Cling film
- Potatoes
- Sucrose solution
- Lab coat

Procedure

Preparing sucrose solutions of different concentrations

The beakers are first labeled appropriately as per the sucrose concentration they will contain. To prepare 0.1M sucrose solution, 68.40 grams were weighed. Then 200ml of water was measured using a measuring cylinder and a pipette. The sucrose and water were then mixed thoroughly in the beaker till the sucrose dissolved. The same process was repeated for 0.2M, 0.4M, 0.8M, and 1.0M with 13.68g, 27.36g, 54.72g, and 68.40g, respectively.

Preparing the strips

The cork borer was hard-pressed through the potato to obtain the strip. The strip was then pushed out onto the tile using a pencil. On both sides, the skin was removed. Potato strips of 4cm in length were obtained using a razor blade after accurate measurement using the ruler.

Placing the potato cylinders in the different sucrose concentration solutions

The potato strips were then carefully blotted using tissue paper without squeezing them to remove water from the external part. Their respective weights were measured and noted. Subsequently, they were placed in the prepared sucrose solutions. After forty-five minutes, the strips were removed, bloated, and reweighed.

Results

Table 1: The mean deviation in the weights of potato strips after forty-five-minute exposure in sucrose solution.

Concentration required (M)	Average initial mass (g)	Average final mass (g)	Percentage change (%)
0.0	3.46	3.61	4.34
0.1	3.23	3.21	-0.62
0.2	3.09	3.54	14.56
0.4	3.46	3.17	-8.38
0.8	3.25	3.04	-6.46
1.0	3.56	3.25	-8.71

Figure 1: Graph showing percentage change against sucrose concentration.

Discussion and Conclusion

From the results in Table 1, it is evident that there is an overall decrease in the mass of the potato cylinder as the concentration is increased, except for the 0.2M and 0.4M concentrations. Figure 1 further confirms the overall trend and the correlation between the sucrose concentration and the mass of the potato strips. The general trend indicates that the mass of the strips decreases as the

sucrose solution concentration increases. This observation can be clearly explained by the process of osmosis took place. As the sucrose concentration increases, the solution becomes hypertonic. Therefore, water moves from the cells of the potato to the surrounding hypertonic solution in the beaker through osmosis (Kurzweil & Walker, 2009). The movement of water through the process of osmosis into the hypertonic solution results in a decrease in the mass of the potato strips after 45 minutes. An increase in the solute concentration makes the solution in the beaker hypertonic compared to the cytoplasmic water concentration, which is hypotonic. Water then naturally moves along the concentration gradient through the process of osmosis to the surrounding solution (Lenart & Flink, 1984).

However, there was some experimental error that affected the results obtained for the 0.2M and 0.4M sucrose concentrations. This has resulted in the skewed line that is observed in Figure 1. Generally, the negative correlation that exists between the concentration and the percentage change in mass makes the mass of potatoes decrease as the sucrose concentration increases (hypertonic) (Kurzweil & Walker, 2009). Though the data obtained is biased due to the experimental error in the 0.2M and 0.4M concentrations, I accept the hypothesis for the experiment that states an increase in the concentration of the sucrose solution results in a subsequent decrease in the weight of the potato strips. The variation could be a result of external factors that affect the osmosis rate, such as humidity and temperature. The high temperature and humidity in the laboratory could be the possible cause of the faster rate of osmosis observed in the 0.2M and 0.4M concentrations. It is noteworthy to note that the cling film used in the experiment prevented the evaporation of the contents of the beaker. Also, measurement errors involved when cutting the potato strips are another potential source of experimental inaccuracy.

Moreover, experimental errors could emerge in the blotting process. There is a possibility that some potato strips were squeezed unconsciously. Despite the few errors involved, I can conclude that the experiment was carried out successfully in the laboratory. To reduce the errors involved, like the one for the 0.2M and 0.4M, the experiment should be conducted in a controlled condition in the future. The laboratory setting for the experiment should be controlled from external factors, and the solutions that contain the potato strips should be kept at constant humidity and temperature to avoid errors like the one observed in this experiment.

References

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