

BIOLOGY LAB REPORT:
Osmosis in Potato Experiment
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Abstract:

This experiment investigates the role of osmosis in cells; potatoes. The experiment also determines the changes that occur in the potato, which are; texture, size and color changes after soaking the potato in different 2 kinds of water solution. The first one is a water solution and the second one is a salt solution. In this experiment, we also study the effect of osmosis in potatoes between 5 different group experiment results and the result of each group are compared to see if there are any similarities or difference.

Osmosis is also often used in facing real-life situations, certain day to day activities in our lives are performed by osmosis. We often don't know the science of osmosis behind these activities. Osmosis plays a very important role in our daily life. With osmosis, tea, the molecules from the herbs are moving from a high concentration to the low concentration through the tea bag which represents the membrane. Another example is that we feel thirsty after eating salty food. The salty food contains a lot of solutes. In result, our cells become concentrated with salt after we consume salty food. So, we feel thirsty and we drink to bring stability to our cells. That's why through this experiment, it will discover the role of osmosis in cells; through potatoes.

As the experiment requires various and different kind of skills also theory learning, by the end, the theory (osmosis) that are used and learned are advanced. Also including skills of doing lab experiment, observation, scientific method process, teamwork, and other many skills that are applied in the process of doing this experiment are also advanced. At the end of the experiment, the conclusion was made that osmosis occurs in cells as the mass of the potato will decrease in salt water and an increase in fresh water.

Research Question:

Based on the objective from the experiment, the research question is formed into "What are the difference between putting a potato inside a fresh water and putting it inside a salt-water solution?"

Hypothesis:

The hypothesis from this experiment is that, by putting the potato into a fresh water, the water molecules will depend on the cells inside the potato

since it has a higher concentration, so, the potato will not indicate a big difference. But, even though the cell membrane stops things enter the cell, water still can pass through it, so, water still can enter the cell. Different, if we put the potato in a salt water, the potato will indicate a big difference, the difference is that the mass of the potato will decrease. The mass of the potato will decrease as the salt water has a low concentration which causes cells to depend with the molecules of salt water.

Variables:

In conducting a lab experiment, an experiment is used to search a cause and effect relationship. The cause and effect relationship explain why things happen and allow us to predict what will happen if us do something. The things that are changing are called variables. There are 3 types of variables;

1. Independent variable:

The variable that can be changed and control. In this experiment, the independent variable is the **salt**. It's the salt as it is the one that gives the changes on the potato, depending how much/ how less the amount of salt is.

2. Dependent variable:

The variable that is impacted by the independent variable. In this experiment, the dependent variable is the **potato**. It's the potato as the potato is observed on to see how much they respond to the change made by the independent variable.

3. Controlled variable/ constant:

The variable that is not changed by the experiment or in other words, it remains constant. In this experiment, the controlled variable is the **water**.

Introduction:

The objective of this experiment was to learn, practice and explore how to use various kinds of materials and ingredients to prove osmosis theory in cells, which the cells are represented by a potato. Besides than that, the objective is to study the processes of diffusion and osmosis using a potato. Through this, we can learn the factors that affect the rate of diffusion and explain how the diffusion affected the potatoes. Which later on, the prediction (hypothesis) was proposed and tested for the osmosis experiment. The last objective is to able to interpret the results from the osmosis experiment, therefore we can identify the variables and make it into a scientific lab report.

As mentioned, one of the theories that are used and learned in this experiment is osmosis. Osmosis plays an important role in cells. In order for cells

to adapt and interact with their environment, chemicals, including water, must be able to move across the cell membrane and across the cell. The movement that happened in the is also known as diffusion. The molecules that move across the cell membrane is known as a process known as osmosis. Osmosis is the diffusion of water through a permeable membrane from a higher concentration to a lower concentration. A higher concentration contains a low solute, while lower concentration contains more solute. Solute means salt. The main purpose of osmosis is to maintain the balance between solute and water concentration inside and outside the cells for the survival of the cell.

The environment inside and outside the cell is very different because it is separated by the cell membrane. The cell membrane is a thin layer that forms the outer boundary of a living cell, the function of the outer boundary is to protect the cell (from the inside and outside environment). Not only that, the cell membrane also acts as the entrance door of the cell, which in this case let things and out of the cell. But it only allows selected necessary molecules which are vital for the cell's functioning. The selective necessary molecules of the cell membrane regulate the vital for many life processes in living organisms (plant and animal cell), and if not, any every molecule would pass through the cell membrane. Meanwhile, in osmosis, the only water that has been "classify/cleaned" is safe to be consumed in order for the cells to stay balanced and stable. As the cell will react differently to water that has too much solute or any other molecules.

As the osmosis is the diffusion of water across a membrane, it is very important for a cell's survival to regulate osmosis. Osmosis plays a role in order to maintain an optimal environment inside and outside of the cell. Which in this case is essential for the survival of the cell. In order for the cell to survive or "keeping water balance", the cell survival depends on the balance of water uptake and water loss. If it's in a salt water, which is low concentration around the cell, the cell will lose its water and shrink. The cell shrinks because of the loss of water molecules. Meanwhile, if it's in a fresh water, which is a high concentration of water around the cell, the cell will gain a lot of water and explode. The cell explodes because the cell will prefer to have more water molecules outside the cell rather than inside, in order to balance it out, the cell takes more water and it explodes. That's why it's very important to maintain between salt and water solution for the survival of the cell.

To further learn the role of osmosis in cells, through this experiment, the osmosis is experimented using potatoes. The potatoes will be compared into 3 different aspects; size, color changes, and shape in order to investigate how much amount of solute in water can affect the potatoes.

Materials:

This lab experiment requires some materials and ingredients that are used in order to conduct the lab experiment. The materials and ingredients required are:

Experiment materials:

1. Procedure Paper
2. Stationery: Pencil and Eraser
3. 2 Beakers
4. Knife
5. Spoon
6. Tissue
7. Cutting board
8. Measuring scale

Experiment ingredients:

1. 2 Pieces of Potatoes (22 gr each)
2. 15 gr of salt
3. 400 ml of water

Procedure:

To be prepared with this experiment, the first step was to actually create a procedure paper. The procedure paper is created by each group, as the experiment is conducted in a group and each group has different materials and procedure but has the same objectives. Creating a procedure paper is very important as it will help us to conduct the experiment to make sure the experiment is conducted correctly. Beside than that, with a procedure paper, it will help to make sure that the objective is reached and meet the target outcomes.

To conduct this experiment, we went to the lab and we were already prepared with our procedure paper. This procedure paper is used to record our findings during the lab experiment. The procedure paper also has all the things we need from the question/problem, research information, variables, hypothesis, conclusion. Beside than that, the procedure paper also has the experiment data table which is used to record all of our findings, the paper also has the list of ingredients and materials needed, lastly, the paper also has a clear step by step procedure in order to help us conducting the experiment in the lab. The experiment data table was divided on 4 main sections, as each section was labeled for different differences that occurred between potato in solution 1 and potato in solution 2. The first section is for size(g) changes, the

second section is for color changes, the third section is for texture changes and the fourth/last section is for water solution(ml) changes.

As the experiment was conducted in the lab, when conducting the lab experiment, all of the materials and ingredients were already provided in the lab. Below are the step by step procedure for conducting the potato in osmosis lab experiment:

1. First of all, prepare all the materials and the ingredients that are needed for the experiment (salt, potato, water, beakers, knife and etc.)
2. Take the potato, put it on the cutting board, cut it into 2 pieces, 22 gram each.
3. Take one of the potato piece and put it on the measuring scale to make sure if it's already 22g. Do it with the other potato piece.
4. Fill each beaker with 200 ml of room temperature water, the first beaker without salt, and the second beaker with 15g of salt.
5. Stir the salt mixture using a spoon, make sure that the salt has dissolve on the water.
6. Put each potato inside each of the beaker.
7. Observe the potato based on the color and texture, then write the findings on the data table.
8. Take a picture of the potato (before).
9. Let the potato soak on the solution for 30 minutes.
10. Wait for 30 minutes.
11. After 30 minutes, take out the potato, dunk the water into another beaker and measure how much water is left on the beaker, then dunk all of the water.
12. Remove the potato pieces into a tissue and make final observations.
13. Do final observations on the potato after the experiment, observe the potato based on the color and texture, then write the findings on the data table.
14. Take one of the potato piece and put it on the measuring scale to see the size changes. Do it with the other potato piece.
15. Finalize the conclusion.

Later on, from all the lab experiment findings, the findings are used to make the lab report. The lab report are then used to be a result from the lab experiment and later on can be done by other people who are also intended to the same experiment.

Data:

The results from the lab experiment is later on recorded in a table and it is titled "Potato in Osmosis Lab Experiment Result", below is the table:

Table 1: Before Experiment

	Size (g)	Color Changes	Texture	Water Solution (ml)
Potato In Solution 1 (Fresh Water)	22g	Yellow	Rough Skin, Hard, Solid, Rigid	200 ml
Potato In Solution 2 (Salt Water)	22g	Yellow	Rough Skin, Hard, Solid, Rigid	200 ml

Table 2: After Experiment

	Size (g)	Color Changes	Texture	Water Solution (ml)
Potato In Solution 1 (Fresh Water)	22.4g	Pale yellow (the yellow has faded)	More rigid but beside than that there is no much change	192 ml
Potato In Solution 2 (Salt Water)	18.8g	Darker yellow (the yellow has added)	Softer, the skin wrinkled, soggy	196 ml

Table 3: Groups Experiment Mass & Water Comparison

Group	Salt Before Mass	Salt after Mass	H2O Salt Before ml	H2O Salt After ml	Fresh Before Mass	Fresh After Mass	H2O Fresh Before	H2O Fresh After
1	15.3g	15.3g	200ml	192ml	45.7g	45.39g	200ml	192ml
2	22g	18.8g	200ml	196ml	22g	22.4g	200ml	192ml
3	65.0g	63.1g	100ml	100ml	65g	65.6g	100ml	101ml
4	83.5g	80.1g	150ml	160ml	64.5g	65.6g	150ml	150ml
5	65.4g	63.2g	100ml	104ml	61.4g	62.8g	100ml	96ml
6	33g	25.9g	225ml	228ml	29g	34.4g	210ml	208ml



Figure 1: Potato in 2 different solution. Left: Saltwater solution, Right: Freshwater Solution.



Figure 2: Comparison of the potatoes in 2 different solution and normal potato

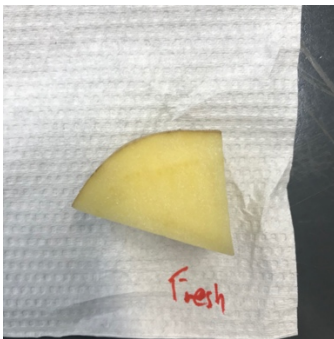


Figure 3: Potato in fresh water



Figure 4: Normal potato



Figure 5: Potato in salt water

Result and Analysis:

The lab experiment took approximately 1 hour. By the end of the experiment, the final result of the potatoes is measured in the size properties to see if there are any mass difference that occurred before and after the experiment. The mass of the potatoes is measured using a measuring scale. As shown in table 2, compared with table 1, there is a difference in the mass of both potatoes. In table 1, which is the before experiment table, both of the potatoes, soaked in fresh and salt water are both 22g. Meanwhile, in table 2, the mass of the potato soaked in fresh water is 22.4g, and the mass of the potato soaked in salt water is 18.8g. Therefore, the mass of the potato soaked in fresh water is increased by 0.4g and the mass of the potato soaked in salt water is decreased by 1.2g. The reason why the potato gained mass in fresh water solution is that there are more salt and other dissolved chemicals in the potato than the water, causing the water molecules will move into the potato. But, the reason why the potato decreased mass in salt water solution is that

there are more salt and other dissolved chemicals outside the potato than the potato, causing the water molecules will move outside the potato.

After comparing its mass measurement results, the potatoes are put on a top of a paper towel with each potato is labeled to be compared to each other. As shown in figure 2, the potatoes are labeled as "fresh", "normal" and "salt". Fresh means the potato that has been soaked in the fresh water solution, while salt means the potato that has been soaked in salt water solution and normal is a normal potato that has not been soaked in any solution of water. In table 1 and table 2, the texture and color on both potatoes differ. The beginning texture of both potatoes is both rough skins, hard, solid and rigid. But, there are some texture changes in the potato soaked in fresh water as it becomes more rigid, but, besides than that, there is no much change. Meanwhile, the potato soaked in salt water becomes softer, the skin wrinkled and become soggy. For the color changes, in the beginning, the color of both potatoes is yellow, after the experiment, the potato soaked in fresh water becomes pale yellow as the yellow has faded, while the potato soaked in salt water becomes dark yellow as the yellow has added.

Other than the physical and mass changes, there is also a change in the water. At first, both of the beakers was filled each with 200 ml of water. After the experiment, the freshwater reduced by 8ml becoming 192ml. While the salt water reduced by 4ml becoming 196 ml.

To make sure our group experiment result is correct, each group (the other 4) shared their experiment results. Later on, the results are compared to see if there any similarities or difference. The things that are shared are; before and after mass of the potato soaked in salt water, before and after mass of the potato soaked in fresh water, before and after salt water, lastly, before and after fresh water. As shown in table 3, there are 5 results (including our group) from 5 different groups, it is seen, that each group uses a variety of sizes of potato and water amount. But, in conclusion, the majority of the results (besides 1 group that has a majority of a different result) showed that the potato's mass in fresh water increased, and the potato's mass in salt water decreased. Other than that, the water amount in salt water increased, and the water amount in freshwater decreased.

In order to improve this experiment, there are some things needed to be improved. The first one is time. If there would be more time, the potatoes would soak more in the water/ salt solution, therefore, there would be more changes happen in the potatoes. If there would be more changes, more things could be learned from both of the potatoes that would help us to learn more about the osmosis theory. Other than that, the lack of materials and ingredient. As the potatoes are only compared between two types of solution, it would've been better if the potatoes are compared between four types of solution. the

first solution is without salt, the second solution is with a little of salt, the third solution is with more salt and the last one is a lot of salt. If there would've been more solution (which means more beakers and potatoes), there are 4 solutions that would've been compared and how each salt level would give an impact to each potato (colors, texture and etc).

Conclusion:

Since the beginning, this lab experiment was intended to comprehend the idea of osmosis in cells. Which the cells are represented by a potato. With an objective to determine the changes that occur in potato which are; texture, size and color changes after soaking the potato in different 2 kinds of water solution. In order to comprehend the idea of osmosis in cells, a hypothesis/ prediction was created on how the result of the experiment would be. It was predicted that the potato soaked in salt water will shrink/ loses its mass, while the potato in fresh water will "enlarge"/ increases its mass. For the physical changes, there are not a lot of changes that will occur in the potato soaked in fresh water, while there are some changes that might occur in the potato soaked in salt water.

To proof our prediction, we conducted a lab experiment. These predictions were then proved during the lab experiment. The lab experiment compares 2 different potatoes in 2 different solutions. The first solution is fresh water and the second solution is a salt solution (fresh water + salt). In order for the potatoes to balance itself with its outside environment, the potato in salt water shrinks as the water molecules inside the potato goes outside the potato, while the potato in fresh water "enlarge" as the water molecules goes inside the potato.

The prediction was later on proved during the lab experiment. The results showed that the earlier prediction, or in other words, the hypothesis was correct. As the mass of the potatoes soaked in fresh water increases and the mass of the potatoes soaked in salt water decreased. The reason behind this is the process and act of osmosis. Although there is one group that have a different result in the experiment, because the weight of the potato in the salt water stays the same and the weight of the potato in fresh water decreases. But, as the majority showed that the results are the same, then it can be concluded from it, and proved that our hypothesis is correct.

From it, it is believed that the results of our experiment are accurate as it proved the osmosis theory in potatoes. The result from both of the potatoes proved that salt and fresh water will impact the potato in size, color, and also texture. There are different changes between putting a potato in fresh water and salt water. In order for the potato to balance, the water moves from a higher concentration to a lower concentration.