[redacted]

Ms. Noller

MYP Biology 1

October 24, [redacted]

The relationship between tangerine slices and ratio of honey to water

Research Question:
How does changing the ratio of honey to water affect the mass of the different tangerine slices through osmosis?

Background:
Passive transport is a type of cellular transport in which the transport happens when the high concentration moves to low concentration without using energy. Osmosis is a particular type of passive transport, which only focuses on the movement of water. In this lab report, I will be investigating osmosis thoroughly with honey and tangerines. According to USDA, the National Agriculture Library, honey is made out of 18% of water, and tangerine contains 85% of water. Therefore, it is evident that there is a possible relationship between the changing of the ratio of honey to water and the mass of the different tangerine slices through osmosis.

Hypothesis:
If I immerse the tangerine slices (mass ranging from 7.7g to 8.3g) into each of the solution with different ratio of honey to water, then the mass of the tangerine slices will decrease as the amount of water diluted into honey decrease. According to USDA, honey contains 18% of water, and tangerine contains 85% of water. Therefore, it is evident that as I decrease the amount of water in honey, more water in tangerine slices would move out of the tangerine through osmosis, which is movement of water across the membrane in order to reach equilibrium.

Variables:

Variables	Description & Units	How to measure/control
Independent Variable	The different ratios of honey to water. Diluting the 50ml of honey with 5ml, 10ml, 15ml, 20ml, and 25ml of distilled water.	Honey is made out of 18% of water; therefore, it means that 9ml out of 50ml of honey is water. When I dilute the 50ml of honey with 5ml, 10ml, 15ml, 20ml, and 25ml of distilled water. the total amount of water would become 14ml, 19ml, 24ml, 29ml, and 34ml out of 50ml of honey. This way I can clearly measure the different ratios of honey to water.

Variables	Description & Units	How to measure/control
Dependent Variable	The mass of different tangerine slices (grams)	Measure the different masses with the electronic balance. All of the tangerine slices must be in the range of 7.7g ≤ x ≥ 8.3g.
Control Variables	50ml of honey	The honey used in the experiment must be the same type of honey. Also, must use 50ml of honey each time since the ratio of honey is changed by changing the amount of water.
	100ml beakers	Must use the same beakers for each of the trials.
	50ml graduated cylinder	Must use the same 50ml graduated cylinder to measure the amount of honey and water.
	Electronic balance	Must use the same electronic balance found in the lab to measure the mass of the tangerines slices.
	400ml of distilled water	The type of water, in this case is distilled water, must be kept the same throughout the experiment.
	Spatula	Must use the same spatula to dilute the honey with water.
	Time period	For each trial, make sure to give all of the tangerine slices a day for the osmosis to happen.

Control Group:
One tangerine in 50ml of pure honey, and another in 50ml of pure distilled water. This way, I am able to compare the changes in the mass of the tangerine slices in diluted honey to the mass of the tangerine slices in pure honey and in pure distilled water.

Materials:
- 5 to 6 tangerines with similar sizes
- 2 bottles of 800g honey
- 400ml of distilled water
- 7 different 100ml beakers
- 50ml graduated cylinder (±1ml)
- Electronic balance (±0.1g)
- Spatula
- Paper

[redacted]

- Pen
- Labeling tape
- Permanent marker

Procedure:

1. Peel the tangerines and divide them into different slices. Measure each of the slices with the electronic balance and sort out the ones with the mass in the range of 7.7g ≤ x ≥ 8.3g. *Must use the same electronic balance throughout the experiment.
2. Write down the mass of each of the usable tangerine slices. Make sure to lay them out in order, so you don't forget the mass for each slices.
3. Measure 50ml of honey with the graduated cylinder for 6 times and pour each of them into 6 different beakers. *Must use the same graduated cylinder throughout the experiment.
4. After finished with step 3, make sure to leave out one beaker with 50ml of honey for Control Group.
5. Leaving out the 50ml of honey of Control Group, number rest of the five beakers and write down the amount of distilled water mixed into honey with the labeling tape and permanent marker.
6. Measure 50ml of distilled water with the graduated cylinder, and pour it into the left beaker. This 50ml of distilled water is another Control Group.
7. Measure 5ml of distilled water and pour it into the beaker of 50ml of honey with the correct labeling. Then, stir it with spatula until the water is completely mixed in with honey. *When I say the water is completely mixed in, it is when you are not able to see the difference between water and honey.
8. Repeat step 7 for each of the other independent variables (different amount of distilled water for dilution).
9. After repeating step 7, put 7 different tangerine slices into each of the 7 beakers including the Control Group. Then, make sure to record which tangerine slices were put into which beakers (ex. the first tangerine slice, which is 8 grams, was put into the first beaker with 5ml of distilled water).
10. Wait for a day for the osmosis to progress. Then, carefully take out the tangerine slices and wash them gently to scrub off honey.
11. Dry the slices and measure the mass with the electronic balance.
12. Record the mass of each of the tangerine slices on the Raw Data chart immediately.
13. Repeat steps 1 through 11 for 2 more times to have total of 3 different trials. *Must use the same beakers and spatula when repeating.
14. When raw data is complete, calculate the difference between the initial mass and the final mss of the tangerine slices. Then, find the average of the differences.

Raw Data

Table 1. Mass of tangerine slices after immersed in different concentration of honey for a day.

Concentration of honey (diluted by water) (ml)	**Mass of the tangerine slices (g)**					
	Trial 1		Trial 2		Trial 3	
	Before	After	Before	After	Before	After
5 of water	8	6.7	7.9	6.5	8.1	6.8

	Mass of the tangerine slices (g)					
10 of water	8.1	7.3	8.1	7.4	8	7.1
15 of water	8.1	7.7	8	7.5	8.2	7.9
20 of water	7.9	7.8	8.2	8	8.2	8.1
25 of water	8	8.2	8.1	8.3	7.9	8.2
50 of honey	8.2	6.4	8.1	6.3	8	6.4
50 of water	8.3	8.9	8	8.7	7.9	8.5

Qualitative Data

Trial 1	1. When the tangerine slices were taken out of the solution, there are a lot of air filled in between the skin and the pulps of the tangerine slices. 2. Some of them have a lot of wrinkles. 3. Smells like honey. 4. It looks like the tangerine lost its color a little bit.
Trial 2	1. Some of them have air filled between the skin and the pulps of the tangerines. 2. Wrinkles 3. Tangerine slices lost their color a little bit 4. The skin of the tangerine slices are more visible now.
Trial 3	1. Again, air filled between the skin and the actual pulps of the tangerine slices. 2. The skin of the tangerine slice is wrinkled 3. Tangerine slices lost their color a little bit 4. Some of the tangerine slices are coated with honey.

Processed Data

Table 2. Difference between the mass of the tangerine slices before and after they were put into the solution

Concentration of honey (diluted by water) (ml)	**Difference of the mass of the tangerine slices before they were put into the solution and after it was put into the solution (g) (final mass - initial mass)**			
	Trial 1	Trial 2	Trial 3	Average (rounded up to the tenth place)
5 of water	-1.3	-1.4	-1.3	-1.3
10 of water	-0.8	-0.7	-0.9	-0.8
15 of water	-0.4	-0.5	-0.3	-0.4

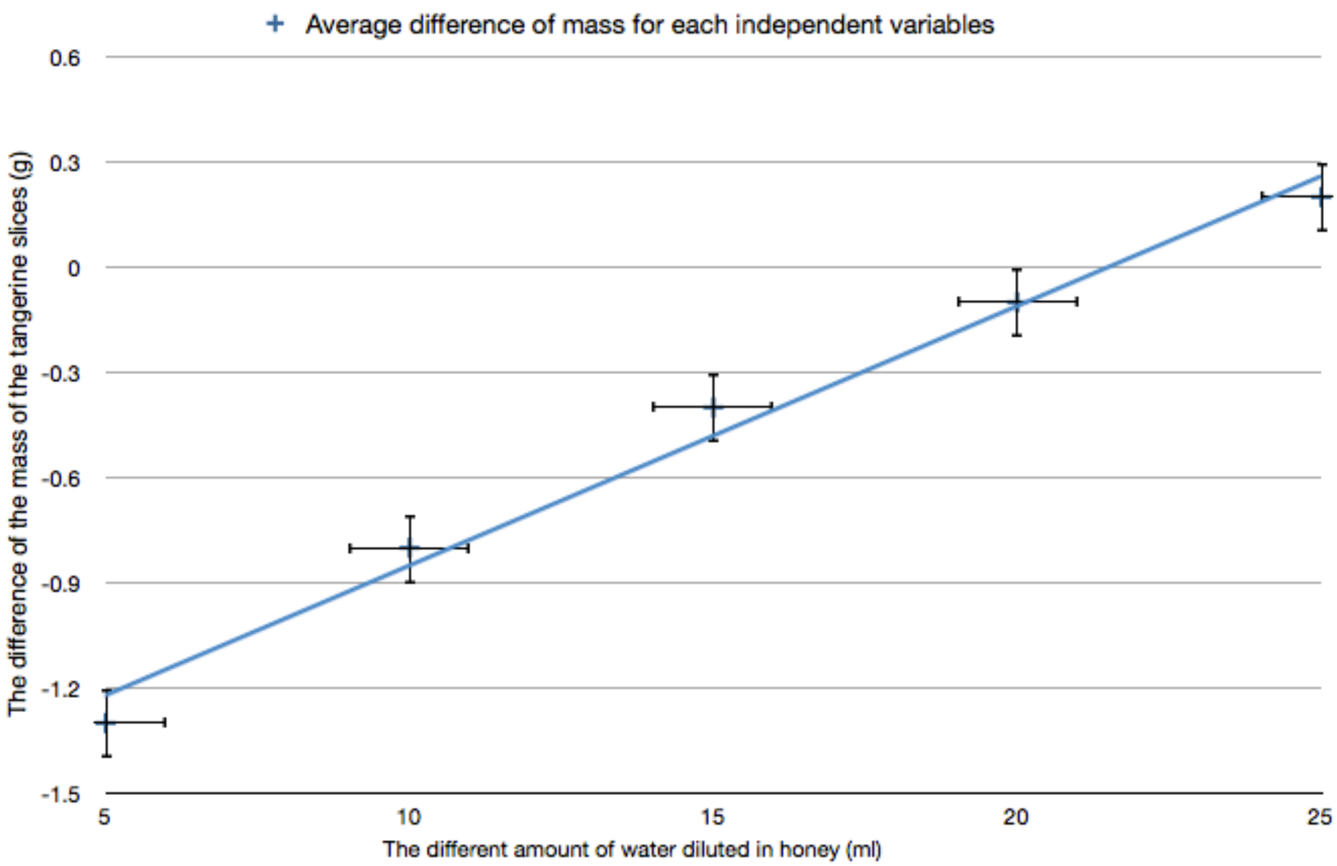
Concentration of honey (diluted by water) (ml)	Difference of the mass of the tangerine slices before they were put into the solution and after it was put into the solution (g) (final mass - initial mass)			
20 of water	-0.1	-0.2	-0.1	-0.1
25 of water	0.2	0.2	0.3	0.2
50 of honey	-1.8	-1.8	-1.6	-1.7
50 of water	0.6	0.7	0.6	0.6

One example of the calculations:
Take the data from Table 1 and find the difference (final mass - initial mass)
6.7 - 8 = -1.3
6.5 - 7.9 = -1.4
6.8 - 8.1 = -1.3

Then, add up the differences and divide it by 3 to get the average difference of the mass.
-1.3 + -1.4 + -1.3 = -4
-4/3 = -1.33333...
∴ ≈-1.3g

Presented Data

Graph 1. The difference between the masses of the tangerine slices before and after they were put into the solution.



*Error bars are indicating the uncertainty of the independent and dependent variables due to equipments.

Conclusion

The research question stated: how does changing the ratio of honey to water affect the mass of the different tangerine slices through osmosis? My hypothesis to this research question was that if I immerse the tangerine slices into each of the solution with different ratio of honey to water, then the mass of the tangerine slices will decrease as the amount of water in honey decrease. This hypothesis has been supported by the data collected through the experiments. Referring back to Table 2 averages, it is clear that the mass of the tangerine slices decreased more when there was less water in the honey. For example, when I diluted honey with only 5ml of water, the total difference between the initial mass and the final mass of the tangerine slice was -1.3. This indicates that the mass of the tangerine slice decreased by 1.3 g. On the other hand, when I diluted honey with 25ml of water, the total difference between the initial mass and the final mass of the tangerine slice was 0.2. This difference indicates that the mass of the tangerine actually increased by 0.2. Also, looking at Graph 1, you are able to point out the apparent pattern or trend of the mass of the tangerine slices as the amount of water increased. The trend line indicates that as the amount of water increased in the order of 5ml, 10ml, 15ml, 20ml, and 25ml, total difference of mass of the tangerine slices increased in the order of -1.3, -0.8, -0.4, -0.1, and 0.2. It is evident that the mass of the tangerine slices slowly increased, even getting heavier than the initial mass by 0.2, as the amount of water increased. This statement can reflect and prove that as the amount of water in honey decrease, the mass of the tangerine slices decrease. This is because of the characteristics of osmosis, which is the movement of water across membrane to reach equilibrium. For example, when I put 5ml of water into honey, which already contains 18% of water, the total percentage of water in honey is 28%. On the other hand, the tangerine slice contains 85% of water. Therefore, the water in tangerine slice moves across the membrane, outer layer of tangerine slice, into the solution in order to reach the equilibrium of water molecules. Therefore, this lab report has proven the hypothesis of the research question right.

Evaluation

Reliability of Procedure

My procedure did test what it was suppose to do. I can ensure that my procedure is reliable because it consistently yielded the same results throughout the repeated trials. Also, there weren't any significant or minor outliers which could have significantly affected the reliability of the procedure. Furthermore, the results indicate that my procedure did what it was suppose to do. My procedure was suppose to yield results that demonstrate the characteristic of osmosis which would make the mass of the tangerine slices decrease as the amount of water in honey decrease. This was exactly how my results turned out. Lastly, human errors were minimized to ensure the procedure did what it was suppose to do. For example, when I measured the initial mass of the tangerine slices, I measured all of them twice to ensure that I wasn't reading the numbers wrong. Therefore, it is evident that my procedure is reliable.

Validity of Procedure

My procedure is not only reliable, but also valid. As mentioned in the previous paragraph, my procedure did what it was suppose to do, successfully testing the aimed science. My procedure was suppose to test the science of osmosis, which it did. Also, my experiment answered the research question. My experiment answered the research question by supporting and proving my hypothesis of the research question as explained in the conclusion. Moreover, all of my control variables were controlled throughout the experiment. For example, I made sure to use the same graduated cylinder, beakers, and electronic balance to measure and contain the substances. Also, I gave all of the tangerine slices a day for the osmosis to happen every trial, and so on. Lastly, I had a positive and negative control to regulate my experiment. My experiment had Control Group: one tangerine slice in pure water, and another in pure honey. This way, I was able to compare the results and regulate my experiment. Therefore, it is evident that my procedure is valid.

Error and Improvements

Even though my procedure is reliable and valid, I did make few errors. I made a mistake with graduated cylinder. When I measured 50ml of honey and poured it into the beakers, the viscosity of honey made it to stick to the inside of graduated cylinder. I did wait for some period of time for it to pour out, but it was enough time for it to pour out as much as it can. This could have affected the results due to the possible change of the concentration of honey. I need to improve on this error by scraping out the honey with a thin spatula, or letting it sit for longer period of time to pour out as much as it can. Another mistake was with the electronic balance. Even though I zeroed the electronic balance each time I measured any of the variables, I found that sometimes it goes down to the negative numbers. This could have hugely affected the actual number results of my experiments even though it didn't for this time. I could improve on this mistake by at least two electronic balance each time to ensure the number. For example, I could measure the mass of the tangerine slice with both of the electronic balances to ensure the number for every trial.

Further Inquiry

In my further investigation, I want to investigate on how does changing the ratio of soap water to water affect the mass of the different tangerine slices through osmosis. During class, I learned that soap actually breaks any kinds of bonds. Therefore, I want to investigate if this characteristic has some kind of different affect on the osmosis. My second further inquiry is going to be about how much water can a tangerine absorb up to. I already know that osmosis is the movement of water across the membrane to reach equilibrium. Then, what if we break that equilibrium and go over the limit? I think this is going to be very interesting investigation.

Works Cited

"Food Composition." *Home*. USDA.gov, 13 May 2013. Web. 20 Oct. 2013.