Name: ____ Date: ________________

Exploring Osmosis with Polymers

Osmosis and the Cell Membrane

In class, we have been discussing the concept of **osmosis**, which is described as the movement of molecules across a semi-permeable membrane from areas of high concentration to areas of low concentration. We have discussed in class that this occurs constantly in cell in order to for homeostasis to be maintained. Today, we will exploring this concept using a polymer similar to gummy worms that you would by at the store.

What is a polymer?

A polymer is a huge molecule made up of repeating units. Many polymers make up both our bodies and the things that we use every day. In this lab activity we will be working with Sodium Alginate, a gum found in the cell walls of brown algae. Sodium Alginate is used by the food industry to create jelly-like foods such as Boba fruit beads and is also used to create medical products, such as dental impressions.

Your task

This is a two-part laboratory activity. In the first part, you will be working with your lab group to create Sodium Alginate "gummy worms". In the second part of the laboratory activity you will explore how soaking your "worms" in tap water, distilled water, and salt water will affect their size and/or mass.

Materials-Part I

- Distilled water
- 1 gram of Sodium Alginate powder
- 2 grams of calcium chloride (CaCl2)
- 1- 250 mL beaker
- 1- 100 mL vial with lid
- Food coloring-one color per group, you might need to share!
- Pipette
- Tweezers
- Paper towels
- Piece of screen
- Electronic mass and weighing cup
- Stirring rod

Name: ____ Date: ________________

Making your "Gummies"

1. Gather all Part I materials from the teacher as you need them, do not come to the front and get everything at once!

2. Measure out 1 gram of sodium alginate powder on electronic mass and pour into 100 mL vial.

3. Add 125 mL of distilled water to the vial and put a lid on it.

4. Shake vial with mixture vigorously for 1 minute.

5. Add desired food coloring to the vial and shake until color is throughout, put vial to the side.

6. Measure out 2 grams of Calcium Chloride and pour into 250 mL beaker.

7. Add 500mL of distilled water to the beaker and stir with a stirring rod.

8. Using the plastic pipette or a straw, suck up some of the colored sodium alginate solution that is in the vial.

9. Squirt the sodium alginate into the calcium chloride solution in order to make "gummy worm"-like polymers.

10. In order to make Boba spheres, drop droplets of sodium alginate into the calcium chloride solution. Alter the size of the droplets for different sized spheres.

11. Allow the gummies to soak in the solution for 5 minutes; during this time begin to read the directions for the second part of the lab.

12. After the gummies have soaked, use the tweezers or your hands to take the gummies out of the solution and let them dry on a paper towel.

Name: ____ Date: ________________

Observing Osmosis

For the second part of the lab activity, you will be investigating the movement of water into and out of a polymer using your knowledge of osmosis.

Research Question
Will soaking Sodium Alginate gummies in tap water, distilled water, and/or salt water affect the size and/or mass of a gummi?

Hypothesis:
____
____
____

Materials

- 2 Boba "gummi" spheres, created from part I
- 2 plastic cups (8oz)
- 2 aluminum screens
- Distilled water
- Salt
- Paper towels
- Triple beam balance or electronic balance
- Masking tape
- Permanent marker

Procedure

1. Obtain two plastic cups and two of the boba "gummies" your group created.
2. Use masking tape and a marker to label each cup with your lab group and distilled or tap water.
3. Find the mass of each sphere using a balance. Record the data in the data table.
4. Place the sphere in the cups.
5. Pour distilled water in the cup marked distilled. Pour enough water in the cup to fully cover the bear (1/2 cup full).
6. Pour tap water in the cup marked tap. Pour enough water in the cup to fully cover the sphere (1/2 cup full).

Name: ____ Date: ________________

7. Place the cups on your tray and let them soak overnight.
8. On the next lab day, gently pour the water from each cup over an aluminum screen into a sink.
9. Catch each sphere on a separate screen.
10. Blot the screen dry by placing it on a paper towel.
11. Find the mass of each sphere. Do this by placing the entire screen with the sphere on the balance. Record the total mass. Carefully slide the sphere back into the empty cup.
12. Find the mass of the screen alone. Calculate the mass of the sphere. Record.
13. Cover the sphere with saturated salt solution. Let this sit overnight.
14. On the third lab day find the mass of the spheres using same procedure as the previous day, and record.

Data Table for Mass:

	Gummi 1			**Gummi 2**		
Mass (grams)	Before Soaking (day 1)	After tap water (day 2)	After salt water (day 3)	Before soaking (day 1)	After distilled water (day 2)	After salt water (day3)
Mass of screen plus Gummi	N/A					
Mass of screen	N/A					
Mass of Gummi bear						

Name: ____ Date: ________________

Questions

1. What happened to the spheres when placed in distilled water? Why?

2. What happened to the spheres when placed in tap water? Why?

3. Was there a difference in your results using tap water compared to distilled water? If so, why?

4. What happened to the spheres when placed in salt water? Why?

5. What do you think would have happened to the spheres if, after the last day, they were again placed in distilled water?

6. Calculate the percent change in mass after each step of the experiment.
    a. % change in mass = (final mass - initial mass)/ initial mass x 100
    b. Place the percentages in the table below:

Name: ____ Date: __________________

Bears	**% Change in Water**	**% Change in Salt Water**
Tap Water Bear		
Distilled Water Bear		

7. Make a bar graph of the percent changes.
    a. Label axes
    b. Place a scale on the vertical axis and give the graph a title. Place the data for both spheres on the same graph.
    c. If you have a negative value for a percent change, start the vertical axis at a negative number. (For example: -50, -25, 0, 25, 50, 75, 100, etc.)

Modified from http://pslc.ws/macrog/kidsmac/activity/bear.htm

Name: ____ Date: _________________