

Technology Idea: Osmosis Demonstration

Background:

Osmosis is the diffusion of water particles through a selectively permeable membrane. The concept of osmosis is rather simple, but actually observing it as it occurs can be difficult. In certain situations it can be observed indirectly, such as when a soggy piece of celery is placed into water. As water particles move into the cells, the cells of the celery gain water and pressure, eventually making the celery firmer. But this process takes time and cannot be seen happening as it occurs.

In this demonstration, you will observe the effects of osmosis as they occur.

The Questions:

Can osmosis be observed as it occurs? What is the evidence of osmosis?

Materials:

- lab stand and clamps
- USB link
- relative or low pressure sensor
- pressure sensor connector tubing
- vaseline or stopcock grease
- long piece of glass tubing or pipet
- 2 500 ml beakers
- stirring rod
- string
- tap water
- distilled water
- table sugar
- 12-15 cm long softened (soaked in water) strips of dialysis tubing
- one-hole rubber stopper of size that will fit into end of open dialysis tubing
- computer and DataStudio software

Procedure:

Step 1:

Plug the sensor into the USB link (that is connected to the computer):

Connect the pressure sensor to the computer interface (such as a USB link), then attach the connector tubing to the end of the pressure sensor.

Step 2:

Apply a small amount of vaseline to the end of the glass tubing, and insert it into the rubber stopper until about 1 cm of glass tubing sticks out the bottom of the stopper. Mix table sugar into about 250 ml of water until the water is saturated. Prepare a tube by tying one end of a strip of dialysis tubing, and then opening the other end. Pour the sugar water into the open end of the dialysis tube until it is level with the top.

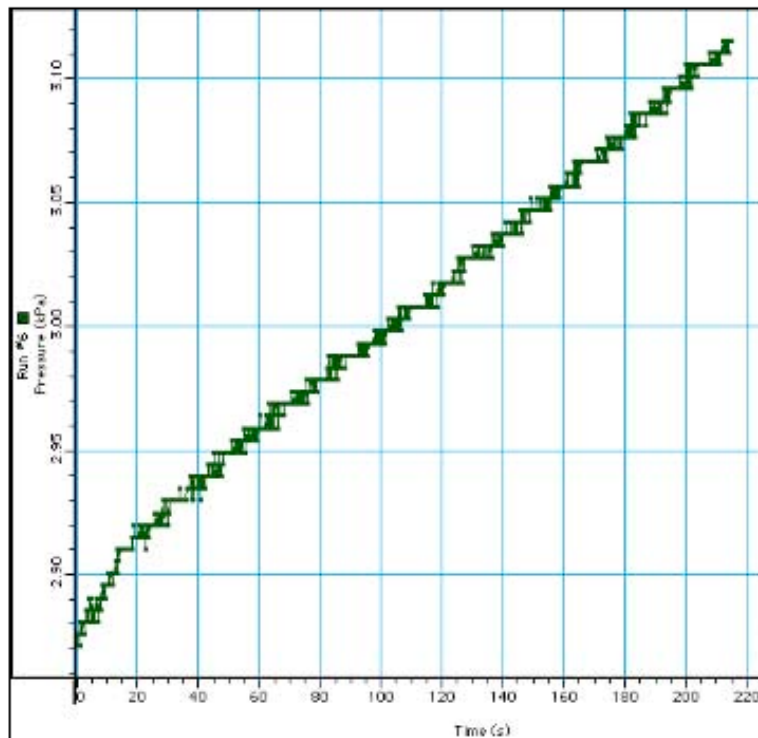
Place the rubber stopper into the dialysis tubing. Do this over a sink as some of the sugar water will overflow. When the rubber stopper is in position, use string to tie the dialysis tubing tightly around the stopper. You should now have a glass tube with a full dialysis "baggie" hanging from the end.

Step 3:

Place a 500 ml beaker on the base of the lab stand. Put about 350 ml of distilled water into the beaker. Clamp the pressure sensor assembly to the lab stand. Clamp the glass tube (vertically oriented) with the dialysis "baggie" hanging to the lab stand. Attach the open end of the pressure sensor tubing to the top of the glass tube. Now gently lower the baggie and glass tubing into the distilled water. When complete, your setup should look something like this:

Step 4:

Configure the DataStudio software to display a pressure-time graph. Click "start" in the software to begin recording data. Allow the software to collect data for a few minutes - if the data is difficult to observe, click the "scale to fit" button on your graph display to bring all the data into view. Your results may look something like this:



Analyze:

1. What was the responding variable in this experiment?
2. Why did the pressure change over time?
3. What is responsible for the change in pressure?

Conclude and Apply:

4. What is the evidence of osmosis in this demonstration?

Extending:

5. After collecting data for about 10 minutes, gently and slowly add sugar to the water in the beaker. Stir carefully so as to not disturb the dialysis tubing. Carefully observe what happens to the pressure graph. Can you explain what is happening to the line on the graph in terms of osmosis?