Osmosis in Potato Slices

Vanderbilt Student Volunteers for Science

Training Presentation

2018-2019 VINSE/VSVS Rural

Important!

- Please use this resource to reinforce your understanding of the lesson! Make sure you have read and understand the entire lesson prior to picking up the kit!
- We recommend that you work through the kit with your team prior to going into the classroom.
- This presentation does not contain the entire lesson—only selected experiments that may be difficult to visualize and/or understand.

Introduction

- Ask the students if they know what osmosis is?

- Discuss the motion of molecules using examples such as the smell of cooking from a distance or the smell of perfume in the air when someone wearing perfume walks by.
  - This happens because molecules are in constant motion and gas molecules (perfume, aroma of cooking) mix (diffuse) with the air in the vicinity.

- Show the students the balloon and Vanilla.
  - Pipette some vanilla into the balloon, blow it up and tie it.
  - Pass the balloon around and have the students smell it. Ask them if they can smell the vanilla.

- Explain that some molecules can pass through the balloon into the air.
  The balloon has very small holes that you cannot see. The holes are too small for the liquid vanilla to pass through, but the vanilla vapor molecules are small enough.

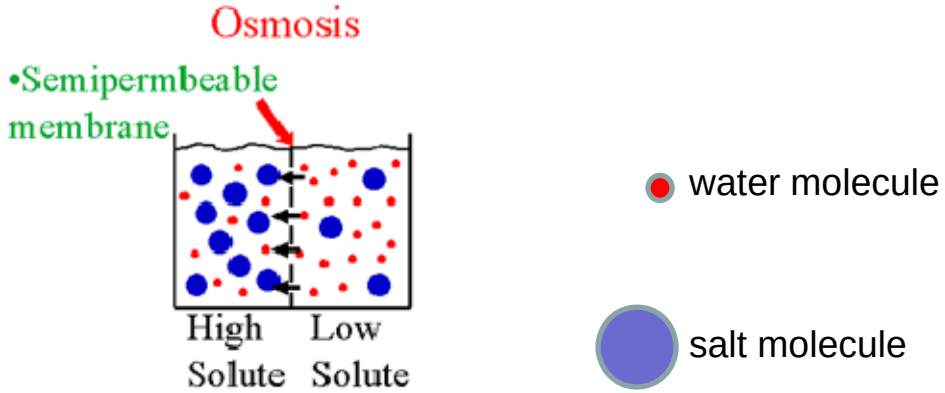
- This movement of molecules through a membrane (the balloon) is called **diffusion**.

Introduction

- **Osmosis** is a special case of diffusion, and refers specifically to the diffusion of water.
  - Water molecules can move in and out of cells in vegetables, flowers, and animals) including people).
  - The cell wall is like the balloon membrane.

- Tell the students that we are going to see how water can move INTO and OUT OF a potato slice.
- Tell them that potatoes contain water and minerals. One of the minerals in a potato is SALT.

Draw the osmosis diagram on the board.



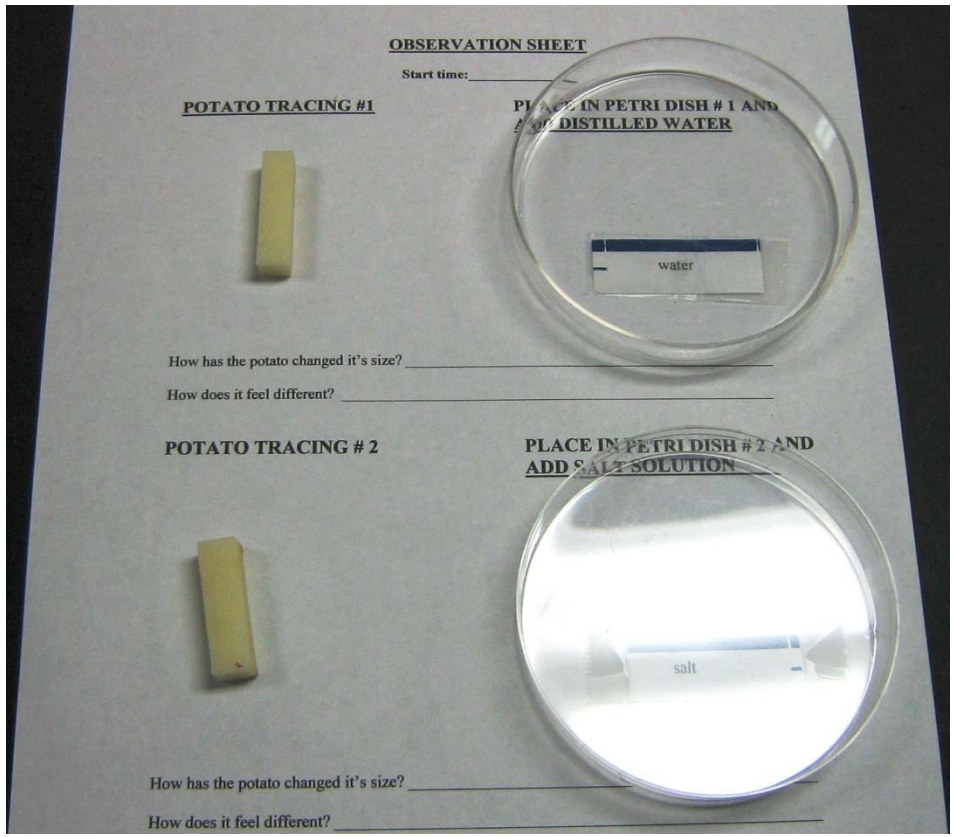
Experiment: Osmosis in Potatoes

- Distribute two slices potato to each group.

- Give each pair:
  - 1 Potato Activity Sheet, one 100 mL beaker of distilled water, 1 container of salt, 1 spoon, 1 petri dish and lid labeled #1- water, 1 petri dish and lid labeled #2- salt, 2 rectangles of potato.

Tell students to:

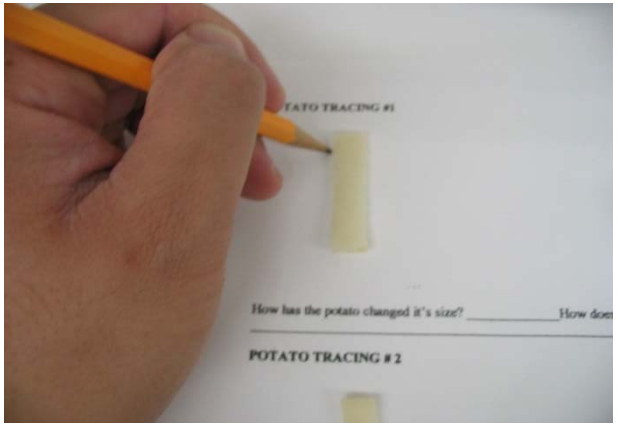
1. Place the 2 petri dishes on the appropriate sections of the Potato Activity Sheet.
2. Pour distilled water into the two small cups, to the 30 mL mark.
3. Place the 2 petri dishes on the appropriate sections of the Potato Activity Sheet.
4. Very carefully feel how rigid or floppy the potatoes are. (Warn them to NOT break them.)

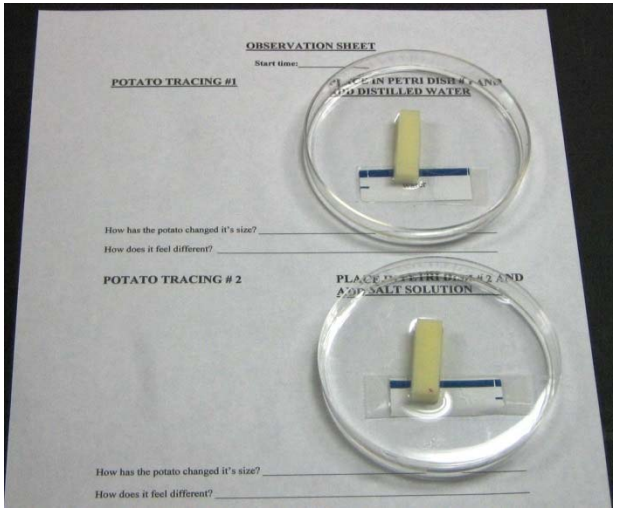


Experiment: Osmosis in Potatoes cont.

1. Trace one of the pieces of potato on the first section of the Potato Activity Sheet and place it in the bottom of the petri dish that is next to its tracing.
2. Pour distilled water from one of the cups into this petri dish #1, so that the potato slice is completely covered and place the lid over the petri dish.
3. Make the salty water by putting 1 tsp of salt into the other 3.5 ml cup and stirring until it is dissolved (it will not matter if there is some solid remaining).

4. Trace the other piece of potato on the second section of the Potato Activity Sheet.
5. Place it in the bottom of the petri dish #2, which is next to its tracing.
6. Pour the salt solution into this petri dish #2, so that potato slice is submerged and place the lids over the petri dish.
7. **Record the Start Time at the top of the page.**





Osmosis in Sodium Polyacrylate

Leave the potato experiment undisturbed for 20-30 minutes until instructed to return to check the results.

•The longer the potatoes soak - the better. While students are waiting for the potatoes to change, do the following activities.

While students are waiting for the potatoes to change, do the following activities:
Give each pair a large (16 oz) cup containing the sodium polyacrylate and a 10 oz cup containing 200 mL water.

Tell them to:

1.Pour the water into the cup with the sodium polyacrylate and stir with a spoon.

2.Observe that all the water is absorbed (forms a gel) immediately. This is osmosis - the water moved into the white powder.

3.Take out about 2 tsps of the gel and put back in to the 10 oz cup. Add 1 tsp salt and stir.

4.Observe that the gel will return to liquid. This is osmosis again – the water moved out of the gel.

Osmosis in Sodium Polyacrylate

- Tell the students that this is similar to what happens when the potatoes are placed in water.
  - When the potato is put into the distilled water, it will absorb the water. The water is trying to dilute the salt inside the potato.
  - When the potato is put into salty water, it will lose water. The water in the potato moves towards the salty water to try to dilute it.

Side Note: Uses for sodium polyacrylate include high absorbancy disposable diapers and moisture absorbent for automobile and jet fuels. When the superabsorbant polymer is distributed in sandy soil, it improves the soil's ability to retain moisture and improves its ability to support agriculture. This polymer absorbs about 300 times its weight of tap water (800 times its weight of distilled water because the ions in tap water reduce the absorbing properties of the polymer). The addition of the salt (sodium chloride) breaks the "gel" polymer apart as water leaves the polymer to dilute the salt concentration outside the polymer network.

Examples of Osmosis in Beans and Fruits

- Show the students the dried beans and the beans that have been soaking in water overnight, the soaked and the unsoaked dried fruit.
- Explain to them that water was absorbed through **osmosis**.

Example of Osmosis in "Orbs"

- Show students the orbs and tell them they are the same as a product sold in gardening stores
- Put the "orbs" into a clear 10 oz cup and add water so that it is about ¾ full. Tell students they can observe the orbs over the next few days (leave with teacher).
- Tell the class that the orbs can be reduced to their original size by putting them on a plate and left to dry for several days. They can then be rehydrated and used again. Some can be sprinkled with salt and water observed being drawn out.

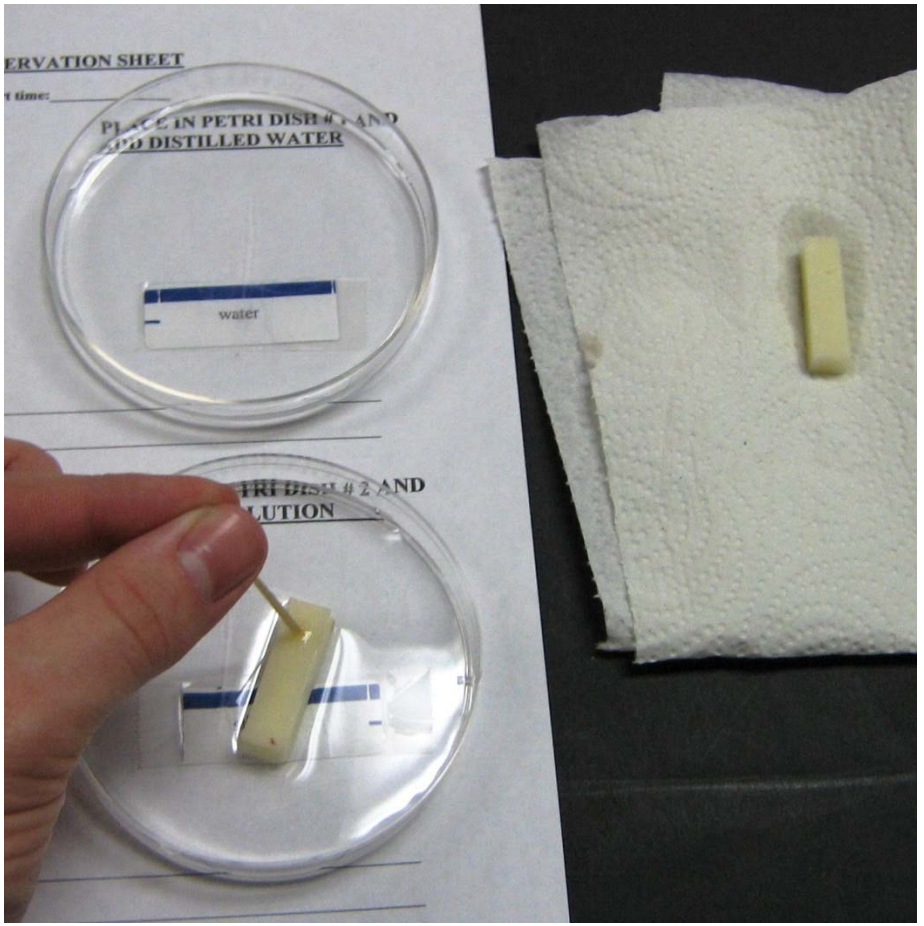
Checking potato results

After 25 minutes, tell the students to do the following:

1.Remove the first potato slice from the water and very gently blot it on a paper towel.

2.Fit the potato to one short end of the original trace (rather than a long end) and note changes in the length.

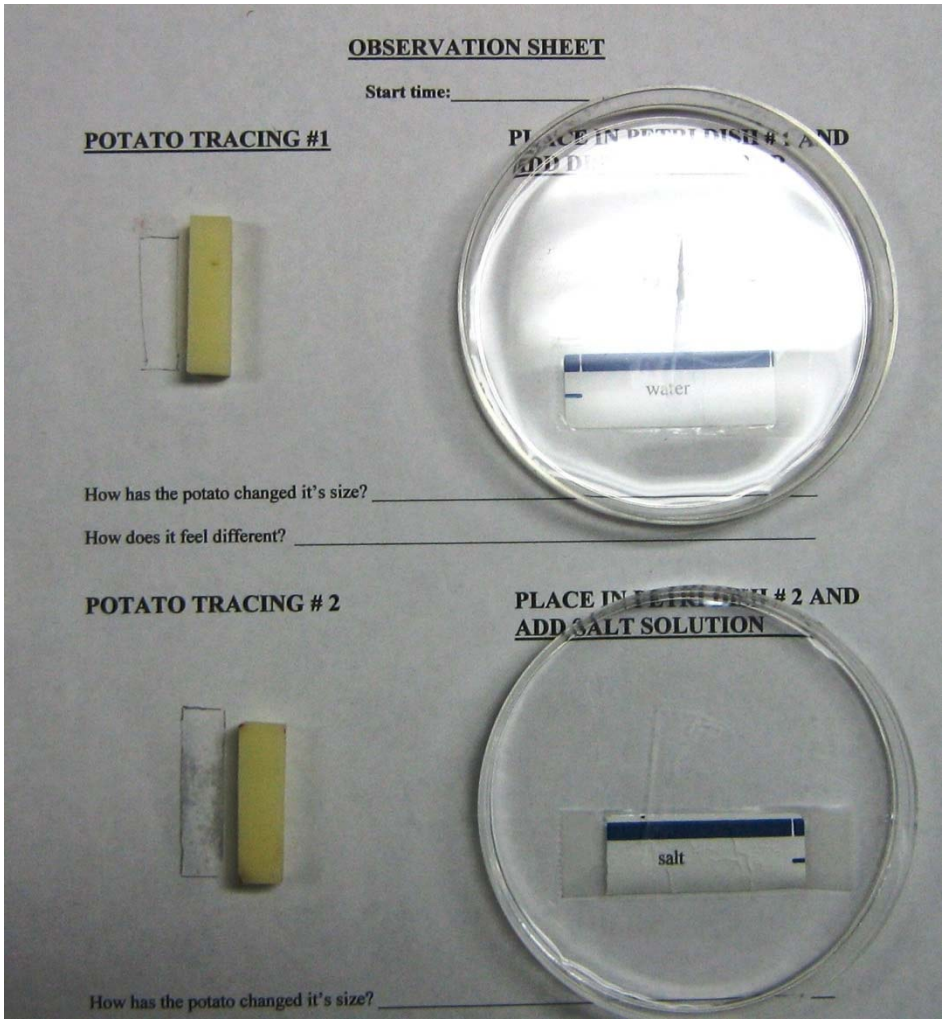
3.Repeat with the other potato slice.



Observations

- The potato slice in the water is larger, indicating that more water molecules went into the potato than came out, because there was a higher concentration of water outside of the potato. The potato slice in the distilled **water** is **longer** (and wider), indicating that more water molecules went into the potato than came out. The potato is also **stiffer**.

- The potato slice in the **salt** solution is **shorter** (and thinner), indicating that more water molecules came out of the potato than went in. This potato is very **limp**.



Explanation

Share the following explanation with students, using the diagram on the board:

- Tell students to recall that **diffusion** is the movement of molecules across a membrane from an area of higher concentration to an area of lower concentration.
- **Osmosis** refers to the movement of **water molecules** across a membrane trying to achieve equilibrium.
- Because there are no salts in distilled water, there is a higher concentration of water molecules in the distilled water compared to inside the potato. Therefore water moves INTO the potato**.**
- **Because the salt water contains a lot of salt** then there is less water in the salt solution compared with the concentration of water in the potato. This means that water from the potato will pass out of the potato in effort to achieve a balance.
- In all cases, water is moving across the membrane to equalize the concentration of the solutions.