

Teacher's Guide

Title: Is There a Connection Between Water Desalination and Making Pickles?

Name: Abdul Muttaleb Yousef Mohammed Jaber

Affiliation: King Fahd University of Petroleum and Minerals, Saudi Arabia

Lesson Objectives: The objective of this lesson is to get students acquainted with the basic principles of sea water desalination and to make them appreciate the importance of seawater desalination in the Kingdom of Saudi Arabia due to the scarcity of fresh water natural resources.

Required Prior Knowledge: This lesson does not need deep scientific knowledge by students. It is enough that the students know the difference between fresh and saline water, and are intended to focus pressure and percentage of units and the membrane force and the quasi-force.

Lesson Duration: The lesson will take approximately 48 minutes.

Lesson Breakdown:

- 1 - After scene# 1: Stimulate the students to explore their previous knowledge about the osmosis and reverse osmosis concepts. If anyone had heard of it let him share the knowledge he gathered previously with students. Discuss with them in which context they have heard of it. Get students prepared to what they are going to watch and listen to.
2. After scene# 2: Let students sit in groups and each group writes the differences between the fresh the pickled vegetables from the appearance, the shape, and the color points of views. Discuss with them their observations.
3. After scene# 3: Let students set in groups and discuss together the reasons for the changes noticed in appearance and color.
4. After scene# 4: Students sitting in groups will discuss the reasons for the changes observed in color, shape and appearance of the dried fruits. They should also discuss the relationships between these changes and those observed with the pickles and fresh fruits.

5. After scene# 5: Discuss with all students the relationships between what happened in the case of the potato fruit and the pickles. Let them conclude that in both cases water molecules move from the pure water side to the sugar or salt water side, which is from the low concentration side to the high concentration side. Discuss with them the case of pure water is placed on both sides of the potato fruit. Stimulate them to get an answer for the question "Why don't water molecules move in both sides of the potato?"

6. After scene# 6: Discuss with the students the barrier that allows water molecules to move from one side but not to the other in the case of the pickled fruits, the dried fruits and the potato fruit to reach up to the concept of "semi-permeable membrane" where the fruits tissues (shells) work as the semi-permeable membrane. Also, discuss with the students the possibility of simulating the natural semi-permeable membranes with artificial ones.

7. After scene# 7: Let students sit in groups and explain the reasons for: water movement from the soil to the leaves of the plant through their roots and stems; preserving fruits in sugar syrups; preserving dried meat and fish in table salt. If the internet is accessible let students use it to browse these examples and so many other relevant examples.

8. After scene# 8: Discuss with students the possible answer for the question "would water molecules continue moving until all pure water moves completely to the salt water side?" Give them a hint to what would happen, that is "it should stop at a certain point".

9. After scene# 9: Get the main components of the experiment with you to the classroom and discuss the way they should assemble the components together to show the movement of water from the side of pure water to the salt water side through the parchment membrane. Let students get in groups to conduct this experiment later on at home or in the school's laboratory when it is available.

10. After scene# 10: Discuss with the students the osmotic pressure concept and let them think about the possibility of reversing the direction of the water molecules movement, which is from the salt water side to the pure water side. Give them a hint about the possibility of reversing the water molecules movement by applying a pressure on the salt water side. Let them realize that the process can be reversed and will be known then as "reverse osmosis".

11. After scene# 11: Let students browse through the internet some of so many examples pertinent to the reverse osmosis and watch the movement after applying the pressure on the salt water side. Let students answer the question about the possibility

of utilizing the reverse osmosis in mass water desalination. Let them explore this possibility from the internet. Discuss with the students the desalination process that requires high pressure, water disinfection, and removal of coloring and particulate impurities.

12. After scene# 12: Let students set in groups and discuss with each other the methods used for water desalination in Kingdom of Saudi Arabia, the location of these units, the cost compared to each other. Discuss with the possibility of having personal small reverse osmosis.

Finally, I hope that this lesson has been useful for our students and full of energy and activities. In case you have any inquiry, please do not hesitate to contact me by the e-mail that will appear on the screen (e-mail appears on the screen),
ajaber@philadelphia.edu.jo

Thank you for your cooperation.