Solar Desalination

General Overview: This experiment intends to show how the energy from the sun or other light sources can be used to purify contaminated water. This purification process is called solar desalination and can be done on a small scale or a much larger scale. It uses the natural water cycle and evaporation to remove contaminants from water, and how light energy can be used for this process.

Grade Level: High School or Middle School
Subject Areas: Chemistry, Environmental Science, General Science
Time Required: Setup takes approximately 10-15 minutes. Periodic observations and data collection require about 5 minutes. Total length of experiment, from setup to clean up, should take approximately 3-4 days using natural light, and observations should be made 1-2 times per day. If heat lamps are used, observations should be made every few hours, and the experiment may be completed in 1-2 days.

Learning Objectives:

- Understand the concept of Solar Desalination
- Gain a greater understanding of how particles can be removed from a solution

Background:

Desalination, the process of removing salt from water, is a critical component of securing freshwater for certain countries, particularly those in the Middle East. Through this process, humans are effectively simulating the water cycle, wielding their knowledge of natural processes to obtain a reliable and bountiful supply of fresh water. Unfortunately, there is a high price to pay for such a valuable reaction. Because of our current capabilities, desalination requires exorbitant amounts of energy. While this makes it infeasible as a standalone freshwater source, many choose to supplement their aquifers and streams with water from desalination. Some people have even begun to turn to alternative energies to make this process more sustainable. One method is solar desalination which uses sunlight to evaporate the water - leaving the salt behind, and allowing for condensation of the purified water.

Procedure:

Each station should be set up with 3 bowls - one dark, clear, and one neutral colored, and 3 cups, along with 3 small rocks and 3 heat lamps or access to sunlight.

1. Fill each bowl with approximately 1 liter of water.

2. Pour 5 grams of salt into each bowl and dissolve through mixing with a spoon until all the salt has dissolved.

3. Place a cup at the center of each bowl. Make sure it is steady and will remain so. The lip of the cup must be above the water surface and below the top of the bowl. See Figure 1 for set up.



Figure 1. A completed solar desalination setup

4. Cover each bowl tightly with saran wrap. Place a rock in the center of the saran wrap; it should rest just above the top of the cup. The saran wrap should cover the entire top of the bowl.

5. Mark the starting height of water in each bowl with a piece of colored tape.

6. Observe the clarity of the water in the bowl, and record your observations.

7. Place all three bowls under a heat lamp or in direct sunlight. Under natural sunlight, it will take longer for desalination to occur.

8. **For heat lamps**: Assess the changes in water level by marking the water level with a piece of tape each hour or two. Record the date and time of each water level measurement by writing it on the piece of tape. The desalination process should take approximately 1-2 days to complete.

9. **For natural light:** Assess the change in water level by marking the water level with a piece of tape each day. This process will likely take longer, approximately 3 to 4 days,

and will depend on weather and the amount of sunlight available. Record the date and time of each water level measurement by writing it on the piece of tape.

10. Each time you assess the water level change, be sure to mark the new height and record the date/time. Examine the clarity of water and record your observations on the data table.

11. After most of the water has evaporated remove the saran wrap and examine the cup and bowl. Observe and record changes in the appearance of the water (or sediment) in the bowl and the appearance of the water in the cup. Measure and record the volume of water left in the bowl and the water in the cup.

12. Clean up, empty bowls and cups into the sink.

Data Table

Day	Clarity of Water	Change in water level	Volume in Bowl	Volume of water in Cup
Start				
Day 1			N/A	N/A
Day 2			N/A	N/A
Day 3			N/A	N/A
Day 4			N/A	N/A
Final				

Reflection Questions

1) At the end of your experiment, which of the bowls had the most water in the cup? Which had the least?

2) Why do you think there were differences in water level in the 3 bowls?

3) Did the clarity of the saltwater change from the beginning of the experiment to the end? Why or Why not?

4) Was there any salt at the bottom of the bowl at the end?