Name_____Date_____Period_____

Marine Chemistry: Desalination

Background

Without water, there is no life and while Man continues to discover it in a myriad of places scattered around the solar system, the Earth is the only place currently known to harbor life. More importantly, the majority of the life on Earth that relies heavily upon the small proportion of water that does not contain salt is facing greater stresses by the day as Man's fingerprint on the environment gets larger and larger.

> *Water scarcity is an abstract concept to many and a stark reality for others. It is the result of myriad environmental, political, economic, and social forces.*
>
> *Freshwater makes up a very small fraction of all water on the planet. While nearly 70 percent of the world is covered by water, only 2.5 percent of it is fresh. The rest is saline and ocean-based. Even then, just 1 percent of our freshwater is easily accessible, with much of it trapped in glaciers and snowfields. In essence, only 0.007 percent of the planet's water is available to fuel and feed its 6.8 billion people.*
>
> -National Geographic Society (2016)

In *The Rime of the Ancient Mariner* by Samuel Coleridge, he made the prophetic statement "...Water, water everywhere, but not a drop to drink". Today, this statement is especially important since our dwindling freshwater supplies have led us to look to the 97% of the planet's water found in the oceans for a lifeline. Desalination is not a new idea but it is rapidly moving from a novel way of creating drinking water to a necessary one. Although only about 1% of the world's population currently relies on desalinated water, a United Nations study published in 2012 has suggested that as much as 14% of the world's population may require it by 2025. In 2018, the city of Cape Town, South Africa nearly became the first city in history to actually run out of drinking water. Through severe water restrictions and emergency supply augmentation, the city was able to avoid what came to be known as "Zero Day" but the incident brought the world's growing freshwater crisis to the international spotlight.

In this lab exercise, you will attempt to desalinate a sample of prepared seawater into freshwater. There are no shortages of methods that can be researched and set up but, regardless of the method used, the experiment must be able to be completed in a double lab period. Early submission of the proposed experiment is required to assure all necessary equipment is on hand the day of the experiment.

A Special Note About Seawater

Remember, seawater is not just H_20 and table salt. NaCl is just one of several compounds typically found in the world's oceans. Each has different molecular weight and chemical characteristics so a process that works for the removal of one impurity is no guarantee it will work for another. The seawater samples you will be provided with contain:

Sodium chloride	Sodium sulfate	Sodium bicarbonate	Sodium fluoride
Potassium chloride	Potassium bromide	Boric acid	Solid particulate

Instructions

Using supplies provided by your instructor and/or those supplied independently, your task is to design an experiment that can desalinate as much of a 500 ml sample of artificial seawater as possible in the time permitted. When experimental time has expired, desalinated samples will be tested via a conductivity meter and then measured. The group with the most confirmed desalinated water will be declared the winner. Groups of 3-4 students are permitted (no more than 7 groups total due to lab space).

Although the typical format for labs used routinely in bio./chem./phys. is rarely used in the geosciences, this is one instance where it will be useful. For this lab, please write up the experiment using the following format used by Penn State University. Details about this type of format can be found at https://www.craftofscientificwriting.com/laboratory-reports.html

- Abstract (5 points)
- Introduction (10 points)
- Procedures and Methods (15 points)
- Results and Discussion (20 points)
- Conclusions (20 points)
- Appendices (including references) (0 points)

The completed lab should be typed and formatted in order as shown above. Total points earned will be scaled to the actual point value of the lab (30 pts.).

Hints/Advice

- Discuss the best way to accomplish this task with your group.
- Choose a method of desalination that can be easily scaled down to something manageable by the group.
- Plan ahead. Certain types of lab equipment will require advanced notice to procure so coordination with the instructor is vital.
- Make sure all materials to be brought in by the group are accounted for prior to the lab period. Equipment can be brought in to Room 202 in advance.
- Remember that the experimental window is limited to a single block period.