CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Alec R. Isaacman

Project Number

34939

Project Title

Osmotic Power: The Impact of Water's Salinity Level on the Production of Osmotic Generated Power

Abstract

Objectives/Goals

The objective is to determine the impact of water's salinity level on the production of osmotic generated power?

Methods/Materials

Two chambers separated by an osmotic membrane were filled with equal amounts of water. One with fresh water and the other with salt water (with different salinity levels). The three most common ocean salinity levels [Polyhaline (18-29 parts per thousand), Mixoeuhaline (30-39 parts per thousand), and Metahaline (40-49 parts per thousand)] were tested to determine the rate of absorption of salt water as it pulls fresh water (pressurized with a bicycle pump) through an osmotic membrane over a 20 minute time span.

Key items in the construction of the testing tank: Flat sheet reverse osmosis membrane as the chamber divider; Plexiglas to support the membrane; purified and salt water.

Results

Polyhaline was tested first. Over 20 minutes the volume of water on the salt water side increased by an average of 32.0625 cu.in. The average increased to 34.4375 cu.in. for Mixoeuhaline (30-39 parts per thousand) was tested. This is an increase of 6.897% over the Polyhaline. The rate of absorption was the highest for Metahaline, which resulted in an average increase of 37.40625 cu.in. Metahaline salinity level absorbed 7.937% more than the Mixoeuhaline and 14.286% more than Ployhaline. The results show that the greater the level of sodium chloride in water, the more fresh water it will absorb through an osmotic membrane.

Conclusions/Discussion

Osmotic power has real world applications and is currently being used to create energy in Norway. This experiment sought to determine the best locations in the world to use osmotic generated power. By testing the impact of ocean's most common water salinity levels on the osmotic process, I could determine where in the world this type of power plant would be most efficient. From my research, I believed that because there are more sodium chloride(NaCl) molecules in the higher levels of salt water, the freshwater would be absorbed more quickly through the osmotic membrane. In fact, Metahaline ocean water had the highest efficiency rate most likely because it contains the highest salinity level. With an increased rate of absorption, a power plant would use less energy to generate power, making it more efficient when built near oceans with higher salinity levels.

Summary Statement

The salinity level of ocean water impacts the efficiency of osmotic generated power.

Help Received

Father help construct the testing tank and assemble the display.

Preliminary