Greater San Diego Science and Engineering Fair
2015 PROJECT SUMMARY

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Project Title:

Solar Desalination: An Eco-Friendly Solution for California's Water Independence

Abstract

Objectives or Goals:
The objective is to determine if solar desalination of ocean water can be used to help end California's water issues.

Hypothesis
It is hypothesized that the rate of clean water production should be directly proportional to the reverse osmotic pressure. Higher the reverse osmotic pressure, faster the rate of clean water production. In addition, the amount of energy required for the reverse osmosis process should be directly proportional to the amount of salinity in the feed water. Higher the salinity, greater the energy requirement to purify a fixed amount of water.

Materials and Methods:
A solar panel was used to capture energy from the sun and convert it into electrical energy. This energy was stored in a 12V DC rechargeable battery and used to power a water pump. The salt water was pushed by the pump into a Reverse Osmosis (RO) system. The RO system generated clean water and also waste water also known as brine. A total of 5 salinity solutions were desalinated under varying pump pressures over an 8-day period.

Results
As the pump pressure was increased, the time taken to collect the same amount of clean water decreased. It was also noted that as the salinity of feed water into the RO system increased, the amount of energy it took to clean that water sample also increased.

Conclusions/Discussion
The conclusion was made for the salinity levels tested (0.5gm/liter to 1.5gms/liter), the most optimum pressure point is somewhere between 60 and 70psi. Going beyond this pressure point resulted in a greater energy usage for very little gain in clean water collection. It was also observed that the rate of brine production far exceeded the rate of brine treatment via osmosis

Summary Statement
The bench model used in this experiment served as a miniature replica of a commercial solar desalination system. The model proved that ocean desalination can be a viable method for creating a new clean water source for California.

Help Received
My dad was a huge help in this project through support and encouragement. He helped me set up my experiment and dedicated many hours into helping me. My teacher, Mrs. Gillum, helped me by answering all my questions and by analyzing my research paper. My mentor, Dr. Matthew Stroud, helped me design this experiment and proof read my final research paper. Lastly, I would like to thank the company Applied Membranes for taking time out of their schedule to look over my bench model design and for providing me with many parts to my experiment.

Writing Your Abstract

Objective or Goal:
State the objective, goal, or hypothesis upon which the project is based. Example: My objective was to learn if the feeding habits of hummingbirds are affected by color.

Materials and Methods:
Indicate the materials, methods, and experimental design used in your project. Briefly describe your experiment or engineering methods.

Results:
Summarize the results of your experiment and indicate how they pertain to your objective.

Conclusion/Discussion:
Indicate if your results supported your hypothesis or enabled you to attain your objective. Discuss briefly how information from this project expands our knowledge about the category subject.

Example

The Frequency of Antibiotic Resistant *E. coli* in Alimentary Tracts
Objective: The objective is to determine if the average American has ampicillin- and tetracycline-resistant strains of *E. coli* in their alimentary tract.

Materials and Methods: Informed consent was obtained from 100 randomly selected people, 50 men and 50 women ranging in age from 10 to 92 years. An isolate of *E. coli* was obtained from the stool of each subject and grown in the presence of tetracycline and ampicillin. The area of inhibition was measured and compared to that of a non-resistant strain of *E. coli*. The percentage of sensitive and resistant organisms was determined by age and sex.

Results: Thirty percent of the men and 24% of the women were found to have ampicillin-resistant *E. coli*. The majority of the sample population was found to be under the age of 50. Slightly more people age 50 and over were found to be resistant than those under 50. Only 12% of both men and women were found to have tetracycline-resistant *E. coli*, with the older population again having a somewhat higher incidence of resistance.

Discussion: Penicillin and its derivatives such as ampicillin, were the first commercially available antibiotics. Tetracycline was introduced later. The length of exposure to the antibiotics is reflected in the greater percentage of subjects with ampicillin-resistant *E. coli* (24% to 30%), compared to those with tetracycline-resistant organisms (12%). In addition, subjects age 50 and over who would have a longer life-time exposure to both antibiotics were more likely to harbor antibiotic resistant *E. coli*. These data suggest that antibiotics should be carefully dispensed and monitored by health care professionals.

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