CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
James M. Levy

Project Number
J1119

Project Title
Let's Drink the Sea! Effects of Design Differences in Evaporation/Condensation Stills on Rate of Seawater Desalination

Abstract

Objectives/Goals
The need for fresh drinking water becomes more urgent as population growth and pollution deplete our supplies. Desalination stills remove salt from ocean water in an environmentally responsible way, but their pure water production rate is slow. This study explored design criteria that might be effective at increasing that rate. It was hypothesized that the best configurations would be those with a large heat differential, and a greater relative surface area available for evaporation.

Methods/Materials
Desalination stills were built from large metal cans and cake pans, graduated cylinders, and funnels. Salt water was placed in each still, covered with plastic that was weighted to sag down into an inverted cone, and subjected to evaporation/ condensation cycles, in order to collect pure water. Rate of collection was recorded as environmental conditions and design elements were varied, including surrounding air temperature, heat differential in the still, surface area of salt water, slope angle of the plastic condensation surface, and color of pans.

Results
All still configurations showed improved rates of pure water production when they were wrapped in black plastic to hide their shiny metal exteriors, and run outdoors in direct sunlight on warm days, as opposed to at identical temperatures indoors. However, the most distinct rate improvements came from physical modifications to the still itself, not these environmental adjustments. The model that outperformed all others was made from a tall, narrow can, providing just a small surface area for evaporation.

Conclusions/Discussion
My results did not support my hypothesis. A large surface area to improve evaporation rate was incorrectly assumed to be the crucial factor in speeding desalination. Instead, rates improved when the condensation surface could drain more quickly, and so be freed up for another round of condensation. This worked best in the tall, skinny still, where the plastic wrap came down to a very steep point. Improving this type of design detail helps make environmentally friendly but slow desalination stills more efficient.

Summary Statement
A homemade desalination still designed to maximize the speed with which water clears from the condensation surface, readying it for another evaporation/ condensation cycle, proved to be a critical element in increasing desalination rates.

Help Received
Graduated cylinders and a balance were borrowed from my school. My family tolerated stills in the bathroom and on the porch for many days.