CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Matthew R. Johnson

Project Number
J0112

Project Title
Flow Dynamics of the Salt Oscillator

Abstract

Objectives/Goals
The objective of my project was to determine if the salt density and the size of the hole connecting the two fluid layers affected the period of the flow oscillations in the salt oscillator.

Methods/Materials
I built my salt oscillator using two cups, table salt, dye so that the fluid flow could be seen, and fresh water. The experimental setup consisted of a cup of salt water with a small hole in the bottom immersed in a larger cup of fresh water. I ran a series of trials with hole sizes varying between 1 mm - 10 mm and with a range of salt densities, and measured the resulting oscillation periods. I used a micrometer to measure the size of the hole, a stopwatch to measure the oscillation period, scales, measuring spoons, and measuring cups. I used a digital camera to take pictures of the flow.

Results
The results showed that the oscillation period does depend on the salt density and hole size. The oscillation periods were in the range of 1.0 sec - 4.0 sec. During each trial the salt solution initially flowed down in a narrow stream and settled on the bottom of the fresh water cup. After a period of time, the salt water stream narrowed even further and then stopped. Shortly thereafter, the up flow and down flow oscillations started, sometimes continuing for several hours. Oscillations did not occur during the trial with the larger hole size of 9.9 mm.

Conclusions/Discussion
The oscillation period of the salt oscillator was more sensitive to the hole diameter than to changes in the salt density. Also, oscillations did not occur if the hole size got too large. I learned some things about layers of fluids with different densities, pressure in fluids at different depths, laminar fluid flow and flow of fluids with different densities through each other, diffusion, unstable systems and oscillators. I also learned how to use a micrometer.

Summary Statement
The project tested the behavior of flow oscillations in a salt oscillator made with salt water overlying fresh water.

Help Received
I would like to thank my mom and dad for supporting me with this experiment.