CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Kelly Eaton

Project Number
S1506

Project Title
Oil Intrusion: How Temperature Affects Diffusion

Abstract

Objectives/Goals
I investigated the relationship between diffusion in water and water temperature, with application to the spreading damage of an oil slick in open ocean. I hypothesize that diffusion rate will increase in direct proportion to absolute temperature.

Methods/Materials
To quantify the measurement of diffusion, I used a droplet of concentrated sodium chloride (salt) solution as the solute rather than crude oil. Since a salt molecule separates into electrically charged ions when dissolved in water, the electrical conductivity between a pair of electrodes can be used to detect when the droplet has diffused to the region between the electrodes. De-ionized (DI) water is used as the solvent rather than ocean water. The experiment is repeated through a range of temperatures of the water solvent to discover the relationship between diffusion and temperature.

Results
Over the experimental 20 - 90 Celsius range, diffusion was observed to increase approximately exponentially with temperature rather than linearly as was hypothesized.

Conclusions/Discussion
Because temperature increases the diffusion rate, a warm-water oil spill is potentially more troublesome than a cold-water spill. Oil spills in warm waters spread faster than I predicted, and therefore can result in more serious environmental consequences over a larger area.

Summary Statement
I experimentally determined the relationship between water temperature and diffusion with application to the spreading of oil spills in the ocean.

Help Received
My mom helped record data that I read off to her during the experiment. She also took pictures of me conducting my experiment. My friend's dad loaned me some scientific equipment from his lab. My dad explained log graph paper to me.