CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
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Project Number
S1512

Project Title
Microwaves: How Cool Are They? Correlation Between Molarities and Temperature Change of Solutions if Heated by Microwav

Abstract

Objectives/Goals
To find the relationship between the concentration by mass of sugar in water and the change in temperature of that solution when it is exposed to microwaves.

Methods/Materials
Six solutions were prepared with constant 50 g of water in each and varying amounts of sugar from one to the next, with 0 g in the first, 10 g in the second, and so on with 50 g in the last. After dissolving the sugar with a stirring rod, the temperature was taken. Then, each was exposed to microwaves for 15 seconds in a microwave oven and the change in temperature was recorded. Process repeated five times and results were averaged. Same tests performed with constant 10 g of sugar and varying amounts of water in the same fashion as above.

Results
The higher percentage of water by mass in a substance, the hotter a substance will get if the mass of water is constant. An increase in the amount of water results in a smaller increase in the temperature change. A decrease in the amount of water results in a greater increase in the temperature change. Higher concentrations of sugar result in a smaller increase in temperature change. Lower concentrations of sugar result in a greater increase in temperature change.

Conclusions/Discussion
There is a direct correlation between the concentration of water by mass and the temperature change of a solution. It is so predictable that I derived an equation in which I can predict the exact temperature change of a sugar solution with known molarity and mass (time exposed to microwaves must remain constant). Other solutions can also be applied to the equation, but constants will vary depending on specific heat capacities of solutions and the purity of the solution.

Summary Statement
Figuring out the correlation between the molarities of sugar and water solutions and the change in temperature of that solution when it is exposed to microwaves.

Help Received
Classmate L. Charles Jarrott helped derive the equation. Dr. John Foster (high-energy physicist) helped me understand how microwaves effect substances exposed to them and how that relates to water.