



**CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY**

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| Name(s) Audrey A. Lee | Project Number J1520 |
| Project Title Can the Index of Refraction Determine the Concentration of Sugar in Water? | |
| <p style="text-align: center;">Abstract</p> <p>Objectives/Goals This project's purpose was to see if sugar concentrations in water can be found using the index of refraction</p> <p>Methods/Materials The aquarium was made using two sheets of 1/8" thick 16" by 14" Lexan plastic, silicone adhesive caulk, a piece of half inch plywood 30.5" long and 16" tall, nails, a 12" piece of 2" by 4" pine, screws and washers, screwdriver, two pieces of 2" by 6" lumber, a jigsaw, a hammer, a Bosch Digital protractor, a digital multimeter with a thermometer, a laser pointer, a wooden bracket for the laser, and household glue. The sugar water was made by pouring the correct amounts of sugar into 3000 cc of distilled water. There were five different concentrations: 1%, 2.5%, 5%, 10% and 20%. Each one was poured into the aquarium using a funnel, and it was filled until a marked point. Then the laser pointer moved with the digital protractor until it hit the nails with its beam. It needs to hit the nails, because they mark the compliment to the angle of refraction, so it is known every time. When the laser beam hit the nails the angle was recorded, as it was the compliment to the angle of incidence. The averages of the angles was found, and these averages were subtracted by 90 because they were complementary to the angle of incidence and the angle of refraction, which are needed in the equation for the refractive index which is $n(\text{index of refraction}) = \sin i (\text{angle of incidence}) / \sin r (\text{angle of refraction})$. Then all the tests' index of refraction for each concentration of sugar water was averaged out so there was only one answer for 1%, one answer for 2.5%, etc.</p> <p>Results For the averaged index of refraction, the refractive index for the control was 1.326. The refractive index for 1% was 1.334. The refractive index for 2.5% was 1.338. The refractive index for 5% was 1.342. The refractive index for 10% was 1.345. The refractive index for 20% was 1.357.</p> <p>Conclusions/Discussion The results showed that the index of refraction increased as the sugar concentration increased. This means that the light was bent more as more sugar was added. This happened because the higher the sugar concentration, the denser it was so it slowed the light down so it had to bend more. This shows that the hypothesis was correct. The concentration of sugar water can be determined by the index of refraction because the index of refraction increases in proportion to the sugar concentration.</p> | |
| Summary Statement This project determined if the index of refraction can measure the concentration of sugar in water. | |
| Help Received My dad helped construct the apparatus. | |