Determining the Concentration of Sugar Within a Liquid Using the Refraction of Light

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When light travels from one medium into another, it bends. This phenomenon is called light refraction. The angle at which the light bends is determined by the density of the medium it travels through. This project investigates whether the sugar content can be reliably calculated without the use of chemical tests or specialized lab equipment, and instead by using a low-power laser pointer and geometric calculations. Known sugar solutions of 0g, 10g, 20g, and 30g of sugar per 100mL of water were prepared and tested by measuring the displacement of the laser beam when shone through a hollow acrylic prism with each solution. This is then repeated 5 more times to ensure accuracy between findings. Snell's law was then used to calculate the light refractive index of each solution. The results showed a consistent relationship between the sugar concentration and refractive index. As sugar concentration increased, so did the refractive index. This is consistent with the hypothesis that, as sugar concentration increases, so will the refractive index, because more sugar means a higher density. These findings demonstrate that this is an effective and low-cost method for estimating sugar content in clear liquids. Practical applications for this exist in the beverage industry to determine sugar concentrations of drinks, or in the brewery industry to get an early estimate of alcohol capability after fermentation.

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