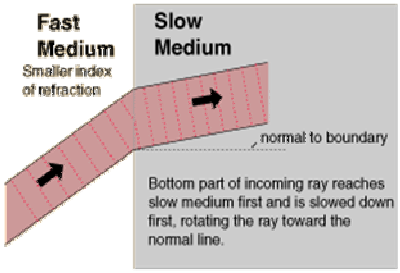
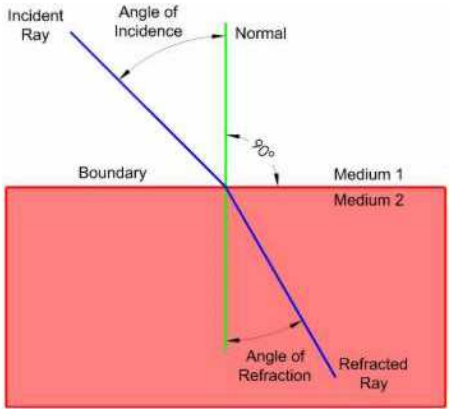
REFRACTIVE INDEX IN THE SUGAR INDUSTRY

The refractive index of a medium is the measure of how much light is bent by the medium as well as how much the speed of light is reduced inside the medium. As the light passes from one transparent medium to another, it changes speed causing it to bend. The degree at which the light bends depends on the refractive index of the two mediums and the angle between the light ray and the line perpendicular (normal) to the surface separating the two mediums. The amount of bending depends on the indices of refraction of the two media as mentioned and is described quantitatively by Snell's Law.



The index of refraction is defined as the speed of light in vacuum divided by the speed of light in the medium.

$n = c / v$



The angle between the light ray and the normal as it leaves a medium is called the angle of incidence. The angle between the light ray and the normal as it enters a medium is called the angle of refraction.

REFRACTIVE INDEX IN THE SUGAR INDUSTRY

The refractive index is made use in the food industry to measure the concentration of sugar (sucrose) in a particular item. In the industry BRIX is used for measuring the approximate amount of sugars in fruits, vegetables, juices, wine, and soft drinks in the sugar manufacturing industry. Brix is defined as the concentration of sucrose dissolved in water, making it ideal for many sugar-related applications. A refractometer can be used to measure the concentration of sugar in an item by measuring light refraction. When light enters a liquid it bends so the more concentrated a solution is with dissolved solids the more the light will bend. A refractometer measures the degree the light has been bent. An index value has been established for each of these angles of refraction and this "Refractive Index" (nD) can be used to either identify or evaluate a given liquid sample. The prism in a refractometer has a greater refractive index than the sample solution. Measurements are read at the point where the prism and solution meet. With a low concentration solution, the refractive index of the prism is much greater than that of the sample, causing a large refraction angle and a low reading. The reverse (lower refraction angle and higher reading) would happen with a highly concentrated solution. The Brix scale, due to it's flexibility of use among nearly every industry, is the most common scale found on refractometers today. It directly correlates to the Refractive Index (nD) scale and is calibrated to the number of grams of cane sugar (sucrose) contained in 100 grams of sucrose solution. Therefore the Brix reading equals actual sucrose concentration.

Often solutions contain many kinds of ingredients other than sugar and conversion tables for such specific solutions are useless due to the occurrence of more than one soluble solid. In these instances an industry standard is used or one can be created by testing from a known desired concentration level. For example,

Beverage X has a normal Brix reading of 12.4%. This number can then be used for all standardizing and quality control for this product's concentration level.

BRIX REFRACTOMETER COMPARISON CHART

	MODEL	RANGE	DIVISIONS	ACCURACY	APPLICATIONS
2211	N-1 Alpha	0 - 32% Brix	0.2%	0.2%	fruit, fruit juice, cutting fluids all metal prism housing for good heat transfer
2121	N-2E	28 - 62% Brix	0.2%	0.2%	concentrated fruit juice
2122	ATC-2E	28 - 62% Brix	0.2%	0.2%	automatic temperature compensation
2131	N-3E	58 - 90% Brix	0.2%	0.2%	high Brix range
2141	N-4E	45 - 82% Brix	0.2%	0.2%	condensed milk, juices
2151	N-10E	0 - 10% Brix	0.1%	0.1%	cutting fluids, fruit juice
2161	N-20E	0 - 20% Brix	0.1%	0.1%	most fruits, cutting fluids
2164	ATC-20E	0 - 20% Brix	0.1%	0.1%	automatic temperature compensation
2181	N-50E	0 - 50% Brix	0.5%	0.5%	juice, coffee, ketchup
2200	H-50	0 - 50% Brix	0.5%	0.5%	hot samples, high acid content samples (jams, marmalades)
2201	H-80	30 - 80% Brix	0.5%	0.5%	hot samples, high acid content samples (jams, marmalades)
2340	500	0 - 90% Brix	0.2%	0.2%	wide Brix range
2912	ATC-1E	0 - 32% Brix	0.2%	0.2%	automatic temperature compensation

HISTORY OF BRIX AND BENEFITS

Professor A. F. W. Brix was a 19th Century German chemist (b.1798, d.1890). He was the first to measure the density of plant juices by floating a hydrometer in them. The winemakers of Europe were concerned that they could not predict which of various grape juices would make the best wine. The benefits of this physics of being able to judge quality ahead of actual bottling was of immense importance in an industry where a bottle of the best wine might sell for hundreds of times more than a bottle of everyday wine. Professor Brix was greeted as a great hero and was honored by having the measuring process named after him.

CONCLUSION

In conclusion, this case study relates to our practical because we are going to study the effect of sugar concentration on the refraction light. My prediction will be that as the concentration of sugar increases the degree at which the light is bent increases.

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