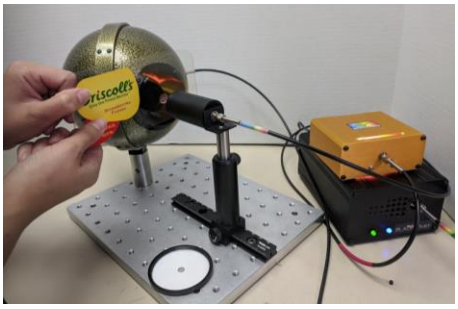
Haze Measurement Application Note

Haze is defined as the cloudiness of a product that is caused by the scattering of light.

Measuring Haze

Haze is an important appearance attribute that directly affects human perception and plays an important role in consumer demand. It can be the difference between deeming something as shiny, beautiful and new, or dingy, weathered, and worn. Haze can be quantified and then used to assess the quality of objects such as liquids, glass, and many types of plastics! This summer the StellarNet Applications team thought it would be fun to test a variety of different samples for haze and share their results with you!



- Plastic packaging and films
- Displays and windows (auto & aero)
- Liquid beverages
- Diffusers for lighting

The technical definition of haze is the amount of light subjected to wide angle scattering greater than 2.5 degrees off-center divided by the total light transmission (ASTM D1003). Standards are available to measure system accuracy and obtain a single haze % value for each sample.

Light may be scattered by particles suspended in the substance, such as pigment particles or contaminants, or by an imperfect surface caused by dirt, oil, or a fine texture.

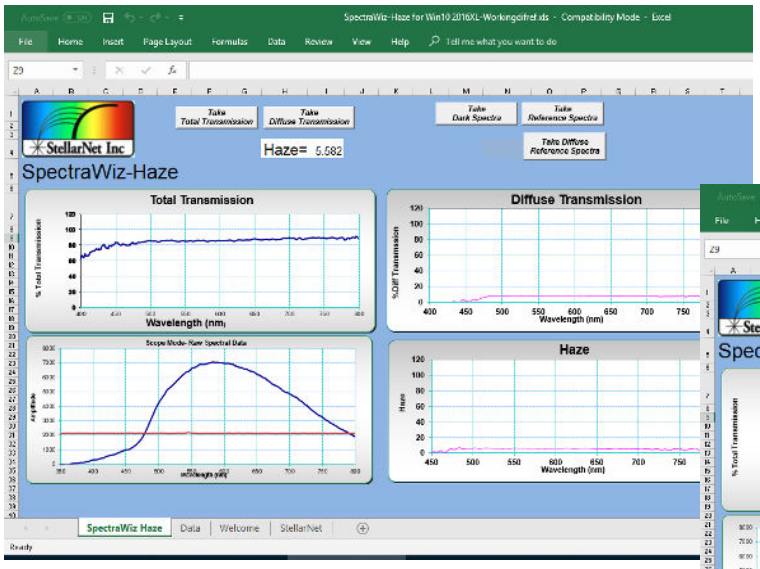
Haze Measurement Application Note

APPLICATION: PLASTIC PACKAGING

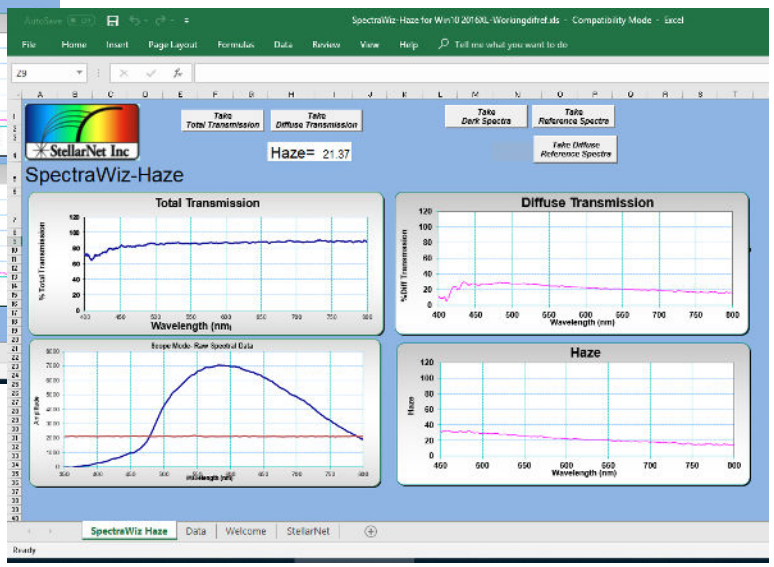
The fresh fruits of summer are defined by their bright colors. However, the haze quality of container packaging can dull those colors for the consumer, leading to a potential loss in sales.

In this example, fresh strawberries and blueberries, packaged in clear plastic containers from different manufacturers reveals exactly why those strawberries look so tasty!

STRAWBERRY CLAMSHELL CONTAINER
HAZE= 5 %



BLUEBERRY CLAMSHELL CONTAINER
HAZE = 21 %



These are spectra from the StellarHaze system. Two simple measurements are taken for each sample, Diffuse Transmission & Total Transmission, and by dividing on by the other, percent haze is achieved.

Haze Measurement Application Note

APPLICATION: Beverage Haze

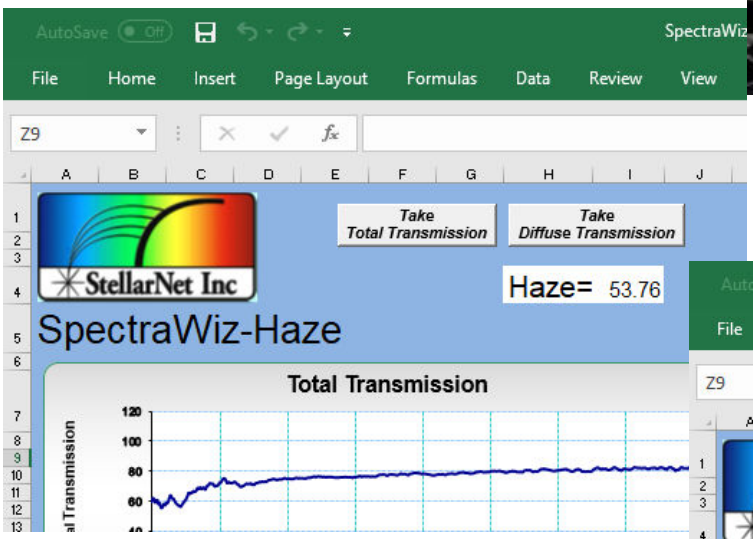
Tea, Beer, Water and other mass produced drinks use on the “cloudiness” of the product to communicate certain attributes of quality to the consumer. In beer, for example, lagers and ales should be clear while a heferweisen or wheat beers are expected to be a bit cloudy.

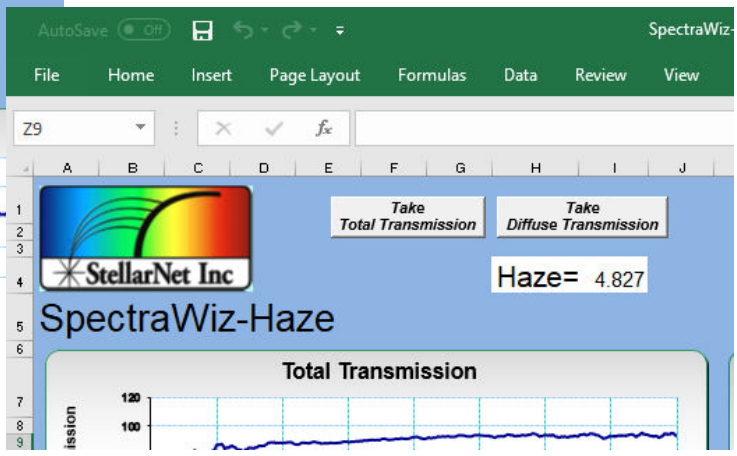
In our example at right, the peach drink appears quite clear to the eye, while the coconut drink appears cloudy, like lemonade.

By using an optical quality cuvette similar to the one shown (and available from several lab supply vendors), the cloudiness, or haze, of the actual liquid can be measured easily and quickly.

Coconut Drink Liquid
HAZE= 54%

Peach Drink Liquid
HAZE = 5%





This is the Haze readout from the StellarHaze system after both spectra are taken.

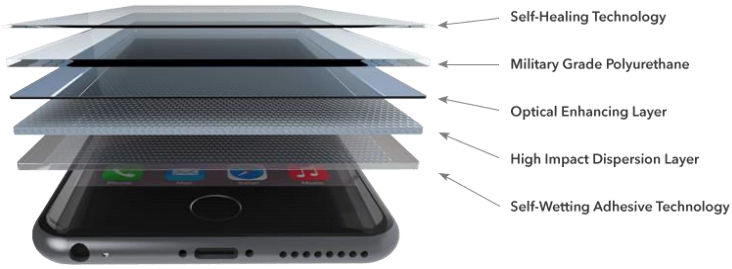
Haze Measurement Application Note

APPLICATION: Display / Screen / Window Film / Optical Window

Touch-sensitive display screens and optical windows are complex and high-tech; even the screen protectors placed on the screens have approximately five different layers of materials. They key design factor in both the display and the protector is transparency.

The crisper the image, the more valuable the device. Haze measurements can monitor the quality of materials in production, and assist research teams in analyzing new materials and methods of design.

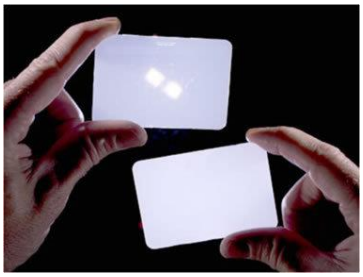
Below, the haze of over-the-counter screen protectors are measured, with the result delivered in percentage values. The closer the value is to 0%, the less light is scattered travelling through the median.

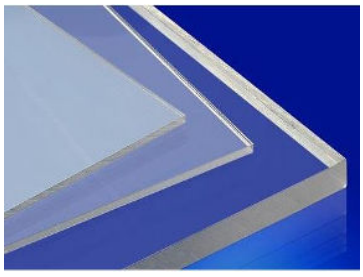


Screen Protector
HAZE= 3.8%

APPLICATION: Diffusers for Lighting

Light scientists and developers of new luminaries often use optical diffusers to spread the light emitting from the bulb or LED in order to have specific affect. LEDs are often directional and have visible "hot spots". Using an optical diffuser with a known Haze allows the lighting designer to remove all the hot spots and uniformly illuminate the room or space without losing too much signal.

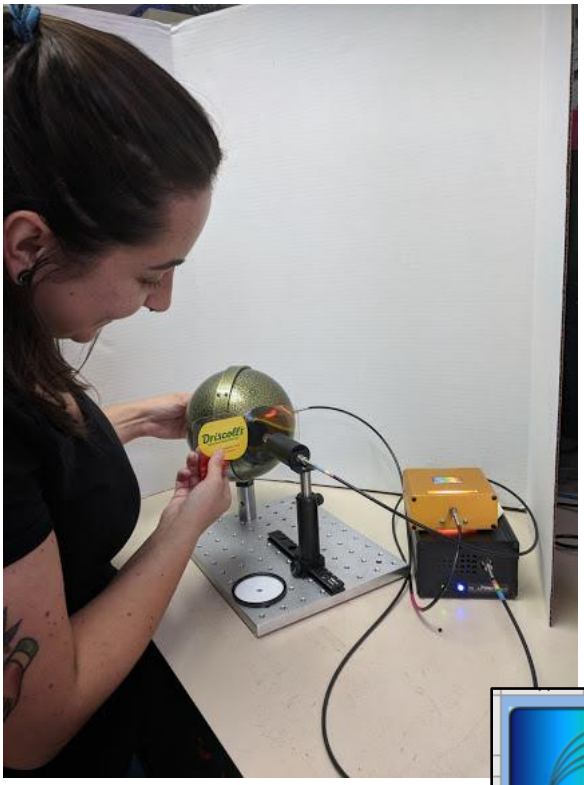




Haze Measurement Application Note

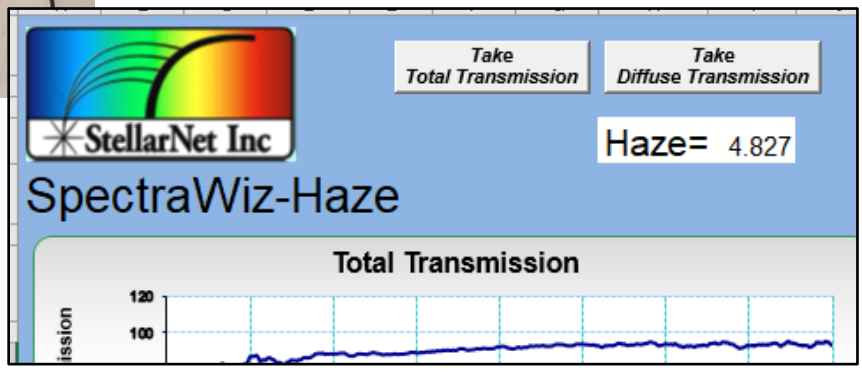
HAZE ISSUES? What to consider in a haze measurement system

In the past, haze measurement systems have been expensive pieces of individual equipment, typically purchased only by industries whose products had required guidelines for haze. Strict quality standards for products such as optical components for the aerospace and space programs required manufacturers to purchase these measurement systems as a dedicated piece of quality control systems, used for nothing else other than QC.



StellarNet's Haze system is the same high quality of a QC system, yet about half the price of a dedicated 'box' product. The system consistently measures within 1% of the ASTM standards. Additionally, because of its modular nature, the system can also be used for a number of different measurement techniques in addition to haze, such as total transmission, color, radiometry, and even chemical absorbance!

The StellarNet haze measurement system is a simple-to-use, modular design consisting of (1) a light source, (2) an integrating sphere, (3) the spectrometer and (4) the specialized software for haze measurement calculation. The operation of the system takes only a few minutes to learn, comes with a complete set of set up procedures, and calibrated ASTM standards are available.



To learn more about the industry standards for haze, refer to the ASTM ASTM D1003 Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.