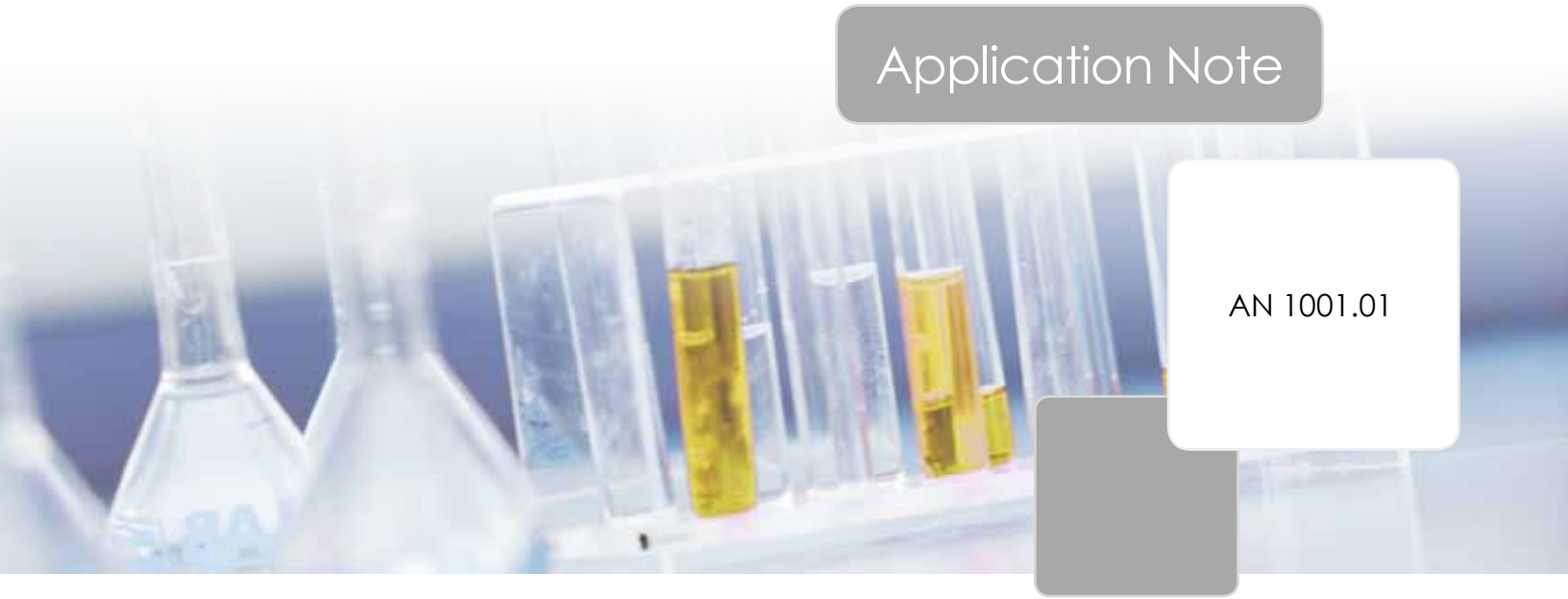

Application Note

AN 1001.01

Measuring Water Whiteness of Liquids Using APHA Color

"APHA Color, also known as Pt-Co or Hazen Color, measures trace yellowness in liquid samples as an indication of purity."

ABSTRACT

As the chemical, petroleum, plastic, and pharmaceutical industries have grown, they developed criteria to judge the color quality of their products. . Descriptions of clear trace yellow liquids were initially based on visual comparisons to dilutions of a platinum-cobalt (Pt-Co) stock solution. Higher purity is associated with less yellow, lower Pt-Co concentrations. In 1892, Allen Hazen defined this color scale for the American Public Health Association (APHA). This color scale is known under three names – APHA, Pt-Co and Hazen Color.
APHA/Pt-Co/Hazen Color ranges from zero for distilled water to 500 for waste water discolored by undesirable impurities and organic materials.

This application note considers the use of the APHA/Pt-Co/Hazen Color index to measure the color of "water white" or near colorless liquids.

The world's true measure of color
HunterLab

WHAT IS APHA?

APHA is a single number yellowness index where each APHA unit is based on a dilution of a Pt-Co 500 ppm stock solution. A detailed description of solution preparation is found in ASTM D1209

An instrumental correlation to the D1209APHA visual standards is defined in ASTM D5386 based on ASTM E313 Yellowness Index. The instrumental APHA correlation method is path length specific and applies only to transmission measurements.

PREPARATION OF APHA STANDARDS

The APHA zero (0) standard is physically represented by distilled water for water-based and general case products. Other reagent grade clear solvents such as toluene or benzene can be used for resins, and mineral oil for oils. These clear solvents contained in a transmission cell are used as a blank to set APHA 0 during the standardization process.
The Pt-Co 500 stock solution is available from third-party suppliers. Intermediate standards for lower APHA levels can be prepared from the stock solution as described in ASTM D1209.

SAMPLE PREPARATION

All APHA samples should be prepared in the same manner and measured at the same temperature.

In order for the APHA index to be meaningful, samples should be similar in yellowness to the Pt-Co standards. In addition, steps should be taken to ensure that samples are clear and non-scattering to avoid a biased APHA evaluation. Based on HunterLab's experience, a sample with a measured haze value above 5 % is visually hazy. The sample should be labeled as such, or filtered before measurement to eliminate scattering.

APHA/PT-CO/HAZEN METHOD PARAMETERS	
Mode	TTRAN - Total Transmission
Illuminant/Standard Observer	C/2°
Color Scale	APHA Index selected as "APHA-10 mm", "APHA-20 mm", "APHA-24 mm", "APHA-50 mm"
Path Length	10, 20 or 50 mm path length transmission cells, or 24 mm ID vials
Standards	A Light Blocker is used to set 0% transmission. The cell filled with a reagent grade colorless solvent is used to set 100% transmission and APHA 0. APHA intermediate standards similar to the product APHA/Pt-Co/Hazen Color to be used for PQ (Performance Qualification) of the instrument over time.
Sample Preparation Parameters	Temperature, Mixing Time, Filtering

If an APHA value is negative or much lower than expected, the sample may be off-hue from the APHA/Pt-Co color standards.
If an APHA value is very high, the sample may be of the correct yellow hue, but more saturated than the upper limit of the Pt-Co 500 stock solution.
In this case, the Gardner Color Index may be more appropriate as it was designed for darker yellow liquids. Alternately, a tristimulus color scale like CIE L*a*b* or Hunter L, a, b could be used.

APHA/PT-CO/HAZEN SAMPLE MEASUREMENT

The instrument must be standardized in Total Transmittance (TTRAN) mode using a transmission cell of the same path length as will be used in the sample measurement. Samples may be measured using a 10, 20, or 50 mm transmission cell or 24 mm ID glass vial. APHA/Pt-Co/Hazen Color measurements are specific to the cell path length. If a transmission cell with a 20 mm path length is used for measurement, the "APHA-20 mm" metric should be selected in the software.

METHOD PRECISION

A statement of precision for the visual APHA/Pt-Co/Hazen Color method is found in ASTM D1209. A statement of instrumental precision is found in ASTM D5386.

CONCLUSION

The APHA/Pt-Co/Hazen Color Index is useful for measuring the trace yellowness associated with the degree of contamination or processing quality of transparent liquid samples that are near-colorless.

REFERENCES

APHA Method 2120, Color by Visual Comparison, Standard Methods for the Examination of Water and Wastewater, American Public Health Association, Washington, D.C. USA.

EPA Method 110.2, Color - Colorimetric - Platinum-Cobalt, Methods for the Chemical Analysis of Water and Wastes, U.S. Environmental Protection Agency, Washington, D.C. USA 1983.

ASTM D5386, Standard Test Method for Color of Liquids Using Tristimulus Colorimetry, describes how color measurement instruments correlate to the physical APHA/Pt-Co color standards described in ASTM D1209, ASTM International, West Conshohocken, Pennsylvania USA.

ASTM D1209, Standard Test Method for Color of Clear Liquids (Platinum-Cobalt Scale), ASTM International, West Conshohocken, Pennsylvania USA.

ISO 2211, Liquid Chemical Products - Measurement of Colour in Hazen Units (Platinum-Cobalt Scale), International Organization for Standardization, Geneva, Switzerland, 1973.

ISO 6271, Clear Liquids - Estimation of Colour by the Platinum-Cobalt Scale, International Organization for Standardization, Geneva, Switzerland, 1997.

Hazen, Allen, A New Color Standard For Natural Waters, American Chemist Journal (14:300), 1892.

Hazen, Allen, The Measurement of the Colors of Natural Waters, American Chemist Journal (18:264), 1896.

More Information about Color Measurement on our HunterLab Blog

measuretruecolor.com

ABOUT HUNTERLAB

HunterLab, the first name in color measurement, provides ruggedly dependable, consistently accurate, and cost effective color measurement solutions. With over 6 decades of experience in more than 65 countries, HunterLab applies leading edge technology to measure and communicate color simply and effectively. The company offers both diffuse/8° and a complete line of true 45°/0° optical geometry instruments in portable, bench-top and production in-line configurations. HunterLab, the world's true measure of color.

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