

Applications

Applications Note

Insight on Color

Vol. 8, No. 16

APHA

Background

Prior to the 1890s, descriptions of slightly colored clear liquids were based on the concept of “water white.” There were many interpretations of “water white” and it became necessary to have a more specific method for describing the color of waste water. In 1892, chemist A. Hazen described the American Public Health Association (APHA) color index. The index was initially used to evaluate the color of waste water by comparison with dilutions of a platinum-cobalt (PtCo) stock solution. The index was used as an indication of purity, as the color of waste water is produced by undesirable impurities and organic materials.

As the chemical, petroleum, plastic, and pharmaceutical industries grew, they also developed the need to measure the color of their products, some of which were similar in hue to the PtCo solutions in A. Hazen’s method. In many cases, the color of their almost “water white” products was an indication of purity, the level of refinement, or the cleanliness of the product container. In 1952, ASTM Test Method D1209 was adopted using a PtCo scale similar to that described by A. Hazen.

APHA is a single number yellowness index where each APHA unit is based on a dilution of the 500 ppm stock solution of PtCo. Distilled water has an APHA value of zero. The stock solution has an APHA value of 500. The PtCo scale and Hazen scale are also based on this sample reagent dilution and have units equivalent to APHA units. APHA is the name used in HunterLab systems, although it could also be called the PtCo scale. A detailed description of solution preparation and measurement procedures may be found in ASTM Designation D1209, “Standard Test Method for Color of Clear Liquids (Platinum-Cobalt Scale).”

ASTM Designation D5386, "Standard Test Method for Color of Liquids Using Tristimulus Colorimetry," describes how color measurement instruments correlate to the physical APHA/PtCo color standards described in ASTM D1209.

In order for the values of this index to be meaningful, the samples to be measured must be clear, slightly colored liquids that are similar in hue to the PtCo standards. Using HunterLab’s EasyMatch QC or Universal Software with a ColorQuest Sphere or UltraScan, samples may be measured using a 10, 20, or 50-mm cell, and the calculations performed are specific to the cell size. 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 measurement. The solvents suggested for use in standardization are distilled water for water-based products, toluene or benzene for resins, and mineral oil for oils.

Sources of the PtCo 500 Color Standard

The APHA/PtCo 500 color standard can be made using the chemical formula described in ASTM D1209 or it can be purchased from the following vendors:

Fisher Scientific Company

Telephone: (800) 766-7000

FAX: (800) 926-1166

WEB: <http://www.fishersci.com>

RICCA Chemical Company

Telephone: (888) GO-RICCA

www.riccachemical.com

Spectrum Chemical Manufacturing Company

Telephone: (800) 525-2299

Telephone: (800) 813-1514

www.spectrumchemical.com/retail/

Conditions for Measurement

Instrumental: ColorQuest Sphere, ColorQuest II Sphere, ColorQuest XE, ColorQuest XT, UltraScan, UltraScan XE, UltraScan PRO, or UltraScan VIS

Illuminant: C

Standard Observer Function: 2 degree

Transmittance and/or Reflectance: Transmittance only.

Formulas

APHA values are calculated from Yellowness Index E313 in accordance with ASTM D5386 using a proprietary formula that correlates well with the APHA standard solutions as defined in ASTM D1209.

Typical Applications

This index is often used by the water processing, chemical, petroleum, plastic, and pharmaceutical industries for the measurement of color in products that are nearly clear or “water white.”

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