Applications Note

Insight on Color **Vol. 8, No. 15**

Yellowness Indices

Background

Visually, yellowness is associated with scorching, soiling, and general product degradation by light, chemical exposure, and processing. Yellowness indices are used chiefly to quantify these types of degradation with a single value. They can be used when measuring clear, near-colorless liquids or solids in transmission and near-white, opaque solids in reflectance.

Conditions for Measurement

Instrumental: Any HunterLab color measurement instrument

Illuminant: D65 (YI E313 only), C.

Standard Observer Function: 2° and 10° (YI E313 only).

Transmittance and/or Reflectance: Either

Formulas

Yellowness Index per ASTM Method E313 is calculated as follows:

$$YI\,E313 = \frac{100\left(C_x X - C_Z Z\right)}{Y}$$

where X, Y, and Z are the CIE Tristimulus values and the coefficients depend on the illuminant and observer as indicated in the table below. Yellowness Index may only be calculated for illuminants D65 and C.

Coefficient	C/2°	D65/2°	C/10°	D65/10°
C_X	1.2769	1.2985	1.2871	1.3013
C_Z	1.0592	1.1335	1.0781	1.1498

Yellowness Index per ASTM Method D1925 is calculated as follows:

$$YI\,D1925 = \frac{100\left(1.274976795X - 1.058398178\,Z\right)}{Y}$$

under C/2° conditions for all instruments except UltraScan XE.

$$YI\ D1925 = \frac{100\left(1.274641506X - 1.057434092\ Z\right)}{Y}$$ under C/2° conditions for UltraScan XE.

The yellowness index formula is shown in ASTM D1925 as:

$$YI\ D1925 = \frac{100\left(1.28\ X_{CIE} - 1.06\ Z_{CIE}\right)}{Y_{CIE}}$$ under C/2° conditions.

The tristimulus values of clear air (for CIE illuminant C and the 1931 CIE 2° standard observer) are X = 98.041, Y = 100.000, Z = 118.103. Using these values, the ASTM formula yields YI = 0.303 for clear air because the factors are truncated to three significant figures. In order to set the yellowness index for air equal to 0.0, the constant multipliers for X_{CIE} and Z_{CIE} have been expanded slightly.

The ASTM D1925 method was withdrawn in 1995, but this formula still provides useful information. This index is always calculated for C/2°, regardless what illuminant and observer are chosen. The focus of this index was on evaluation of transparent plastics.

Typical Applications

These indices are often used by the textile, paint, and plastics industries, but may be used for measurement of any nearly white or nearly colorless object.

For Additional Information Contact:

Technical Services Department
Hunter Associates Laboratory, Inc.
11491 Sunset Hills Road
Reston, Virginia 20190
Telephone: 703-471-6870
FAX: 703-471-4237
www.hunterlab.com