



Whiteness Index

Background

Whiteness is a property important in many industries. Producers of white products decided that it would be easier to deal with whiteness as a single number index rather than three color scale parameters. As a result, various whiteness indices were developed. In order for a whiteness index to be valid, it must be used on the type of materials for which it was intended. When items are being compared using a whiteness index, they must be similar in gloss, texture, translucency, and other physical attributes. They must also be very near white. Whiteness values assigned to colored items are meaningless.

A perfect white is a Perfect Reflecting Diffuser (PRD), which has a value of 100. Pressed magnesium oxide (MgO) and pressed barium sulfate (BaSO_4) are high-reflectance materials that closely approximate a PRD.

Various whiteness indices exist and are used for numerous applications. The most common whiteness index available on HunterLab instruments is WI E313, which is defined by ASTM Designation E313-73 (Reapproved 1993), "Standard Test Method for Indexes of Whiteness and Yellowness of Near-White, Opaque Materials." This index may be applied to most opaque materials. The CIE Whiteness Index is also available on many HunterLab instruments. This index is used mainly in the textile industry as required by AATCC Test Method 110-1995, "Whiteness of Textiles," which was revised to require use of WI CIE rather than WI E313. WI CIE is described in CIE Publication 15.2 (1986), pages 36-38. It is recommended for use with CIE Illuminant D_{65} and may be used with either the 2° or the 10° observer.

Conditions for Measurement

Instrumental: Any HunterLab color measurement instrument

Illuminant: C (WI E313), D_{65} (WI CIE)

Standard Observer Function: 2 degree (WI E313), 2 or 10 degree (CIE WI)

Transmittance and/or Reflectance: Reflectance only.

Formulas

$$WI E313 = 4Z\% - 3Y$$

$$WI CIE = Y + 800 (x_n - x) + 1700 (y_n - y)$$

where

$$\begin{array}{ll} C/2^\circ & D_{65}/10^\circ \\ x_n = 0.3101 & x_n = 0.3138 \end{array}$$

$$y_n = 0.3162 \quad y_n = 0.3309$$

Typical Applications

This index is often used by the textile, paint, and plastics industries for measuring product whiteness.

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