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Instrumental Assessment of Degree of Staining

Developed in 2010 by AATCC Committee RA36; editorially revised and reaffirmed 2012. Technically equivalent to ISO 105-A04.

1. Scope

1.1 This evaluation procedure is intended as an alternative to the visual method of AATCC Evaluation Procedure 2, Gray Scale for Staining (see 8.1), for assessing the degree of staining on a fabric test specimen used in colorfastness tests (see 8.2). This procedure is applicable to any test method referring to the Gray Scale for Staining.

2. Principle

2.1 An undyed fabric specimen which has been subjected to a fastness test in contact with the dyed fabric being tested and an equivalent undyed reference fabric are measured for comparison. The undyed reference fabric has been independently subjected to the same fastness test in the absence of the dyed fabric. The comparison is assessed in CIELAB units, and numerically converted to a staining scale grade. The numerical conversion uses an equation specifically for the determination of degree of staining.

3. Terminology

3.1 **colorant staining, n.**—the unintended pickup of colorant by a substrate due to (1) exposure to a colored or contaminated liquid medium, or (2) direct contact with dyed or pigmented material, from which colorant transfers by sublimation or mechanical actions (as in crocking).

3.2 **colorfastness, n.**—the resistance of a material to change in any of its color characteristics, to transfer of its colorant(s) to adjacent materials or both, as a result of the exposure of the materials to any environment that might be encountered during the processing, testing, storage or use of the material.

3.3 **gray scale for staining, n.**—a scale consisting of pairs of standard gray chips representing progressive differences in color or contrast corresponding to numerical colorfastness grades.

4. Apparatus

4.1 Spectrophotometer or colorimeter

meeting any one of the geometric definitions described in CIE publication 15.2, subclause 1.4 (see 8.3).

5. Procedure

5.1 Mount the specimen fabric and the reference fabric, on non-optically-brightened white card stock.

5.2 Measure the reference fabric, according to AATCC Evaluation Procedure 6, Instrumental Color Measurement. It is recommended that the arithmetic mean of at least two measurements be utilized. If the instrument permits different viewing conditions to be used, the preferred method is to include the specular component.

5.3 Measure the specimen fabric by the same procedure used in 5.2. If the staining on the specimen fabric is uneven, several measurements shall be made and the arithmetic mean value employed in the calculations (see AATCC Evaluation Procedure 6, Section A1.8).

6. Calculations

6.1 Calculate (see 8.4) the CIELAB color difference ΔE^*_{ab} and the magnitude of the lightness difference ΔL^* between the adjacent fabrics, as described in 6.1 and 6.2, to two decimal places. Calculations shall be performed using the CIE 1964 10° supplemental standard observer and illuminant D₆₅, with the 1931 2° observer and illuminant C being a permitted alternative.

6.2 Calculate, to two decimal places, the Gray Scale difference ΔE_{GS} from ΔE^*_{ab} and ΔL^* using the following equation:

$$\Delta E_{GS} = \Delta E^*_{ab} - 0.4 * [(\Delta E^*)^2 - (\Delta L^*)^2]^{1/2}$$

6.3 Calculate, to two decimal places, the staining-scale grade (SSG) using the following equation:

$$SSG = 6.1 - 1.45 * \ln(\Delta E_{GS})$$

If SSG is greater than 4, recalculate using the following equation:

$$SSG = 5 - 0.23 * \Delta E_{GS}$$

6.4 Determine from Table I the Gray Scale for Staining Grade (GSs) to be reported.

7. Report

7.1 The report shall contain, as a minimum, the following information:

7.1.1 The Gray Scale for Staining

Table I—Gray Scale for Staining Step Values

Calculated SSG	Reported GSs
5.00 to 4.75	5
4.74 to 4.25	4-5
4.24 to 3.75	4
3.74 to 3.25	3-4
3.24 to 2.75	3
2.74 to 2.25	2-3
2.24 to 1.75	2
1.74 to 1.25	1-2
Less than 1.25	1

Grade(s) [GSs value(s) from Table 1]. Follow the directions and report as directed in the appropriate test method.

7.1.2 The number and date of this procedure; i.e., AATCC EP12-20XX;

7.1.3 All details necessary for the identification of the sample(s) tested;

7.1.4 The configuration of the instrument;

7.1.5 Identification of the spectrophotometer or colorimeter used;

7.1.6 Whether illuminant D₆₅ or illuminant C was used;

7.1.7 Whether the 1964 10° supplemental standard observer or the 1931 2° observer was used.

8. Notes and References

8.1 *AATCC TECHNICAL MANUAL*, American Association of Textile Chemists and Colorists, AATCC Evaluation Procedure 2, Gray Scale for Staining. Available from AATCC, P.O. Box 12215, Research Triangle Park NC 27709; tel: +1.919.549.8141; fax: +1.919.549.8933; e-mail: orders@aatcc.org.

8.2 Jaekel, S. M., The Variability of Grey-Scale Assessment and its Contribution to the Variability of a Test Method, *Journal of the Society of Dyers and Colourists*, Vol. 96, 1980, pp540-544.

8.3 Commission Internationale de l'Éclairage, Publication CIE No. 15:2004 Colorimetry, 3rd ed., Central Bureau of the CIE, Vienna, 2004. Print copies available from USNC-CIE Publications Office, TLA Lighting Consultants, Inc., 7 Pond St., Salem MA 01970; tel: +1.508.745.6870; e-mail: tmlattla@aol.com, or electronic copies via the web site of the Central Bureau of the CIE (www.cie.co.at).

8.4 AATCC Method 173, CMC: Calculation of Small Color Differences for Acceptability, and reference 8.3.