Colorfastness to Perspiration and Light

Developed in 1967 by AATCC Committee RA23; jurisdiction transferred in 1996 to AATCC Committee RA50; reaffirmed 1971, 1974, 1978, 1989, 1991; revised 1982, 2004 (with title change); editorially revised and reaffirmed 1986; editorially revised 1990, 1993, 1996, 2005.

1. Purpose and Scope

1.1 The purpose of this method is to determine the effect of the combination of perspiration solution and light exposure on the colorfastness of a colored textile specimen. Therefore, only perspiration solutions will be used in this procedure.

2. Principle

2.1 A colored test specimen is immersed in a perspiration test solution for a specified period of time and immediately exposed to light in a fading apparatus for a specified period of time.

2.1.1 Fading apparatus will be the xenon-arc lamp test apparatus as described in AATCC Test Method 16, Colorfastness to Light.

3. Terminology

3.1 **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 material to any environment that might be encountered during the processing, testing, storage or use of the material.

3.2 **lightfastness**, n.—the property of a material, usually an assigned number, depicting a ranked change in its color characteristics as a result of exposure of the material to sunlight or an artificial light source.

3.3 **perspiration,** n.—a saline fluid secreted by the sweat glands (in this test an artificial perspiration solution will be used).

4. Safety Precautions

NOTE: These safety precautions are for information purposes only. The precautions are ancillary to the testing procedures and are not intended to be all inclusive. It is the user's responsibility to use safe and proper techniques in handling materials in this test method. Manufacturers MUST be consulted for specific details such as material safety data sheets and other manufacturer's recommendations. All OSHA standards and rules must also be consulted and followed.

4.1 Good laboratory practices should be followed. Wear safety glasses in all laboratory areas.

5. Apparatus, Materials and Test Solutions

5.1 Xenon-arc lamp fading apparatus (see AATCC Method 16, Option 3)

5.2 Balance with a weighing accuracy of 0.01 g.

5.3 pH meter accurate to 0.01.

5.4 Cardboard: 41 kg (91 lb) White Bristol Index (no backing of exposed area of colored test specimen) (see 12.1).

5.5 Acid perspiration solution.

5.6 Gray Scale for Color Change (see 12.1).

5.7 Blotting paper (see 12.1).

6. Preparation of Reagent

6.1 Prepare the acid perspiration solution by filling a 1 L volumetric flask half full of distilled water. Add the following chemicals and mix to be sure that all chemicals are thoroughly dissolved:

10 ± 0.01 g sodium chloride (NaCl)

1 ± 0.01 g lactic acid, USP 85%

1 ± 0.01 g disodium hydrogen phosphate, anhydrous (Na_2HPO_4) (see 12.2)

0.25 ± 0.001 g ℓ-histidine monohydrochloride ($C_6H_9N_3O_2{\cdot}HCl{\cdot}H_2O$)

Fill the volumetric flask with distilled water to the 1 L mark.

6.2 Test the pH of the solution with a pH meter. If it is not 4.3 ± 0.2 discard it and prepare a new one, making sure all ingredients are weighed accurately. The use of pH test paper is not recommended for this purpose because of its lack of accuracy.

6.3 Do not use perspiration solution that is more than three days old (see 12.3).

7. Test Specimens

7.1 Cut a specimen of colored fabric 5.1 × 7.0 cm (2.0 × 2.75 in.).

8. Procedure

8.1 Weigh the specimen to ± 0.01g.

8.2 Place each test specimen (as prepared in 7.1) in a 9 cm diameter, 2 cm deep petri dish. Add freshly prepared perspiration solution to a depth of 1.5 cm in the petri dish. Soak the test specimen in the solution for 30 ± 2 min with occasional agitation and squeezing to ensure complete wetting. For fabrics hard to wet out, alternately wet the specimen and pass through a laboratory wringer until it is completely penetrated by the solution.

8.3 Remove specimen from solution and blot each specimen to remove excess solution. Reweigh specimen to determine 100 ± 5% wet pick up.

8.4 Mount wet, unbacked specimen in exposure frame or mount specimen on water repellent backing and white card stock.

8.5 Expose specimens in fading apparatus in accordance with AATCC 16, Option 3 for 20 AFUs.

8.6 Remove the specimens.

9. Evaluation

9.1 Evaluation of color change.

9.2 The color change can be quantitatively determined by measuring the color difference between the unwashed sample and a test specimen using a suitable colorimeter or spectrophotometer with the appropriate software (see AATCC Evaluation Procedure 7, Instrumental Assessment of the Change in Color of a Test Specimen).

9.3 To evaluate the color change of the test specimens visually, follow Evaluation Procedure 1, Gray Scale for Color Change, using the Gray Scale for Color Change. For improved precision and accuracy more than one rater should rate the specimens.

10. Report

10.1 Report the color change grade.

10.2 Report the Fading apparatus used.

11. Precision and Bias

11.1 *Precision.* In 2002 a single laboratory study was performed using a single operator. This study was intended to be a temporary table of variances to give some indication of test variability. A complete interlaboratory study is to be conducted in the near future for the purposes of precision and bias. Table values do not reflect different types of material tested to this standard. *Between-Laboratory* variability is not indicated either. Special care and consideration of the variances reported must be used when examining test variability problems.

11.1.1 Samples tested consisted of four fabrics, with three replicates each. Lightfastness exposure conditions were those found in AATCC Method 16-1998, Option E. Each sample was evaluated instrumentally three times and averages were calculated. The data is found in Table I.

Table I—ΔE

	Brown #1	Brown #2	Green	Blue
Specimen 1	1.26	4.37	6.25	7.83
Specimen 2	0.95	4.89	8.18	6.42
Specimen 3	1.17	5.78	5.23	4.87
Average	1.127	5.013	6.553	6.373

Table II—Within-Laboratory Standard Errors and Sample Variance

Sample Identification	Standard Dev.	Standard Error	Sample Variance	95% Confidence
Brown #1	0.159	0.092	0.025	0.396
Brown #2	0.713	0.412	0.508	1.771
Green	1.498	0.865	2.245	3.722
Blue	1.481	0.855	2.192	3.678

*Note: Because the interlaboratory test included less than five laboratories, estimates of standard error and sample variance may be either underestimated or overestimated to a considerable extent and should be used with special caution. The values should be viewed as minimal data with regards to precision. Confidence intervals are not well established.

11.1.2 *Within-laboratory* standard errors and Sample Variance are shown in Table II. Data is on file at the AATCC Technical Center.

11.2 *Bias*. The colorfastness to natural and artificial light can be defined only in terms of a test method. There is no independent method for determining the true value. As a means of estimating this property, the method has no known bias.

12. Notes

12.1 Available from AATCC, P.O. Box 12215, Research Triangle Park NC 27709; tel: 919/549-8141; fax: 919/549-8933; e-mail: orders@aatcc.org.

12.2 Also sold as sodium phosphate, dibasic, anhydrous.

12.3 AATCC Committee RA52, Colorfastness to Perspiration, established that fungi begin to grow in the acid perspiration solution and that the pH rises after three days of storage under ambient room temperatures even when kept in a stoppered solution bottle.