

Test Method for Colorfastness to Perspiration and Light

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 TM16.3, Test Method for Colorfastness to Light: Xenon-Arc.

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 TM16.3, Option 3)

5.2 Balance with a weighing accuracy of 0.0001 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).

5.5 Acid perspiration solution (see 12.4).

5.6 Gray Scale for Color Change (AATCC EP1) (see 12.1).

5.7 White AATCC Textile Blotting Paper (see 12.1).

5.8 Wringer (see 12.5).

6. Preparation of Reagent

6.1 Acid Perspiration Solution.

6.1.1 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 (Na₂HPO₄) (see 12.2)

0.25 ± 0.001 g *l*-histidine monohydrochloride (C₆H₉N₃O₂·HCl·H₂O)

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

6.1.2 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.

6.1.3 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 After 30 ± 2 min, pass each test

specimen through the wringer with the multifiber stripes perpendicular to the length of the wringer rolls (all stripes go through the wringer at the same time) or press between White AATCC Textile Blotting Paper such that each test specimen weighs 200 ± 5% its original weight (e.g., if the original specimen weighed 10 g, it should weigh between 19.5 and 20.5 g after soaking and wringing).

8.4 Mount wet, unbacked specimen in exposure frame or mount specimen on white cardboard stock that has been wrapped with a thin plastic film (see 12.6) to prevent wetting of the backing.

8.5 Expose specimens in fading apparatus in accordance with AATCC TM16.3, Option 3 for 20 AFUs.

8.6 Remove the specimens.

9. Evaluation

9.1 Evaluation of color change.

9.2 Evaluate the change in color in the test specimen by comparison with the Gray Scale for Color Change (AATCC EP1), or using AATCC EP7, Instrumental Assessment of the Change in Color of a Test Specimen, and record the numerical rating that corresponds to the appropriate one on the Gray Scale (see 12.1).

9.3 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.

10.3 Report the reagent 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 TM16-1998, Option E.

Each sample was evaluated instrumentally three times and averages were calculated. The data is found in Table I.

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: +1.919.549.8141; fax: +1.919.549.8933; e-mail: ordering@aatcc.org; web site: www.aatcc.org.

12.2 Also sold as sodium phosphate, dibasic, anhydrous.

12.3 AATCC Committee RR52, 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.

12.4 There may be instances where alkaline perspiration may be used in this test method. In these instances the alkaline test solution should be run as described in AATCC TM15, Test Method for Colorfastness to Perspiration. For convenient reference the composition of the alkaline solution is as follows: Alkaline Solution - 10 g sodium chloride; 4 g ammonium carbonate, USP; 1 g disodium hydrogen phosphate, anhydrous (Na_2HPO_4); 0.25 g *l*-histidine monohydrochloride. Make up to 1 L with distilled water. This solution should give a pH of 8.0 (see 12.2).

12.5 No specific wringer model is suggested. The purpose of the wringer is to achieve the total wet pick up after soaking in the solution. In lieu of the wringer, other suitable methods, like pressing between White AATCC Textile Blotting Paper, may also be used.

12.6 The purpose of the film used to wrap the card is to prevent the card from becoming wet. It shall be a transparent film such as food grade wrapping film.

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.

13. History

13.1 Reaffirmed 2020.

13.2 Revised 2013, 2004 (with title change), 1982. Reaffirmed 1991, 1989, 1978, 1974, 1971. Editorially revised 2019, 2014, 2010, 2005, 1996, 1993, 1990. Editorially revised and reaffirmed 2009, 1986.

13.3 Developed in 1967 by AATCC Committee RA23; jurisdiction transferred in 1996 to AATCC Committee RA50. Partially equivalent to ISO 105-B07.