

Colorfastness to Bleaching with Hydrogen Peroxide

Developed in 1961 by AATCC Committee RA34; revised 1963, 1968, 1972, 2004; reaffirmed 1975, 1979, 1984, 1999; editorially revised 1985, 1987, 1995, 2001, 2002; editorially revised and reaffirmed 1989, 1994 (with title change). Related to ISO 105-N02.

1. Purpose and Scope

1.1 This test method is intended for evaluating the resistance of the color of textiles of all kinds except polyamide, in all forms, to the action of bleach baths containing hydrogen peroxide at concentrations commonly employed in textile processing.

2. Principle

2.1 A specimen of the textile in contact with specified white cloths is immersed in the bleaching solution, rinsed and dried. The change in color of the specimen and the staining of the test cloths are evaluated.

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.

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.

4.2 In preparing bleaching baths, use appropriate personal protective equipment while handling hydrogen peroxide (35%) and sodium hydroxide concentrates. Chemical goggles or face shield, rubber gloves and rubber apron should be worn during preparation steps involving

these materials.

4.3 An eyewash/safety shower should be located nearby for emergency use.

4.4 Use proper protective equipment, such as gloves and metal tongs, during handling of hot sample tubes.

4.5 Exposure to chemicals used in this procedure must be controlled at or below levels set by governmental authorities (e.g., Occupational Safety and Health Administration's [OSHA] permissible exposure limits [PEL] as found in 29 CFR 1910.1000 of January 1, 1989). In addition, the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) comprised of time weighted averages (TLV-TWA), short term exposure limits (TLV-STEL) and ceiling limits (TLV-C) are recommended as a general guide for air contaminant exposure which should be met (see 12.6).

5. Apparatus and Materials

5.1 Test tube or beaker, diameter and length such that the test specimen roll will have a reasonably snug fit and be covered by the bleach solution.

5.2 Bleach bath of the applicable composition given in Table I.

5.3 Two white test cloths, each 10.2 × 3.8 cm (4.0 × 1.5 in.), one piece made of the same kind of fiber as that of the textile to be tested, the second piece made of the fiber indicated in Table II. A white multifiber test fabric (see 12.4) may be used instead of the second white cloth.

5.4 Gray Scale for Staining (see 12.7).

5.5 AATCC Chromatic Transference Scale (see 12.7).

6. Test Specimens

6.1 If the textile to be tested is cloth, place a 10.2 × 3.8 cm (4.0 × 1.5 in.) specimen of it between the two pieces of white cloth, and sew along all four sides to form a composite specimen.

6.2 If the textile to be tested is yarn, knit it into cloth and sew the knitted cloth as above, or form a layer of parallel lengths of yarn between the two white cloths, and sew around the four sides to hold the yarns in place.

6.3 If the textile to be tested is fiber, comb and compress some of it into a sheet 10.2 × 3.8 cm (4.0 × 1.5 in.) in size, place the sheet between the two white cloths, and sew around the four sides to form a composite specimen.

7. Procedure (see 12.2)

7.1 For Tests I, II, III, loosely roll the composite specimen in the direction of the long edge, place the roll in the test tube. Immerse cloth in the appropriate bleach solution (Table I), and keep it submerged for the indicated time and temperature (Table I).

7.2 For Test IV, saturate the composite specimen with 100% of its weight of the appropriate bleach solution (Table I), roll in the direction of the long edge and place in saturated steam (see 12.3) at 99-101°C (210-214°F) for 1 h.

7.3 Remove the composite specimen, rinse for 10 min in flowing cold tap water and squeeze. Remove the stitching on two long sides and one short side, open the specimen, and dry at a temperature not exceeding 60°C (140°F) with the

Table I—Composition of Bleaching Bath and Conditions of Use

	Test I Wool	Test II Silk (Quantities per liter of distilled water)	Test III Cotton	Test IV Cotton
Hydrogen peroxide, 35% ^a	15.4 mL (17.5 g)	8.8 mL (10.0 g)	8.8 mL (10.0 g)	8.8 mL (10.0 g)
Sodium silicate, 42° Be ^b		5.1 mL (7.2 g)	4.2 mL (6.0 g)	7.0 mL (10.0 g)
Sodium pyrophosphate ^c	5.0 g			
Sodium hydroxide ^d			0.5 g	0.5 g
Wetting agent ^e			2.0 mL	
pH (initial) ^f	9.0-9.5	10.5	10.5	10.5
Time	2 h	1 h	2 h	1 h
Temperature	49°C (120°F)	82°C (180°F)	88°C (190°F)	100°C (212°F)
Liquor to cloth ratio	30:1	30:1	30:1	1:1

^a By weight.

^b 42° Be, water white, 10.6% Na₂O, 11.8 lb/gal.

^c Na₂P₂O₇ · 10H₂O.

^d C.P. grade.

^e Doubly sulfonated castor oil.

^f Adjust with NaOH solution if necessary.

Table II—Choice of Test Cloth

If first piece is	Second piece to be
Wool, silk, linen, rayon	Cotton or multifiber test fabric (see 12.4)
Cotton, acetate	Viscose rayon or multifiber test fabric (see 12.1)

three parts in contact only at the one line of stitching.

8. Evaluation Method for Alteration in Color (Shade and Strength).

8.1 Rate the color change of the test specimens using the Gray Scale for Color Change (usage of the scale is discussed in AATCC Evaluation Procedure 1). For improved precision and accuracy, the specimens should be rated by more than one rater.

Grade 5—negligible or no change as shown in Gray Scale Step 5.

Grade 4.5—change in color equivalent to Gray Scale Step 4-5.

Grade 4—change in color equivalent to Gray Scale Step 4.

Grade 3.5—change in color equivalent to Gray Scale Step 3-4.

Grade 3—change in color equivalent to Gray Scale Step 3.

Grade 2.5—change in color equivalent to Gray Scale Step 2-3.

Grade 2—change in color equivalent to Gray Scale Step 2.

Grade 1.5—change in color equivalent to Gray Scale Step 1-2.

Grade 1—change in color equivalent to Gray Scale Step 1.

8.1.1 The color change can be quantitatively determined between the original sample and a test specimen using a suitable colorimeter or spectrophotometer (see AATCC Evaluation Procedure 7, Instrumental Assessment of the Change in Color of a Test Specimen).

9. Evaluation Method for Staining

9.1 Rate staining by using the Gray Scale for Staining or the AATCC Chromatic Transference Scale (usage of the scales is discussed in AATCC Evaluation Procedures 2 and 8). The scale used should be indicated when reporting the

test results as follows:

Grade 5—negligible or no color transfer.

Grade 4.5—color transfer equivalent to Step 4-5 on the Gray Scale for Staining or Row 4.5 on the 9-step AATCC Chromatic Transference Scale.

Grade 4—color transfer equivalent to Step 4 on the Gray Scale for Staining or Row 4 on the 9-step AATCC Chromatic Transference Scale.

Grade 3.5—color transfer equivalent to Step 3-4 on the Gray Scale for Staining or Row 3.5 on the 9-step AATCC Chromatic Transference Scale.

Grade 3—color transfer equivalent to Step 3 on the Gray Scale for Staining or Row 3 on the 9-step AATCC Chromatic Transference Scale.

Grade 2.5—color transfer equivalent to Step 2-3 on the Gray Scale for Staining or Row 2.5 on the 9-step AATCC Chromatic Transference Scale.

Grade 2—color transfer equivalent to Step 2 on the Gray Scale for Staining or Row 2 on the 9-step AATCC Chromatic Transference Scale.

Grade 1.5—color transfer equivalent to Step 1-2 on the Gray Scale for Staining or Row 1.5 on the 9-step AATCC Chromatic Transference Scale.

Grade 1—color transfer equivalent to Step 1 on the Gray Scale for Staining or Row 1 on the 9-step AATCC Chromatic Transference Scale.

10. Report

10.1 Report the following information for each type of white fiber used in the test:

The bleach solution used (test number in Table I).

The classification of alteration in color.

The classification of staining.

The classification chart used (AATCC Chromatic Transference Scale or Gray Scale for Staining).

11. Precision and Bias

11.1 *Precision.* In 2000 a single laboratory study was performed using a single operator.

11.1.1 Samples tested consisted of six fabrics with three replicates each. Refer to Table 1 for the bleach formulas and

conditions used. Color change and staining were evaluated instrumentally for each sample.

11.1.2 *Within-laboratory* standard errors and sample variance are shown in Table III on page 154. Data is on file at the AATCC Technical Center.

11.2 *Bias.* Colorfastness to bleaching with hydrogen peroxide 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 The white cloths should be plain weave, *medium* weight, free from finishes, residual chemicals and chemically damaged fibers. Cotton and linen should be bleached; other materials should be cleaned to their usual degree of whiteness. A white multifiber test fabric (see 12.4) may be used instead of the second white cloth.

12.2 Select from Table I the test most suitable for the conditions under which the fiber is to be used. For example, if a colored silk is to be used as an effect thread in a woollen or worsted fabric, check its colorfastness by the wool method. If a colored silk is to be used as an effect thread in a silk fabric, check its colorfastness by the silk method.

12.3 Saturated steam may be obtained by placing approximately 20 mL of water in the bottom of a test tube fitted with a flared glass rod long enough to keep the specimens above the water level. Heat to active boil. Use a reflux condenser to maintain volume of liquor. Invert a small watch glass over the specimen to prevent direct impingement on the sample of water drops from the condenser.

12.4 Available from Testfabrics Inc., P.O. Box 26, 415 Delaware St., W. Pittston PA 18643; tel: 570/603-0432; fax: 570/603-0433; e-mail: testfabric@aol.com; and Textile Innovators Corp., div. of SDL Atlas L.L.C., P.O. Box 8, 101 Forest St., Windsor NC; tel: 252/794-9703; fax: 252/794-9704; e-mail: tic@sdlatlas.com.

12.5 For very critical evaluations and in cases of arbitration, ratings must be based on the geometric gray scale for evaluating staining.

12.6 Available from Publications Office, ACGIH, Kemper Woods Center, 1330 Kemper Meadow Dr., Cincinnati OH 45240; tel: 513/742-2020.

12.7 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.