

Test Method for Colorfastness to Sodium Hypochlorite of a Textile Floor Covering

1. Purpose and Scope

1.1 This test method is used to determine the fastness of colored pile yarn floor coverings to the effects of a sodium hypochlorite solution, commonly called chlorine bleach. It is applicable to predyed, postdyed, printed, or other otherwise colored pile yarn floor coverings.

2. Principle

2.1 A specimen of pile yarn floor covering is treated with a small volume of sodium hypochlorite bleach. After allowing the treated specimen to remain at controlled conditions for a specific time, it is rinsed in water to remove all of the bleach. Any color loss is assessed after drying.

3. Terminology

3.1 **color change**, n.—a change in color of any kind whether in lightness, hue or chroma or any combination of these, discernible by comparing the test specimen with a corresponding untested specimen.

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

3.3 **sodium hypochlorite bleach**, n.—4-6% solution of sodium hypochlorite (NaOCl), pH 9.8-12.8, commonly called “chlorine bleach.”

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 the handling of 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. Caution should be used when cutting specimens. All chemicals should be handled with care.

4.2 In preparing, dispensing and handling aqueous chemical solutions, use chemical goggles or face shield, impervious gloves and an impervious apron.

4.7 An eyewash/safety shower should be located nearby and an organic vapor respirator should be available for emergency use.

4.8 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; (see web site: www.osha.gov for latest version). In addition, the American Conference of Governmental Industrial Hygienist (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 12.1).

5. Apparatus and Materials

5.1 AATCC Stain Cup and 50 mm (2.0 in.) Diameter Staining Ring (see 12.2).

5.2 Gray Scale for Color Change (AATCC EP1) (see 12.2).

5.3 Water, deionized.

5.4 Sodium Bisulfite (NaHSO_3) (see 6.2).

5.5 Balance, capable of weighing to the nearest 0.01 g.

5.6 Sodium Hypochlorite Bleach Standards, (NaOCl).

5.7 Illumination conditions. The source under which the comparison is made shall be determined prior to evaluation. Sources simulating any of the following CIE illuminants may be utilized (see 12.3 and 12.4):

Color Illuminant	Description	Temperature
D ₆₅	Daylight	6500K ± 200
D ₇₅	Daylight	7500K ± 200
A	Incandescent	2856K ± 200
CWF	Cool White Fluorescent	4150K ± 350

Note: Additional illuminants or changes in color temperature can be negotiated between contractual parties.

6. Preparation of Standard Sodium Hypochlorite Bleach Solution

6.1 Sodium Hypochlorite Bleach standards with traceable certificates shall be

used without titration. The solution must be used within 36 h after exposure to atmospheric conditions. Titration is necessary if the purchased standard is diluted to another strength.

6.2 The Sodium Bisulfite Solution used to neutralize the treated specimens should be prepared by diluting 17.25 g in 1000 mL of deionized water.

7. Test Specimens

7.1 Cut two test specimens from the finished pile yarn floor covering. The specimens shall be a minimum of 150 mm (6 in.) square.

7.2 Remove any extraneous surface materials by brushing and/or vacuuming.

8. Test Procedure

8.1 Condition all test specimens, pile side up, on a non-absorbent surface for 24 h at standard conditions of $21 \pm 2^\circ\text{C}$ ($70 \pm 4^\circ\text{F}$) and $65 \pm 5\%$ RH. Avoid contamination or contact with extraneous materials.

8.2 Place the 50 mm (2 in.) diameter-staining ring in the center of one of the test specimens. The other specimen is a control used for rating. While pressing down on the ring, pour 20 mL of the sodium hypochlorite bleach solution into the center of the ring, taking care not to splatter bleach outside of the staining ring. Press the bottom of the stain cup through the ring into the pile, moving it up and down five times to facilitate wetting of the pile fiber from top to bottom. Do not rotate or twist the cup inside the ring as surface abrasion shall affect the results. Carefully remove the staining ring and stain cup.

8.3 Recondition the treated specimen for 24 ± 4 h in a flat position, pile side up, at standard conditions of $21 \pm 2^\circ\text{C}$ ($70 \pm 4^\circ\text{F}$) and $65 \pm 5\%$ RH. Avoid any air draft which could result in an accelerated drying.

8.4 Neutralize the bleached specimens in a bath containing the prepared Sodium Bisulfite solution for a minimum of 5 mins.

8.5 Rinse the bleached specimen with running water at $21 \pm 6^\circ\text{C}$ ($70 \pm 10^\circ\text{F}$) until rinse water indicates removal of all unfixed dye. Removal of unfixed dye is enhanced by the use of a laboratory wringer.

8.6 Extract (centrifuge or vacuum) the wet specimen to remove excess water.

8.7 Allow specimens to air dry at room temperature in conditioning racks.

9. Evaluation or Results

9.1 Rate the color loss of the test specimen by using AATCC EP1, Evaluation Procedure for Gray Scale for Color Change, where a grade of 5 represents no color change and 1 represents a severe color change.

9.2 Illuminate the surface with an illumination level at the specimen plane in the range of 1080-1340 lx (100-125 fc) (see 12.5). The light should be incident upon the surfaces at $45 \pm 5^\circ$ and the direction of viewing at $90 \pm 5^\circ$ to the plane of the surfaces. Compare the perceived visual differences between the original and tested carpet specimens with the perceived differences represented by the Gray Scale. The colorfastness grade is that number of the Gray Scale pair whose contrast corresponds to the contrast between the perceived difference in color or contrast between the original material and tested specimen. The cleanliness and physical condition of the Gray Scale is extremely important in obtaining consis-

tent results.

9.3 Only observers whose color vision has been tested normal using an appropriate color vision test for color acuity shall perform this procedure.

10. Report

10.1 Report the numerical color change grade for each specimen tested.

10.2 Report the sodium hypochlorite activity and the amount of the solution used to treat the specimen.

10.3 Report any deviation to this test method.

11. Precision and Bias

11.1 Precision.

11.1.1 An interlaboratory study involving five laboratories and three tufted carpets was conducted in 2009 using the procedure described in this test method. A total of three replicates of each material were tested on different days by each of the five laboratories. The interlaboratory precision study is characterized by repeatability (S_r and r), reproducibility (S_R and R), and the average results shown in Table I.

11.2 Bias.

11.2.1 Colorfastness to Sodium Hypochlorite Bleach 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 Publications Office, ACGIH, Kemper Woods Center, 1330 Kemper Meadow Dr., Cincinnati OH 45240; tel: +1.513.742.2020; web site: www.acgih.org.

12.2 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.

12.3 For visual assessments to be made, it is recommended that the correlated color temperature be calibrated to 6500 ± 200 K by a service traceable to a national standard.

12.4 Filters and lamps shall be properly maintained and cleaned periodically following manufacturer's recommendations.

12.5 The illumination range of 1080-1340 lx (100-125 fc) is recommended for critical visual assessments of materials of medium lightness and is the same range specified for critical visual assessment in ASTM D1729, Standard Practice for Visual Appraisal of Colors and Color Differences of Diffusely Illuminated Opaque Materials.

13. History

13.1 Reaffirmed 2021.

13.2 Editorially revised 2020 to add Table I which was previously omitted and to align History section to AATCC style guidelines; editorially revised 2019, 2016; reaffirmed, 2013, 2012.

13.3 Developed in 2011 by AATCC Committee RA57.

Table I—Interlaboratory Precision Analysis for Colorfastness to Bleach¹

Materials Used	Average	S_r	S_R	r	R
A-Tufted Nylon Carpet with Bleach Resistance	3.03333	0.54772	0.62138	1.53362	1.73986
B-Tufted Nylon Carpet Acid Dyed	1.63333	0.28868	0.46248	0.80829	1.29495
C-Solution Dyed Carpet	4.83333	0.12910	0.25820	0.36148	0.72296

¹Laboratories 5; Materials 3; Determinations 3.