

Colorfastness to Light: Detection of Photochromism

Developed in 1972 by AATCC Committee RA50; supersedes AATCC 32-1952; reaffirmed 1975, 1980, 2000, 2005; editorially revised 1981, 1988, 2004; editorially revised and reaffirmed 1985, 1989, 1995. Technically equivalent to ISO 105-B05.

1. Purpose and Scope

1.1 This test method is intended for detecting and assessing colored textiles which change in color after brief exposure to light but which return to their original shade when stored in the dark.

2. Principle

2.1 A specimen is exposed to light of high intensity for a time much shorter than that necessary to cause a permanent change. The change in color of the specimen is assessed immediately after exposure with the Gray Scale for Color Change. The specimen is then stored in the dark under specified conditions and assessed again.

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 **photochromism**, *n.*—a qualitative designation for a reversible change in color of any kind (whether a change in hue or chroma) which is immediately noticeable upon termination of light exposure when the exposed area of a specimen is compared to the unexposed area.

NOTE: The reversion of the color change or instability of the hue or chroma upon standing in the dark distinguishes photochromism from fading.

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 Do not operate the test equipment until the manufacturer's instructions have been read and understood. It is the operator's responsibility to conform to the manufacturer's directions for safe operation.

4.2 The test equipment contains high intensity light sources. Do not look directly at the light source. The door to the test chamber must be kept closed when the equipment is in operation.

4.3 Before servicing light sources, allow 30 min for cool-down after lamp operation is terminated.

4.4 When servicing the test equipment, shut off both the off switch on the front panel and the main power disconnect switch. When equipped, ensure that the main power indicator light on the machine front panel goes out.

4.5 Daylight exposure of skin and eyes for prolonged periods may be hazardous and, therefore, caution should be employed to protect these areas. Do not look directly at the sun under any circumstances.

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

5. Apparatus and Materials

5.1 AATCC Blue Wool Standard L2 used in the methods for determining colorfastness to light (see 10.1).

5.2 A fading apparatus is described in AATCC Method 16, Colorfastness to Light.

5.3 A suitable opaque mask such as the metal holder, opaque paper mask or black paper mask (see 10.2).

5.4 Black paper such as the inside of the paper mask (see 10.2).

5.5 Gray Scale for Color Change (see 10.1).

6. Specimen

6.1 An area of textile not less than 60 × 30 mm (2.4 × 1.2 in.) is required. The specimen may be a strip of cloth or yarn, either wound close together on a card or laid parallel and fastened on a card.

6.2 To facilitate handling, the specimen and a similar strip of the standard may be mounted on separate cards.

7. Procedure

7.1 Calibrate the fading apparatus by exposing the Blue Wool Standard L2 as directed in AATCC Method 16. Cover

one-half of the strip of standard with the opaque mask. The paper mask must be placed in the holder such that the black portion of the mask is facing the lamp.

7.2 Expose the partially covered standard in the fading apparatus under the same conditions recommended in AATCC Method 16 until the contrast between the original and the exposed portion of the standard is equal to Step 4 on the Gray Scale. This sample should be exposed continuously (see 10.3). Determine the time necessary to produce this change.

7.3 Cover one-half of the specimen with the opaque mask and expose it in the same position and under the same conditions as in 7.2 for one twenty-fifth of the time or radiant energy necessary to produce a detectable fade on Standard L2.

7.4 Remove the specimen from the source of light; immediately remove the cover from the specimen and assess the contrast between the original and the exposed portions with the Gray Scale.

7.4.1 If the contrast is equal to or less than Step 4 of the Gray Scale, the specimen is not photochromic and further examination is not necessary.

7.4.2 If the contrast between the original and the exposed portion of the specimen is greater than Step 4 of the Gray Scale, leave the specimen in the dark for 1 h at 21 ± 1°C (70 ± 2°F) and relative humidity of 65 ± 2%.

7.4.2.1 If the contrast has not fully disappeared in 1 h, expose the sample to steam at atmospheric pressure for 15 s in an attempt to accelerate any further recovery of the shade which might occur in a longer period of recovery.

7.5 Inspect the specimen to determine if the contrast between the covered control and exposed portion is still visible and if so reassess the contrast between the original and exposed portions of the specimens against the Gray Scale.

7.6 Assess the fastness to light in a parallel test using AATCC Method 16, Section 26.

8. Interpretation and Report

8.1 If the specimen immediately shows a contrast equal to or less than Step 4 of the Gray Scale between the exposed portion and the original immediately after exposure, the specimen is not photochromic. Report the lightfastness of the specimen in the normal manner.

8.2 If the sample immediately after exposure shows a contrast between the original and the exposed specimen which

is greater than Gray Scale Step 4 but which after conditioning according to 7.4.2 shows a difference no greater than Gray Scale Step 4-5, report the specimen as being photochromic.

8.3 If the contrast between the original and the exposed portion of the specimen after conditioning for 1 h in the dark is greater than Step 4 of the Gray Scale, the sample is not photochromic but of low initial lightfastness. Assess the grade for the first perceptible change given in parentheses.

8.4 The lightfastness rating of the specimen must be followed by the letter "P," and the Gray Scale grade in parentheses (see 10.4); e.g., 6 (P4) or 6-7 (P2-3) (see 10.5).

8.5 Report details of exposure using the form titled "Typical Exposure Control and Report Form" found in Table V of AATCC Method 16.

9. Precision and Bias

9.1 *Precision.* Precision for this test method has not been established. Until a precision statement is generated for this

test method, use standard statistical techniques in making any comparisons of test results for either *within-laboratory* or *between-laboratory* averages.

9.2 *Bias.* Detection of photochromism (colorfastness to light) can be defined only in terms of a test method. There is no independent method for determining true value. As a means of estimating this property, the method has no known bias.

10. Notes

10.1 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.

10.2 Available from SDL Atlas L.L.C., 1813A Associate Lane, Charlotte NC 28217; tel: 704/329-0911; fax: 704/329-0914; e-mail: info@sdlatlas.com.

10.3 In a fading apparatus which rotates each specimen frame, the specimen should be fixed in its frame so that the frame does not rotate, but only revolves about the lamp on the rack.

10.4 The following examples illustrate the various types of lightfastness assessment possible:

Grade	Meaning
6	Normal lightfastness grade.
6(1)	Specimen undergoes slight permanent change after a short exposure but on subsequent exposure it is as resistant as Standard 6.
6(P4)	Specimen undergoes slight change after a short exposure to high intensity radiation but this virtually disappears on storage in the dark; apart from this slight photochromic change, the specimen is as resistant as Standard 6.
6(P2)	Specimen undergoes very marked change after a short exposure to high intensity radiation but this virtually disappears on storage in the dark. As far as resistance to permanent photochemical change (fading) is concerned, the specimen is as resistant as Standard 6.
10.5	Temporary changes in color which may be due to lower moisture content and/or higher temperature and whose existence can be ascertained by a hot pressing test should not be reported as photochromic.