

Test Method for Colorfastness to Sodium Hypochlorite Bleach in Home Laundering

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1. Purpose and Scope

1.1 This test method is used to determine the colorfastness to sodium hypochlorite bleach, commonly called "chlorine bleach," in home laundering of textiles which are expected to withstand frequent laundering.

1.2 Results of this test method may be used in combination with other testing for establishing care instructions (see 5.1, 9.6 and 12.8).

1.3 If a chlorine bleach contains ingredients other than the sodium hypochlorite, it is the total effect of these chemicals on the color change that is being evaluated.

1.4 This test method is designed for home laundering devices. An accelerated colorfastness test simulating multiple home laundering (including those with sodium hypochlorite) is described in AATCC TM61, Test Method for Colorfastness to Laundering: Accelerated. There is no known correlation between those sections of AATCC TM61 and this method.

2. Principle

2.1 Specimens are laundered under appropriate conditions of temperature, detergent solution, chlorine bleach solution and abrasive action for five home laundering cycles. The laundered specimens are evaluated for color change.

3. Terminology

3.1 **bleach**, n.—*in home laundering*, a product that will clean, whiten, brighten and aid in the removal of soils and stains from textile materials by oxidation that is inclusive of chlorine and non-chlorine products.

3.2 **care instructions**, n.—*in textiles*, a series of directions describing which care practices should refurbish a product without adverse effects and warning of those care practices expected to have a harmful effect (see 12.1).

3.3 **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 materials.

3.4 **laundering**, n.—*of textile materials*, a process intended to remove soil and/or stains by treatment (washing) with an aqueous detergent solution and normally including subsequent rinsing, extracting and drying.

3.5 **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 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 Manufacturer's safety recommendations should be followed when operating laboratory testing equipment.

4.3 The 1993 AATCC Standard Reference Detergent WOB and the 2003 AATCC Standard Reference Liquid Detergent WOB may cause irritation. Care should be taken to prevent exposure to skin and eyes.

4.4 All chemicals should be handled with care.

4.5 In preparing, dispensing and handling bleach and detergent, use chemical goggles or face shield, impervious gloves and an impervious apron.

4.6 If concentrated sulfuric acid is diluted to prepare the 10% acid (see 14.8.1 and 14.8.3), use chemical goggles or face shield, impervious gloves and an impervious apron. Concentrated acids should be handled only in an adequately ventilated hood. CAUTION: Always add acid to water.

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 14.1).

5. Uses and Limitations

5.1 Specimens may be tested using these procedures, but without sodium hypochlorite bleach, to determine the effect of laundering with water and/or water and detergent alone (see 9.6 and 12.8). To test for colorfastness to non-chlorine bleach, see AATCC TM172, Colorfastness to Powdered Non-Chlorine Bleach in Home Laundering (see 14.2).

6. Apparatus and Materials (see 14.3)

6.1 Automatic washing machine (see 14.4).

6.2 Automatic tumble dryer (see 14.5).

6.3 Conditioning/drying racks with pull-out screens or perforated shelves (see 14.6).

6.4 Ballast of 920 × 920 mm (± 30 mm) hemmed pieces of cloth. Choose one of the following.

6.4.1 Ballast type 1, bleached cotton sheeting.

6.4.2 Wash load ballast type 3, 50/50 polyester/cotton plain weave.

6.5 1993 AATCC Standard Reference Detergent WOB or 2003 AATCC Standard Reference Liquid Detergent WOB (see 14.7).

6.6 Drip and line drying facilities.

6.7 Balance with at least 5 kg minimum capacity and sensitivity to ± 0.1 g.

6.8 Lab timer.

6.9 Gray Scale for Color Change (AATCC EP1) (see 14.7) or suitable colorimeter or spectrophotometer for color change.

7. Reagents

7.1 Sodium hypochlorite (NaOCl), 4-6%.

- 7.2 Distilled water.
 7.3 Sulfuric acid, H_2SO_4 , (10% solution).
 7.4 Potassium iodide, KI, (10% solution).
 7.5 Sodium thiosulfate, $\text{Na}_2\text{S}_2\text{O}_3$, (0.1N).

8. Test Specimens

8.1 Use one specimen weighing 110.0 ± 10.0 g from a sample. If a garment or textile item (towel, bed sheet, etc.) is to be used as a specimen, weigh the entire item to 0.1 g. If the garment weight exceeds the specified load weight of 1.8 kg, the total weight is to be included in the report. See 9.2.3 for exact weight specifications on load.

9. Procedure

9.1 Table I summarizes washing and drying conditions. Information on the machine and laundering conditions may be found in the AATCC LP1 (see 14.10).

9.2 Washing.

9.2.1 Fill the washer with the specified water volume at the selected water temperature using the normal cycle setting. Measure and record the water hardness in any test.

9.2.2 Add 66 ± 1 g of 1993 AATCC Standard Reference Detergent WOB or 100 ± 1 g of 2003 AATCC Standard Reference Liquid Detergent WOB (see 6.5). Add 240 ± 5 mL (1 cup) of sodium hypochlorite bleach or the amount recommended by the manufacturer for a full load of laundry. Run the washer for 2 min to ensure proper mixing of liquor.

9.2.3 Add enough ballast to the specimen to make a 1.8 ± 0.1 kg load. Set the washer on the cycle selected for washing and set the wash timer (see Table I and 9.1). Start the agitation and independently time the wash for reproducible results. When the desired wash time is complete, stop washer and advance the dial to the end of the wash cycle. Restart washer to rinse, drain and spin the load.

9.2.4 For the specimen to be dried by procedures A, B or D, allow washing to proceed through the rinse and final spin cycle. Remove test specimens immediately after the final spin cycle, separate any tangled pieces, taking care to mini-

mize distortion, and dry by procedures A, B or D [see Table I and AATCC LP1 (see 9.1)].

9.2.5 For the specimen to be dried by procedure C, Drip Dry, stop the washer at the end of the final rinse cycle just before the water begins to drain. Remove the specimens soaking wet.

9.3 Drying.

9.3.1 (A) Tumble Dry. Place the washed load (test specimens and ballast) in the tumble dryer, set on the cycle which generates the correct exhaust temperatures as specified in AATCC LP1 (see 9.1). For fabrics that are heat sensitive, lower temperatures consistent with producer's recommendation are required and must be reported. Operate the dryer until the total load is dry. Remove the load immediately after the machine stops.

9.3.2 (B) Line Dry. Hang each specimen by two corners with the fabric length in the vertical direction. Allow the test specimens to hang in still air at room temperature until dry.

9.3.3 (C) Drip Dry. Hang each dripping wet specimen by two corners, with the fabric length in the vertical direction. Allow specimens to hang in still air at room temperature until dry.

9.3.4 (D) Screen Dry. Spread each specimen on a horizontal screen or perforated surface, removing wrinkles but not distorting or stretching and allow to dry in still air at room temperature.

9.4 Repeat 9.2 and 9.3 for a total of five launderings or to an end point of color change (see 14.2).

9.5 On completion of the fifth laundry cycle, (or after each cycle where end point criteria are to be met), condition the specimens for at least 4 h by laying each specimen separately on the screen or perforated shelf of a conditioning rack at an atmosphere of $21 \pm 2^\circ\text{C}$ ($70 \pm 4^\circ\text{F}$) and $65 \pm 5\%$ RH before evaluating color change.

9.6 If this test method is to be used to develop care instructions, specimens may also have to undergo further testing. Non-chlorine bleach sensitivity may need to be tested using AATCC TM172. To separate the effects of components such as hardness, pH or bleach content (see 5.1, 12.8 and ASTM D3938, Standard Guide for Determining or Confirming Care In-

structions for Apparel and Other Textile Products), this method with detergent only and/or this method using water only may be used.

10. Evaluation

10.1 Visual evaluation.

10.1.1 Using an unwashed specimen from the sample as a control, rate the color change of the test specimen in at least three places on the specimen or three times in one place using 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.

10.1.2 Ratings may be made compared to an unexposed control cut from the test sample or compared to a laundered control specimen of known fastness.

10.2 Instrumental evaluation.

10.2.1 Instrumental measurements comparing unexposed and exposed, (washed), specimen or garments may be used (see AATCC EP6, Instrumental Color Measurement, AATCC EP7, and AATCC TM173, Test Method for Calculation of Small Color Differences for Acceptability).

11. Interpretation of Results

11.1 This test is a satisfactory end use test for demonstrating the effect of the 1993 AATCC Standard Reference Detergent WOB or the 2003 AATCC Standard Reference Liquid Detergent WOB and chlorine bleach on textile materials in home laundering. The color change results will establish a level of performance that can be used to prepare care instructions (see 14.9 and ASTM D3938).

11.2 If a significant color change is observed, an untreated duplicate sample should be retested using this method with water only and/or by following AATCC TM172 (see 9.6).

12. Report

12.1 Report the numerical average color change grade for each specimen tested.

12.2 Report washing conditions (Arabic and Roman Numerals) and drying conditions (capital letter from Table I; [i.e., (1) IIIA (iii)] means NORMAL cycle, wash water temperature of $41 \pm 3^\circ\text{C}$, tumble dry [permanent press]).

12.3 Report the type and amount of detergent used.

12.4 Report the brand, sodium hypochlorite activity, and amount of the chlorine bleach used.

12.5 Report the available chlorine content delivered to the wash by the dosage

Table I—Washing and Drying Conditions (see 14.10)

Machine Cycle	Wash Temperatures	Drying Procedures
(1) Normal or Cotton/Sturdy	(II) $27 \pm 3^\circ\text{C}$ ($80 \pm 5^\circ\text{F}$)	(A) Tumble:
(2) Delicate	(III) $41 \pm 3^\circ\text{C}$ ($105 \pm 5^\circ\text{F}$)	i. Cotton/Sturdy
(3) Permanent Press	(IV) $49 \pm 3^\circ\text{C}$ ($120 \pm 5^\circ\text{F}$)	ii. Delicate
	(V) $60 \pm 3^\circ\text{C}$ ($140 \pm 5^\circ\text{F}$)	iii. Permanent Press
		(B) Line
		(C) Drip
		(D) Screen