

Procedure for the Evaluation of Multifiber Adjacent Fabrics

Developed in 2005 by AATCC Committee RA59; reaffirmed 2006.

1. Purpose and Scope

1.1 This procedure is intended to permit the qualification of candidate multifiber test fabrics, by comparing the staining of their components with that of a control multifiber fabric, under controlled conditions.

2. Principle

2.1 The staining properties of individual components of candidate multifiber test fabrics are evaluated by comparing the shades obtained on them and on the components of a control fabric, using a soap solution and each of four different dye baths. The bath containing the yellow disperse dye, Terasil Yellow 2GE 200%, stains the secondary acetate and polyamide components (of the control fabrics and fabrics under test); the bath containing the orange acid dye, Irgalan Orange RL-KWL 250%, stains the polyamide components; the bath containing the blue direct dye, Solophenyl Blue GL 250%, stains the cotton components; and, the bath containing the navy disperse dye, Terasil Navy Blue BGLN 200%, stains the polyester and polyamide components. Evaluations of the stained components are conducted by colorimetric measurements to eliminate the subjectivity of visual evaluations.

3. Safety Precautions

NOTE: These safety procedures are for information purposes only. The precautions are ancillary to the testing procedures and not intended to be all inclusive. It is the user's responsibility to use safe and proper techniques in handling materials in this procedure. 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.

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

3.2 All chemicals should be handled with care.

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

4. Uses and Limitations

4.1 The procedure was tested on multifiber test fabrics containing 15 mm wide fiber stripes. Multifiber test fabrics containing narrower fiber stripes may also be evaluated as long as the aperture on the spectrophotometer used will accommodate the smaller size.

4.2 This procedure was developed using Staining Scale Rating (SSR) values as calculated in ISO 105-A04 (see 15.4). These calculated SSR values are used to assign the reported Gray Scale for Staining (see 15.5). This reported value is based upon a range that is broader than would be found by using the calculated SSR values between 4 and 3 (see 15.5).

5. Apparatus and Materials

5.1 Launder-Ometer.

5.1.1 A laundering machine for rotating closed canisters in a thermostatically controlled water bath at 40 ± 2 rpm (see 15.1).

5.1.2 Stainless steel lever lock canisters Type 1 (see 15.1), 500 mL (1 pt), 75×125 mm (3.0×5.0 in.)

5.1.3 Stainless steel lever lock canisters Type 2 (see 15.1), 1200 mL, 90×200 mm (3.5×8.0 in.).

5.1.4 Adapter plates for holding canisters (see 5.1.3) on laundering machine shaft (see 15.1).

5.1.5 Teflon fluorocarbon gaskets (see 11.5, 15.1 and 15.2).

5.2 Spectrophotometer geometry d/0° specular included, small area view; calculation

$D_{65}/10^\circ$; tolerance ΔE_{cmc} 0.5

5.3 pH meter accurate to ± 0.01 .

5.4 Balance with a weighing accuracy of ± 0.001 g.

5.5 Control Multifiber Fabric (see 15.6)

6. Reagents

6.1 Soap, specified in ISO 105-C02 (see 15.3, 15.4).

6.2 Terasil Yellow 2GE 200% (see 15.3).

6.3 Irgalan Orange RL-KWL 250% (see 15.3).

6.4 Solophenyl Blue GL 250% (see 15.3).

6.5 Terasil Navy Blue BGLN 200% (see 15.3).

6.6 Distilled or Deionized water.

7. Specimens

7.1 Multifiber fabric, to be used as a control (see 15.6); Weight: (3.00 ± 0.1) g.

7.2 Multifiber fabric under test; Weight: (3.00 ± 0.1) g; approximately 100×100 mm.

7.3 Mark the specimens to distinguish between the control specimens and the specimens under test.

8. Preparation of Reagents

8.1 Soap Solution.

8.1.1 Dissolve 50 g soap in 1 L water at 45°C .

8.2 Terasil Yellow 2GE 200% Dispersion.

8.2.1 Dispersion: 2.45 g dye into 1000 mL (see 8.6).

8.2.2 Dilution: 20 mL dispersion into 1000 mL

8.2.3 Test Solution for 0.00049 g/L Terasil Yellow 2GE 200%: 10 mL from first dilution and 100 mL soap solution into 1000 mL (see 8.7).

8.3 Irgalan Orange RL-KWL 250% Solution.

8.3.1 Solution: 1.10 g dye into 1000 mL (see 8.6).

8.3.2 Test Solution for 0.011 g/L Irgalan Orange RL-KWL 250%: 10 mL solution and 100 mL soap solution into 1000 mL (see 8.7).

8.4 Solophenyl Blue GL 250% Solution.

8.4.1 Solution: 0.775 g/L dye into 1000 mL (see 8.6).

8.4.2 Dilution: 20 mL into 1000 mL.

8.4.3 Test Solution for 0.000155 g/L Solophenyl Blue GL 250%: 10 mL from first dilution and 100 mL soap solution into 1000 mL (see 8.7).

8.5 Terasil Navy Blue BGLN 200% Dispersion.

8.5.1 Dispersion: 2.4 g dye into 1000 mL (see 8.6).

8.5.2 Test Solution for 0.024 g/L Terasil Navy Blue BGLN 200%: 10 mL dispersion and 100 mL soap solution into 1000 mL (see 8.7).

8.6 Original Dispersion or Solution. Disperse or dissolve a specified quantity of dye in a 200 mL beaker. Using a funnel, transfer it into a 1 L volumetric flask. Using a spray bottle, spray some water around the sides and to the bottom of the beaker and add it to the flask. Repeat until all the dye is transferred. Fill the flask about 3/4 full with water, close it with a stopper, tip it upside down several times to ensure complete dispersion or solution and fill the flask to the meniscus. Trans-

fer the liquid into a 1 L Erlenmeyer flask and close it with a stopper and mark 'Original Dye Solution.'

8.7 Test Solution. To prepare the test solution for the orange and navy dyes, shake the Erlenmeyer flask containing the 'Original Dye Solution' to ensure a homogeneous dispersion or solution. Using a volumetric pipette, transfer the specified aliquot into a volumetric flask. To avoid excess foaming slowly add 100 mL soap solution and water to fill the flask to the meniscus. Transfer the liquid to a 1 L Erlenmeyer flask, close and mark the flask with 'Test Solution.'

8.7.1 The yellow and blue dyes require an additional dilution prior to making the 'Test Solution.' Shake the Erlenmeyer flask containing the 'Original Dye Solution' to ensure a homogeneous dispersion or solution and transfer the specified aliquot into a 1 L volumetric flask. Dilute with water to the meniscus. Transfer the liquid to a 1 L Erlenmeyer flask, close and mark the flask 'Dilution.' To prepare the 'Test Solution' transfer the specified aliquot into a 1 L volumetric flask. To avoid excess foaming, slowly add 100 mL soap solution and water to fill the flask to the meniscus. Transfer the liquid to a 1 L Erlenmeyer flask, close and mark the flask with 'Test Solution.'

9. Preparation of Canisters

9.1 Rinse canisters to be used with acetone and then with water.

9.2 Immerse lids and seals in a small beaker with acetone for 2 min, rinse with water.

10. Pre-Wetting Specimens

10.1 Wet out the specimens in 1 L water at 50°C for 10 min.

10.2 Rinse the specimens in cold water.

10.3 Squeeze the specimens between blotting paper, or with a wringer to approximately 80% wet pickup.

11. Procedure

11.1 It is essential to attain a level staining of the respective fibers. Evaluations are conducted by colorimetric measurements to eliminate objectivity from visual evaluations. To ensure reproducibility it is necessary to adhere closely to the testing protocol.

11.2 In each of the four canisters, add 300 mL of one of the test solutions.

11.3 Check the pH of the test solution. This should be 9.5-10.

11.4 Enter a control specimen and a specimen under test in a canister and immediately stir for 5-10 s.

11.5 Clamp the covers on the canisters with a Teflon gasket inserted between the neoprene gasket and the top of each canister to prevent contamination.

11.6 Repeat this for the other three canisters.

11.7 Load the canisters as rapidly as possible into the Launder-Ometer or similar device.

11.7.1 If an operator is conducting the tests without an assistant, it is recommended that only two treatment baths (canisters) be prepared and run at one time.

11.8 Start the test at $20 \pm 2^\circ\text{C}$, raise the temperature to $50 \pm 2^\circ\text{C}$ in 20 min and continue at this temperature for 45 min.

11.9 Stop the machine, remove the canisters and place the specimens separately by color in 500 mL beakers. Rinse the specimens with cold water for 2 min. Repeat the rinse with fresh water for an additional 2 min.

11.10 Place the specimens flat on blotting paper and dry in an oven at $50\text{-}60^\circ\text{C}$ and condition at $65 \pm 2\%$ RH and $21 \pm 1^\circ\text{C}$ for a minimum of 4 h prior to evaluation.

12. Evaluation

12.1 Fold the specimens to form two layers of the strip to be measured. Place the specimen on the instrument with the weave at a 45° angle. Take two measurements, each at a different place, rotate the

specimen 90° and take two additional measurements, each at a different place.

12.2 Obtain the CIELAB L^* , a^* , b^* , h_{ab} values for the following components:

12.2.1 Secondary acetate for the specimens treated with the yellow dye.

12.2.2 Polyamide for the specimens treated with the orange dye.

12.2.3 Cotton for the specimens treated with the blue dye.

12.2.4 Polyester and polyamide for the specimens treated with the navy dye.

12.2.5 The secondary acetate, polyamide, polyester and cotton for the untreated control multifiber fabric and for the untreated multifiber fabric under test (the values should be practically identical).

13. Calculations

13.1 The ΔE^*_{ab} values are calculated, using the formulae in Clause 4.2.1 of AATCC Test method 173, CMC: Calculation of Small Color Differences for Acceptability. The staining scale ratings (SSR values) are calculated (see Table I) using the formulae in Clauses 6.4 and 6.5 in ISO 105-A04.

13.2 The staining scale ratings for the control multifiber fabric and of the multifiber fabric under test are based on the respective CIELAB values from the appropriate fibers of the tested versus the original specimens.

13.3 If the software does not give the SSR values, the calculations may be made with a hand-held calculator. However, it is more efficient to enter the formulas in an Excel template. (Table I)

13.4 Enter the formulas into the template in cells L3, M3, N3, and O3, exactly as shown in Table II, starting with the equal sign.

13.5 Copy the CIELAB values from the instrument's software into the appropriate cells of the template.

13.6 The adjacent multifiber fabric under test is acceptable for its staining properties when the SSR values are less than 4.00 and greater than 3.00 (see 15.5).

Table I. Excel Template for the Calculation of Staining Scale Rating

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1			MF Type	Specimen Under Test				Untreated Specimens				Calculated Values			
2	Dyes	Fibers		L^*_s	a^*_s	b^*_s	h^*_s	L^*_u	a^*_u	b^*_u	h^*_u	ΔL^*	ΔE^*	ΔE_{ab}	SSR
3	Yellow	DIA	Control												
4			Test												
5	Orange	PA	Control												
6			Test												
7	Blue	CO	Control												
8			Test												
9	Navy	PES	Control												
10			Test												
11		PA	Control												
12			Test												