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Standard Guide for Evaluating Fabric Softeners¹

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1. Scope

1.1 This guide evaluates the performance characteristics of fabric softener products. It provides guidance for treating fabric in the wash, rinse, or dryer cycle in a home laundry and for evaluating the efficacy of the treatment chemicals. This guide can be used for simple screening of fabric softener products, or to evaluate the products through multiple accumulative cycles.

1.2 The relative ranking of products assessed by these procedures may be affected by such factors as fabric load composition and the kind and level of soils, as well as by the washing and drying procedures used.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are provided for information only.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

E313 Practice for Calculating Yellowness and Whiteness Indices from Instrumentally Measured Color Coordinates²

2.2 Other Standard:

AATCC Test Method 110-1994 Whiteness of Textiles³

3. Terminology

3.1 Definitions:

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709.

3.1.1 *fabric softener*—a laundry auxiliary product or laundry detergent ingredient that gives fabrics a soft feel, smooth surface, or reduces static electricity, or a combination thereof.

3.1.2 *home laundering*—the cleaning and restoring of textile materials to a serviceable condition using the washing and drying equipment commonly found in the home.

4. Summary of Guide

4.1 Fabrics are stripped for the removal of mill textile conditioners or previously applied fabric softeners following which they are treated with fabric softener products in the wash or rinse, dried and evaluated for softness, whiteness retention, rewet or water absorbency, and static control using test panels or instrumental methods.

5. Significance and Use

5.1 The methods in this guide can be used for simple screening of fabric softener products or to evaluate the performance, through multiple accumulative cycles, relative to a designated reference product.

5.2 A single assessment of each of the product characteristics tested by these methods will not predict overall performance of the softener product. A single test run under specified fixed conditions cannot be expected to reflect the comparative performance under many other possible conditions of use.

6. Fabric Pretreatment

6.1 Scope:

6.1.1 This section provides a procedure for preparing new or previously used textile specimens for further treatment and evaluation.

6.1.2 All new fabrics received directly from the mill or purchased from vendors must be stripped of mill conditioners and processing auxiliaries. Test towels may be reused for up to five evaluations and sheets used for load bulk may be reused indefinitely, if stripping is done between each evaluation.

6.2 Apparatus and Materials:

6.2.1 *Household Automatic Washing Machine*, top load.

6.2.2 *Household Automatic Laundry Dryer*, gas or electric.

6.2.3 *Hand Towels*, approximately 16 by 24 in., white cotton loop terry cloth. Care should be taken to use towels of similar construction, and weight fiber mix.

6.2.4 *Flat Bed Sheets*, full size (approximately 104 by 81 in.), 65 % polyester/35 % cotton or 50/50 blend.

6.2.5 AATCC (*American Association of Textile Chemists and Colorists*) 1993 *Standard Reference Detergent WOB*, (without brighteners), or a commercially built anionic detergent, as desired.

6.3 *Stripping Procedure:*

6.3.1 Load washer with up to 8 lb of dry fabrics. Do not overload.

6.3.2 Add 50 to 80 g of built anionic detergent.

6.3.3 Set machine for normal cycle, high or large water fill level, and hot wash/warm rinse temperature setting. Allow washer to fill with water and continue on through the complete wash and rinse cycle.

6.3.4 Repeat 6.3.2 and 6.3.3 four more times.

6.3.5 Wash this load of fabric through the complete cycle three times with no detergent. If there appears to be residual detergent (as evidenced by sudsing during the previous cycle) repeat the water only cycles one or two more times to ensure removal of all anionic detergent.

6.3.6 Dry fabrics in the automatic dryer at the *normal* or *hot* setting until the load is dry.

6.3.7 Store the fabrics. If closed storage is not available, store in plastic bags.

7. Fabric Treatment with Fabric Softener

7.1 *Scope:*

7.1.1 This section provides the procedure for application of the test products to the textile substrates.

7.2 *Apparatus and Materials*—Same as 6.2.

7.3 *Conditions of Treatment:*

7.3.1 *Washing Machine Water Level*—Use the water fill setting that will give a 16 to 19-gal water level. Record actual water fill to the nearest gallon.

7.3.2 *Water Hardness*—Tap water or conditioned water containing 150 ± 20 ppm calcium carbonate hardness.

7.3.3 *Water Temperature*—Record temperature actually used. If only one treatment temperature is tested, use a warm wash/cold rinse setting. The suggested test temperatures are as follows:

Hot water	130°F (54.4°C)
Warm water	90°F (32.2°C)
Cold water	80°F (26.7°C)

7.3.4 *Dryer Setting*—Use the *regular* or *normal* dryer setting.

7.3.5 *Fabric Load Weight*—Dry load should weigh 2.3 to 2.7 kg. A load consisting of three sheets and four hand towels will generally be in this range.

7.3.6 *Wash Detergent Dosage*—Use 50 g of AATCC 1993 Standard Reference Detergent WOB (without brighteners). If a commercial detergent is used, follow manufacturer's recommendation. If the wash detergent is also the softening product being evaluated, determine dosage in accordance with 7.3.7.

7.3.7 *Softener Product Dosage*—The amount of the softener dispersion to be used in each test is determined by the level of active softener ingredient desired per unit weight of dry fabric. If commercial products are being tested, follow manufacturer's dosage recommendations.

7.4 *Procedure:*

7.4.1 Weigh three sheets and four towels previously prepared as in 6.3. Load weight should be 2.3 to 2.7 kg.

7.4.2 Set wash controls for *regular* or *normal* cycle with a wash period of 12 ± 2 min and a water fill level of 16 to 19 gal.

7.4.3 Start wash cycle. As the washer fills, add wash detergent dose to washing machine.

7.4.4 Put fabric bundle in washer and allow washer to run until it reaches the deep rinse cycle. (If *untreated* control fabrics are being prepared, allow washer to go to final spin and skip to 7.4.8).

7.4.5 Stop washer and remove towels and sheets.

7.4.6 Start deep rinse cycle until tub is approximately one third filled with cold water. If a rinse cycle product is being evaluated, add the required amount of fabric softener and agitate to ensure uniform dispersion. Record water temperature and time. Specify water temperature.

7.4.7 Add damp fabric bundle. Start machine and allow it to complete the rinse and spin cycles.

7.4.8 Place fabric bundle in dryer. Add dryer cycle softener, if appropriate. Use the *regular* or *normal* dryer setting.

7.4.9 Dry towels for 45 min or until dry. Store the towels overnight so they equilibrate (see 8.2.1).

7.4.10 Treated towels can now be evaluated for softness (Section 8) or absorbency (Section 9), or both.

8. Fabric Softness Evaluation by Test Panel Scoring

8.1 *Scope*—This section covers a subjective testing procedure for ranking the relative softness of treated fabrics. Treated towels are ranked by panelists on a five point scale (least soft = 1, most soft = 5). The comparisons include an untreated towel and a towel treated with a control product for benchmark rankings.

8.2 *Procedure:* 03817c812c72/astm-d5237-05

8.2.1 Condition the fabrics in a constant temperature-humidity room (if available) for 24 h prior to evaluation. Suggested controlled environments are between 65 to 75°F (18.3 to 23.9°C) and 40 to 50 % relative humidity.

8.2.2 It has been observed that different scores result when one-day old towels are compared to four-day old towels. This may be due to a loss *fluff* over time, resulting in a leveling effect. Fabrics being tested should all be treated with softener the day prior to the evaluation.

8.2.3 To effectively evaluate a set of towels, at least four panel members are needed. Eight are preferred. The panelists should wash their hands before handling the test fabrics. During the evaluation the panelists may need to rewash their hands to remove any softener or oily build up that might interfere with the test.

8.2.4 Each panelist is given a group of test fabrics for scoring.

8.2.4.1 Each group of test fabrics shall consist of up to five pieces. The test group should contain one untreated control, one softness reference fabric, and no more than three test fabrics. The softness reference fabric has been treated with dihydrogenated tallow dimethyl ammonium chloride at 0.1 % single use level, based on dry fabric weight.

8.2.4.2 Panelist should use the same handling technique for scoring each towel in the test set.

8.2.4.3 The panelist first picks out the harshest towel and scores it one. Then the softest towel is selected and scored five. The other towels are scored intermediate between the high and low selections and given scores such as two, three, or four. The towels are then rearranged and the evaluation repeated. (To eliminate bias, towels are blind coded and panel members are not told their rating results before repeat evaluations.)

8.2.4.4 Additional comments by the panel member on the feel of the fabric should be recorded, for example, *oily*, *waxy*, *greasy*, etc.

8.2.4.5 After each test the scores are totaled and averaged to give a single rating number for each treatment product.

8.3 Paired Comparison Method:

8.3.1 Towels should be conditioned as in 8.2.1.

8.3.2 Fabrics (towels) being tested should all be treated with softener the day before testing.

8.3.3 For effective evaluation, at least 10 and preferably 15-20 panelists are required.

8.3.4 Arrange the towels in pairs so that towels treated with a product are paired at least once and preferably twice with towels treated with all the other treatments. Untreated towels may be included as an additional treatment.

8.3.5 A panelist feels each pair of towels and records their preference as to which towel of the pair is softer. The panelist must choose one of the towels in each pair, even if both appear equally soft.

8.3.6 When all the panelists have evaluated all the pairs, the results are tabulated and treated as described in *Sensory Evaluation Techniques*.⁴

8.3.6.1 For each pair of towels, total number of times each towel was judged softer.

8.3.6.2 Create a table with the number of columns and the number of rows both equal to the number of treatments. Label one column and one row with each treatment.

8.3.6.3 In the row for treatment “A” and the column for treatment “B” enter the number of times the towel treated with A were judged softer than the towel treated with B. In the row for treatment B, and the column for treatment A, enter the number of times treatment B was judged softer than treatment A. Do this for all the pairings.

9. Evaluation of Fabrics for Rewet (Water Absorbency)

9.1 *Scope*—This section covers the evaluation of treated fabrics for water absorbency. Test strips of treated fabrics are positioned in a dyed water solution. The height of migration of the water in a specified time is measured.

9.2 Apparatus:

9.2.1 *Swatches*, two 2 by 5 in., cut from towels treated in accordance with 7.4.

9.2.2 *Aqueous Solution*, 0.010 % of Rhodamine BX or any water-soluble dye which is not substantive to cellulose.

9.2.3 *Ring Stands*, two.

9.2.4 *Bar*, one from stand.

9.2.5 *Clamp Holders and Binder Clamps*, two.

9.2.6 *Laboratory Jacks*, two large.

9.2.7 *Beakers*, two 600 mL.

9.2.8 *Timers*, two.

9.3 Procedure:

9.3.1 Attach the bar horizontally to the ring stands with two clamp holders.

9.3.2 Cut the 2 by 5-in. swatches from the towels, treated in accordance with Section 7.

9.3.3 Mark a line 1 cm from the narrow edge of each swatch.

9.3.4 Attach the 2 by 5-in. swatches onto the bar with the binder clamps.

9.3.5 Fill the beakers three-fourths full with the dye solution.

9.3.6 Raise the beakers with the jacks until the solution level is at the 1-cm mark on the swatches. Start the timer.

9.3.7 After 6 min, remove the swatches from the bar and measure the distance of migration. Because the migration line is often uneven, three readings are taken across each swatch and the readings are averaged. Record this value as mm/6 min.

9.3.8 Two swatches, containing no softener, are used for a reference control against which the treated swatches are compared.

9.4 *Interpretation of Results*—The greater the migration of the dye solution up the fabric, the better the rewet (absorbency) properties.

10. Evaluation of Fabrics for Whiteness Retention

10.1 Apparatus:

10.1.1 Same as fabric treatment.

10.1.2 *Towel Swatches*, 8 by 8 in. Cut 8 by 8-in. swatches from one of the stripped hand towels. Four to ten swatches will be needed for this whiteness retention test.

10.1.3 *Light Source*, to approximate northern daylight.

10.2 *Conditioning*—Same as fabric treatment procedure.

10.3 Procedure:

10.3.1 Using indelible ink, mark the terry hand towels I, II, III, and IV.

10.3.2 At one of the borders of each swatch, mark the 8 by 8-in. towel swatches I, II, III, and IV.

10.3.3 Staple swatch I to towel I, swatch II to towel II, etc.

10.3.4 Follow fabric treatment procedure in accordance with 4.3.1 to 4.3.9, excluding 4.3.3.

10.3.5 Remove swatch I from towel I and retain in a clean, polyethylene bag, or other suitable container, for the scoring evaluation.

10.3.6 Staple a fresh 8 by 8-in. swatch marked Ia to towel I.

10.3.7 Repeat 4.3.2 to 4.3.9 of the fabric treatment method using the same towel and sheet bundle.

10.3.8 Remove swatch II from towel II and retain in a clean, polyethylene bag, or other suitable container, for the scoring evaluation. (Steps 10.3.5 through 10.3.7 should be repeated removing swatch III and replacing it with a swatch marked IIIa and, likewise, for swatch IB. At this point swatches are on hand

⁴ Meilgaard, Cville, and Carr, *Sensory Evaluation Techniques*, CRC Press LLC, 2000 N.W. Corporate Blvd., Boca Raton FL, 33431, pp. 103–106.