

Laboratory Procedure for Transfer of Free Permethrin from Textile Surfaces

Developed in 2018 by AATCC Committee RA49; editorially revised 2019.

Foreword

This laboratory procedure was originally developed as a method for transfer, extraction, and analysis of “free” permethrin insecticide. Because specific analysis methods vary among equipment manufacturers and models, the committee chose to standardize and publish only the transfer procedure. The practice may also be used for substances other than permethrin if paired with suitable extraction and analysis techniques. Although there is no result or data produced directly by the procedure, results reported after final analysis should note the use of this procedure.

1. Purpose and Scope

1.1 This procedure is used to transfer “free” permethrin insecticide from the surface of a textile material to a clean cloth for subsequent extraction and analysis. It may also be used to transfer other treatment substances

2. Principle

2.1 Using a Martindale abrasion tester, specimens of a treated sample fabric (with permethrin) are rubbed with an untreated white test fabric to transfer the permethrin from the specimen to the white test fabric. Trials at various (increasing) numbers of rubs are used to determine the total amount of free permethrin present on the surface of the test specimen.

3. Referenced Documents

3.1 ASTM D4850, Standard Terminology Relating to Fabrics and Fabric Test Methods (see 11.1).

3.2 ASTM D1776, Standard Practice for Conditioning and Testing Textiles (see 11.1).

3.3 ASTM D4966, Standard Test Method for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Tester Method) (see 11.1).

4. Terminology

4.1 **abrasion**, *n.*—the wearing away of any part of a material by rubbing against

another surface (ASTM D4850).

5. 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 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.

5.1 Good laboratory practices should be followed. Wear safety glasses and gloves when manipulating treated materials.

5.2 All chemicals should be handled with care.

5.3 An eyewash/safety shower should be located nearby for emergency use.

5.4 After testing, and to avoid any risk of contamination by permethrin, eliminate all activity of the treated samples, referring to the manufacturer’s recommendation.

6. Uses and Limitations

6.1 The degree of permethrin transfer is affected by the number of rubs. The number should be varied to produce varying degrees of abrasion and to determine the total free permethrin on the surface.

6.2 Extraction and analysis are not included in this method procedure. Final results may vary based on the selection of solvent and analytical technique.

7. Apparatus, Reagents, and Materials

7.1 Martindale Abrasion Tester (see Fig. 1) with the following replaceable items:

7.1.1 Standard Felt, of mass 750 ± 50 g/m² and 3 ± 0.3 mm thick, cut into three 140-mm diameter round specimens.

7.1.2 Polyurethane Foam Backing, 3 ± 0.01 mm thick, 29–31 kg/m³ density, and 170–210 N hardness, cut into three 38-mm diameter round specimens.

7.1.3 Weights, to create 12 kPa pressure for woven fabric and 9 kPa pressure for knitted (see Fig. 2).

7.2 AATCC Crocking Cloth, 100% cotton, plain weave, 32 ± 5 warp ends/cm, 33 ± 5 filling picks/cm, 100 ± 3 g/m²,



Fig. 1—Martindale abrasion tester.

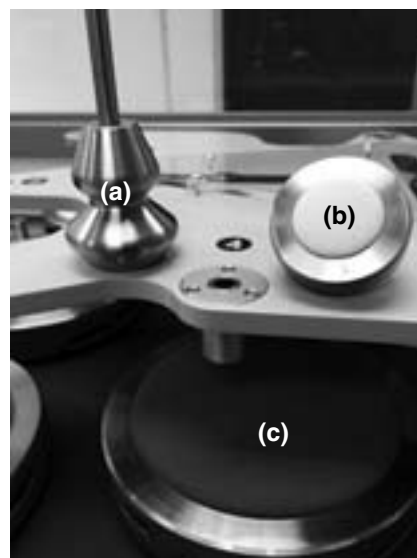


Fig 2—(a) Weight, (b) Sample holder with foam and untreated white specimen, and (c) Testing table with felt and test specimen.

cut into three 38-mm diameter round specimens.

8. Specimens

8.1 Minimize handling of the sample to avoid transfer of permethrin prior to testing.

8.2 Cut three 140-mm diameter round specimens diagonally across the width of the sample.

8.3 All specimens should be cut at least

100 ± 5 mm from the selvage.

9. Conditioning

9.1 Prior to testing, condition test specimens, as well as white test fabric, standard felt, and foam backing specimens, as directed in ASTM D1776, Standard Practice for Conditioning and Testing textiles (see 11.1). Condition for at least 4 h in an atmosphere of 21 ± 2°C, 65 ± 5% RH, by laying each specimen separately on screen or perforated shelf of a conditioning rack.

9.2 Perform all tests in the standard atmosphere for testing. This will minimize variation in abrasion due to wet friction.

10. Abrasion

10.1 Using the manufacturer's directions, set the abrasion figure to a Lissajous figure with 60-mm stroke length.

NOTE: Check the rubbing area by placing a 140-mm untreated white specimen on the Martindale tester table and a 38-mm colored specimen in the sample holder. Run for several minutes, then measure the area of transferred color. Transferred area should be approximately 75 cm².

10.2 Place a felt specimen, followed by

a test specimen on a testing table of the Martindale Abrasion Tester (see Fig. 2). Place the mounting weight (supplied with the tester) on the test specimen and secure the fabric/felt to the table with the mounting weight in place. Remove the weight and inspect for tucks, ridges, or distortions. If necessary, loosen and repeat until smooth.

10.3 Repeat 10.2 for each remaining felt specimen and test specimen.

10.4 Assemble a holder by placing one untreated white test fabric specimen face down into the specimen holder. Place a foam specimen between the specimen and the metal insert. Assemble the holder according to the manufacturer's instructions (see Fig. 2).

10.5 Repeat 10.4 for each remaining white test fabric specimen and foam specimen.

10.6 Place each assembled holder on the Martindale Abrasion Tester above a table mounted with fabric/felt specimens. Add the required weight to give a pressure on each specimen of 12 kPa for woven fabric and 9 kPa for knitted fabric (see Fig. 2).

10.7 Using the manufacturer's directions, set the counter system to record the desired rubs and start the abrasion test. (Complete transfer of the free permethrin

is usually obtained at greater than 300 rubs).

10.8 After the set number of rubs is complete, carefully remove the untreated white test fabric specimens.

10.9 Repeat the procedure with fresh specimens and increasing numbers of rubs as needed.

10.10 Untreated white test fabric specimens may be subsequently extracted, and extract analyzed, to determine the maximum amount of "free" permethrin on the test fabric surface (see 11.2).

11. Notes

11.1 Available from ASTM International, 100 Barr Harbor Dr., W. Conshohocken PA 19428; +1.610.832.9500; www.astm.org.

11.2 An ultrasonic method and solvent such as 80% acetonitrile/20% methanol is recommended for extraction of permethrin from the untreated white test fabric specimens after completion of the transfer procedure. The quantity of extracted permethrin may be determined by gas chromatography or other analytical technique. To determine the *maximum* "free" permethrin, the transfer procedure should be repeated with an increasing number of rubs, until the quantity of extracted permethrin ceases to increase. Concentration of free permethrin may be expressed as mg/m², using the rubbing area from section 11.1 (75 cm² = 0.0075 m²).