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Antifungal Activity, Assessment on Textile Materials: Mildew and Rot Resistance of Textile Materials

Developed in 1946 by AATCC Committee RA31; revised 1952, 1957, 1971, 1981, 1987, 1988 (with title change), 1993, 1999; reaffirmed 1970, 1974, 1979, 1989, 1998, 2013; editorially revised and reaffirmed 1986, 2004; editorially revised 2010.

1. General Purpose and Scope

1.1 The two purposes of this test method are to determine the susceptibility of textile materials to mildew and rot and to evaluate the efficacy of fungicides on textile materials.

2. Principle

2.1 Tests I, II, III and IV can be used, singly or in combination, depending on the type of exposure to which the textile material will be subjected. For example, if the final product will come in contact with soil, Test I, which simulates this exposure, should be used; if the finished product will never come in contact with soil or tropical conditions, a much less severe test (e.g., II or III) should be used. Test II is specifically designed for cellulose-containing materials while Test III is for all others. For all materials intended for outdoor and above ground use, Test IV should be used. The two important considerations when evaluating textile materials in relation to fungal growth are (1) the actual deterioration of the textile product (rot), and (2) growth not necessarily deteriorating the product but making it unsightly (mildewy) often with an unpleasant and musty odor.

2.2 Certain pre-exposures of textile products may be indicated when specific end-uses are critical (see Appendix A). When the end-use will be near high temperature and the fungicide may be volatile, a preliminary oven exposure may be desired. When the end-use will be in tropical exposures or outside with rainfall present, a leaching exposure should be performed before mildew evaluation is made. When at all possible, the textile material should be exposed to the expected conditions of use prior to performing this test.

3. Terminology

3.1 **mildew resistance**, n.—in textiles, resistance to development of unsightly fungal growths and accompanying unpleasant, musty odors on textile materials

exposed to conditions favoring such growths.

3.2 **rot resistance**, n.—in textiles, resistance to deterioration of a textile material as a result of fungal growth in or on it.

NOTE: Such deterioration is normally assessed by measuring loss in tensile strength.

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 This test should be performed only by trained personnel. The U.S. Department of Health and Human Services publication *Biosafety in Microbiological and Biomedical Laboratories* should be consulted (see 24.1).

4.2 CAUTION: Some of the fungi used in these tests are allergenic and pathogenic; i.e., capable of infecting humans and producing disease. Therefore, every necessary and reasonable precaution must be taken to eliminate this risk to the laboratory personnel and to personnel in the associated environment. Wear protective clothing, respiratory protection, and impervious gloves when working with the organisms. NOTE: Choose respiratory protection that prevents penetration by the spores.

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

4.4 All chemicals should be handled with care.

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

4.6 Sterilize all contaminated samples and test materials prior to disposal.

4.7 Exposure to chemicals used in this procedure must be controlled at or below levels set by government 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 Hygienists (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 24.2).

Test I Soil Burial

5. Scope

5.1 This procedure is generally considered to be the most severe test for textile products. Only those specimens that will come in direct contact with soil—such as sandbags, tarpaulins, tents—need to be tested by this procedure. It can also be used for testing experimental textile fungicides.

6. Test Specimens

6.1 Prepare the fabric specimens with dimensions $15.0 \pm 1.0 \times 4.0 \pm 0.5$ cm ($6.0 \pm 0.4 \times 1.5 \pm 0.2$ in.) with the long dimension parallel to the warp and unraveling to 2.5 ± 0.1 cm width (1.0 ± 0.04 in.), or, in the case of fabric with less than 20 threads per 2.5 cm (1.0 in.) to a predetermined number of threads to give a specimen 2.5 ± 1.0 cm in width (1.0 ± 0.4 in.). A sample cutter can also be used (see 24.3). The number of specimens will vary according to the number of variables. The suggested number of specimens is five for each treatment, control and reference fabric.

7. Test Procedure

7.1 Viability control: Expose untreated cotton cloth 271 g/m² (8 oz/yd²) in the soil bed for seven days during the test period to verify fungal activity. The soil bed shall be considered as satisfactory if the viability control fabric loses 90% breaking strength after seven days exposure.

7.2 Soil Bed: Place the air-dry test soil (see 24.4) in trays, boxes or suitable containers to a depth of 13.0 ± 1.0 cm (5.1 ± 0.4 in.) and bring to optimum moisture content by gradual addition of water accompanied by mixing to avoid puddling. After allowing it to stand for 24 h, sieve it through a 6.4 mm (0.25 in.) mesh screen. Maintain uniform moisture content by covering the soil container with a suitable lid. The moisture content of the soil during the test period shall be maintained between $25 \pm 5\%$ (based on dry weight). If