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Ageing of Sulfur-Dyed Textiles: Accelerated

Developed in 1943 by AATCC Committee RR9; revised 1952, 1975; reaffirmed 1944, 1972, 1978, 1983, 1988, 1989, 1999; editorially revised 1990; editorially revised and reaffirmed 1994, 2004, 2009, 2013.

1. Purpose and Scope

1.1 This test method describes a procedure for determining whether sulfur-dyed textile materials will deteriorate under normal storage conditions and to establish the degree of such deterioration.

2. Principle

2.1 Specimens are steam-aged in a moist atmosphere under controlled conditions and then tested for loss in strength to determine if storage deterioration is likely.

3. Terminology

3.1 **accelerated ageing**, *n.*—*in textile processing and testing*, use of controlled environmental conditions to promote rapid physical and/or chemical change in a textile material.

3.2 **sulfur dye**, *n.*—a dye, containing sulfur both as an integral part of the chromophore and in attached polysulfide chains, normally applied in the alkali-soluble reduced (leuco) form from a sodium sulfide solution and subsequently oxidized to the insoluble form in the fiber.

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.

5. Apparatus

5.1 Conventional laboratory drying oven (see 10.1), uniformly heated and controlled to $\pm 2^\circ\text{C}$ ($\pm 4^\circ\text{F}$). It should be provided with ventilating ports and some

means for introducing moisture (see 10.2) or;

5.2 Steam ager (see 10.3) equipped with proper controls for uniform steam flow and temperature.

6. Test Specimens

6.1 Suitable test specimens are taken and blanks of the same material, dyed and undyed, used.

7. Procedure

7.1 Oven Test. Expose the specimens to $135 \pm 2^\circ\text{C}$ ($275 \pm 4^\circ\text{F}$) heat in the oven for 6 h continuously. At the beginning of the second, third, fourth, fifth and sixth hours the ports or vents are closed and 20 mL of water added for each 0.03 m^3 (1.0 ft^3) of oven capacity. The vents are kept closed for 5 min, then opened and circulation resumed for the rest of the period. As an alternate method the test specimens may be removed from the oven at the end of each hour and thoroughly humidified in an atmosphere of steam, then replaced in the oven. At the end of the 6 h of heating, the specimens are removed from the oven and placed in a conditioning room, if available.

7.1.1 Alternate Oven Test. Expose the specimens to $135 \pm 2^\circ\text{C}$ ($275 \pm 4^\circ\text{F}$) heat in the oven for 6 h continuously. At the beginning of the test, 100 mL of water for each 0.03 m^3 (1.0 ft^3) of oven capacity is introduced into the oven in a vessel having a surface area of approximately 413 cm^2 (64 in.^2). The vents are left open during the entire test. At the end of the 6 h of heating, the specimens are removed from the oven and placed in a conditioning room, if available.

7.2 The Steam Ager Test. The test specimens may be suspended while aging, or may be tacked on frames, which are then placed in the steam ager, pyramid style, with the bottom baffle functioning as a support. The specimens are aged for 8 h with saturated steam at 103 kPa (15 lb) pressure, or for 16 h at 51.7 kPa (7.5 lb) pressure. After the aging test is completed the specimens are removed from the ager and placed in a conditioning room, if available.

8. Evaluation of Results

8.1 Determine the breaking strength (see 10.4) of the aged specimens to eval-

uate the degree of deterioration due to ageing. Test specimens and unaged blanks should be conditioned for 16 h at standard conditions, $65 \pm 2\% \text{ RH}$ and $21 \pm 1^\circ\text{C}$ ($70 \pm 2^\circ\text{F}$), before making breaking strength tests (see 10.5). A minimum of 10 significant breaks should be made and the results averaged. Results are reported as percent loss (or gain) in strength based on the unaged material.

9. Precision and Bias

9.1 *Precision*. Precision for this test method has not been established. Until a precision statement is generated for this test method, use standard statistical techniques in making any comparisons of test results for either *within-laboratory* or *between-laboratory* averages.

9.2 *Bias*. The accelerated ageing of sulfur-dyed textiles can be defined only in terms of a test method. There is no independent method for determining the true value. As a means of estimating this property, the method has no known bias.

10. Notes

10.1 The oven used may be of any conventional design and constructed of conventional material as long as the heating elements or materials of construction do not give off gases when heated which would tend to distort the results. The quantity of materials tested must bear a fixed relationship to the capacity of the oven, 25 g of materials tested per 0.03 m^3 (1 ft^3) of oven capacity being considered correct.

10.2 The temperature control must be accurate within $\pm 2^\circ\text{C}$ ($\pm 4^\circ\text{F}$). Care must be exercised to insure that the thermometer indicates the true and correct internal temperature of the area in which the samples are being tested.

10.2.1 The oven should be equipped with ports or vents of such size as to allow the air in the oven to be changed approximately every 2 min except when humidifying. This may be accomplished by natural convection or by a circulating system. During humidification the ports or vents should be closed to confine the moisture within the oven for the specified time.

10.2.2 Controlled amounts of water (or steam) should be admitted into the oven at specified intervals. This may be entered through either the top or the side of the oven. The requisite amount of water should be added onto a heated mass of material in order to effect rapid vaporization. To effect this relatively rapid vaporization the weight of material should be approximately 100 g for each gram of water admitted per hour. The amount of water admitted should be sufficient to cause the filling of the oven with steam at atmospheric pressure each hour. 20 mL of