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Test Method for Ageing of Sulfur-Dyed Textiles: Accelerated

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 breaking strength to determine if storage deterioration is likely.

3. Referenced Documents

3.1 ASTM E145, Standard Specification for Gravity-Convection and Forced-Ventilation Ovens.

3.2 ASTM E1402, Standard Guide for Sampling Design.

4. Terminology

4.1 **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.

4.2 **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.

5. Safety Precautions

5.1 The safety precautions specified in the method/procedure are ancillary to the testing procedures and are not intended to be all inclusive.

5.2 It is the user's responsibility to reference applicable safety data sheets, use safe and proper techniques, and wear appropriate personal protective equipment in handling materials in this standard.

5.3 Users **MUST** consult manufacturers for specific details such as equipment operating instructions and other recommendations. Consult and follow all applicable health and safety regulations (e.g., OSHA standards and rules).

6. Apparatus

6.1 Conventional laboratory drying oven (see 13.1), uniformly heated and controlled to $\pm 2^\circ\text{C}$. It should be provided with ventilating ports and some means for introducing moisture (see 13.2) or;

6.2 Steam ager (see 13.3) equipped with proper controls for uniform steam flow and temperature.

6.3 Tensile testing machine.

7. Sampling

7.1 Test results are valid only when the samples are statistically representative (see ASTM E1402).

7.2 Sampling must be random. Every unit of product must have a mathematically equal chance of becoming a sample; and every portion of each sample must be equally likely to become a test specimen.

7.3 All specimens must be alike within the variations due to pure chance. There must be no differences within samples assignable to known causes.

8. Test Specimens

8.1 Sufficient samples are taken for both control and test specimens. Tensile specimens are prepped from control and aged samples after conditioning (see 10.1).

9. Procedure

9.1 Oven Test, Option 1. Expose the specimens to $135 \pm 2^\circ\text{C}$ heat in the oven for 6 h continuously. At the beginning of the second, third, fourth, fifth and sixth hours, close the ports or vents and add 20 mL of water for each 0.03 m^3 (1.0 ft^3) of oven capacity. Keep vents closed for 5 min, then open and resume circulation for the rest of the period. At the end of 6 h of heating, remove the specimens from the oven and place in a conditioning room.

9.1.1 Oven Test, Option 2. Expose the specimens to $135 \pm 2^\circ\text{C}$ heat in the oven for 6 h. Remove the test specimens from the oven at the end of each hour and thoroughly humidify in an atmosphere of steam, then replace in the oven. At the end of 6 h of heating, remove the specimens from the oven and place in a conditioning room.

9.1.2 Oven Test, Option 3. Expose the specimens to $135 \pm 2^\circ\text{C}$ heat in the oven for 6 h continuously. At the beginning of the test, introduce 100 mL of water for each 0.03 m^3 (1.0 ft^3) of oven capacity using a vessel having a surface area of approximately 413 cm^2 (64 in^2). Leave the vents open during the entire test. At the end of the 6 h of heating, remove the specimens from the oven and place in a conditioning room. Under the conditions above, it has been found that the water will require 1.75-2.0 h to evaporate.

9.2 Steam Ager Test. Suspend the test specimens while ageing, or tack on frames and place in the steam ager, pyramid style, with the bottom baffle functioning as a support. Age the specimens for 8 h with saturated steam at 103 kPa (15 psi) pressure, or for 16 h at 51.7 kPa (7.5 psi) pressure. After the ageing test is completed, remove the specimens from the ager and place in a conditioning room.

10. Evaluation

10.1 Condition test specimens and unaged controls for 16 h at standard conditions, $65 \pm 5\%$ RH and $21 \pm 2^\circ\text{C}$ ($70 \pm 4^\circ\text{F}$), before performing breaking strength tests. Perform testing under the same standard conditions.

10.2 Determine the breaking strength of the unaged control specimens. Since comparative, but not absolute, results are to be obtained, any suitable breaking strength machine may be used which is adaptable to breaking the specimens being tested. Perform a minimum of 10 significant breaks and average the results.

10.3 Determine the breaking strength of the aged specimens. Perform a minimum of 10 significant breaks and average the results.

10.4 Calculate percent loss (or gain) in strength based on the unaged control material.

11. Report

11.1 Describe or identify the sample tested.

11.2 Report that the sample was tested using AATCC TM26-2020.

11.3 Report the testing conditions:

11.3.1 Test procedure (oven test: Option 1, Option 2, Option 3, or steam ager test).

11.3.2 Test conditions.

11.4 Report test method used for breaking strength.

11.5 Report the test results:

11.5.1 Mean breaking strength and standard deviation of unaged control specimens.

11.5.2 Mean breaking strength and standard deviation of aged test specimens.

11.5.3 Percent loss (or gain) in strength based on the unaged control material.

11.6 Describe any modification(s) of the published method.