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Surface active agents — Fabric conditioners — Determination of antistatic performance

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Foreword

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ISO 23324 was prepared by Technical Committee ISO/TC 91 surface active agents.

Surface active agents — Fabric conditioners — Determination of antistatic performance

1 Scope

This document specifies a method for the determination of static electricity elimination performance for fabric conditioners.

This document is applicable to assessment of static electricity elimination performance for fabric conditioners and antistatic agents.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 fabric electrostatic

relatively stable electric charges accumulating within or on the surface of fabric, created by some external influences, such as friction

3.2 the fabric surface resistance (R_s)

the resistance measured when electric current flows through the surface of fabric

3.3 the fabric surface resistance coefficient (ρ_s)

the surface resistance of fabric measured with two electrodes placed on its surface, the length of the two electrodes and the distance between them are unit length (cm).

3.4 antistatic agent

products used to treat fabric for eliminating static electricity

3.5 fabric conditioners

products of both antistatic and softening function, which generally contain cationic surface active agents

4 Principle

The electrostatic effect of fabric is subject to not only the amount of static electricity generated, but also the dissipation capacity of electrostatic charge. The fabric surface resistance is a physical quantity characterising the electrostatic charge attenuation velocity of fabric. Soak the polyester in fabric conditioner solution under specified conditions. Measure the surface resistance of the polyester with ultra-high resistance meter before and after soaking. Assess the antistatic performance for fabric conditioner with the decrease of the surface resistance coefficient (□ρ_s) or the decrease of the logarithm of the surface resistance coefficient (□$\lg\rho_s$).

5 Material

Polyester: white or milky woven twill. Warp - 428 threads per decimeter. Weft - 242 threads per decimeter.

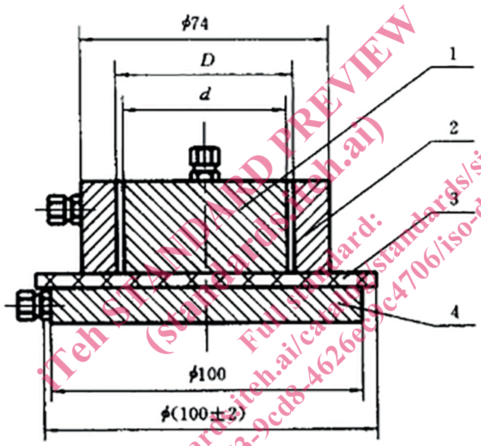
Note: Polyester of other specifications or cloth of other textures can be used. However, only the comparative test result of antistatic performance for different fabric conditioners can be provided, which shall be included in the test report.

6 Apparatus

6.1 Digital ultra-high resistance meter

Three coaxial electrodes. Measuring range: 1×10^{3} Ω~1×10^{16} Ω. The intrinsic error within limits shall not exceed 10 % of the indicated value. The pressure that the electrodes press on sample is 100 g/cm^{2}. Structure size of coaxial-electrode system, see Figure 1.

Note: Commercial instruments for ultra-high resistance meter



Key

1 measuring electrode

2 shield electrode

3 test sample

4 high-voltage electrode

Figure 1 — Coaxial-electrode system

6.2 Oven, controllable at (45± 2) °C.

6.3 Humidistat. Glass desiccator that containing potassium carbonate-saturated solution can be used. The relative humidity (RH) of air after equilibrium is 43% at 10 °C~30 °C.

6.4 Vegetable dehydrator (see Figure 2). Diameter of the upper rim of outer basket is (26±3) cm, and the height is (17±2) cm.

Figure 2 — Vegetable dehydrator

6.5 Speed controller (optional) for use with the vegetable dehydrator (6.4),see Annex A.

6.6 Other tools: scissors, ruler, filter paper, plastic tweezers, plastic clip and thermometer.

7 Procedure

7.1 Preparation of test clothes

7.1.1 Washing of test clothes

Cut 10 cm selvage off the polyester, then cut it into 100 mm × 100 mm test clothes.

Dissolve soap flakes (neat soaps, soap powder or soap base, with dried sodium soap content ≥ 54 %) in distilled water or deionized water to make the concentration of dried sodium soap in soap solution 1g/l. Keep the temperature between 40 ºC and 45 ºC.

Transfer 2 l of the soap solution to the vegetable dehydrator (6.4). Put 20 pieces of the 100 mm × 100 mm test clothes into it, cover and spin for 15 min. During the spinning, turn clockwise five times then anticlockwise five times for 3 min at a speed of 18 r/min to 22 r/min under control or monitoring (6.5), then stop for 2 min. Repeat 2 times. Discard the water and spin fast for 30 s.

Transfer 2 l of 40 ºC to 45 ºC distilled water or deionized water to the vegetable dehydrator (6.4). Cover and spin for 3 min. During the spinning, turn clockwise five times then anticlockwise five times. Discard the water and spin fast for 30 s. Then, repeat the rinse 2 times.

7.1.2 Drying of test clothes

Pick the washed test clothes with plastic tweezers. Clip both sides of the test clothes hanging to dry at room temperature for 2 h to 3 h. Lay the dried test clothes on filter paper in an enamel tray and cover with another filter paper. Dry in the oven at 45 ºC for 4 h. Put it in the humidistat (6.3) and keep in reserve.

7.2 Preparation of conditioner solution

Dilute test sample with distilled water or deionized water to 850 ml in a 1000 ml beaker to make the concentration 10,0 g/l. Transfer 200 ml of the solution to four 400 ml beakers, respectively, for parallel test.

Soak four pieces of 100 mm × 100 mm test clothes (7.1) in each 200 ml conditioner solution for 10 min at room temperature and stir with a glass rod. Take out and clip both sides of the test clothes hanging to dry for 3 h. Dry in the oven at 45 ºC for 4 h as specified in 7.1.2.

Another four pieces of 100 mm × 100 mm test clothes (7.1) shall be used for blank test (without soaking in conditioner solution). Separate the dried test clothes of different samples and those of the blank with filter paper. Place in the humidistat (6.3) for fifteen or more hours at room temperature.

7.3 Measurement of surface resistance

7.3.1 measurement conditions

Measurement shall be controlled at humidity (43±5)% and temperature (20±2) ºC.

7.3.2 Preparation of ultra-high resistance meter

Warm up the ultra-high resistance meter off or 10 min according to the operation manual.

7.3.3 Measurement of surface resistance

Switch the knob to "R" to measure the surface resistance (with circular shield electrode applied voltage and high-voltage electrode earthed).

Put the test clothes and blank test clothes, of which the humidity has been adjusted in humidistat, during the test with tweezers on the high-voltage electrode in sequence. Place the shield electrode and measuring electrode on the cloth surface, then cover.

Press "*R*" on the panel to measure resistance, then press "Charge". Adjust the voltage with "▲" or "▼" to select the test voltage (generally, select 250 V as the test voltage). Press "Auto" and "Measure". 1 min later, when the reading stabilises, read the resistance on the screen.

Press "Discharge" after the measurement of one test cloth. Press "Reset" after 1 min, then take the test cloth out. Repeat the procedure with another test cloth.

Turn off the high resistance meter and restore all the wiring after use.

8 Expression of results

8.1 Method of calculation

8.1.1 Fabric surface resistance (R_s)

The resistance directly read on the screen is the fabric surface resistance (R_s), in Ω.

8.1.2 Fabric surface resistance coefficient (ρ_s)

The fabric surface resistance coefficient (ρ_s), in Ω, is given by the formula (1), to compare the results got from high resistance meters of different parameters.

$$\rho_s = R_s \times \frac{2\pi}{ln\frac{D}{d}} \qquad (1)$$

where

R_s is the fabric surface resistance, in Ω, specified in 7.1.1

D is the inner diameter, in centimeters, of circular shield electrode

d is the diameter, in centimeters, of measuring electrode

π is 3,1416

When D = 5,4 cm and d = 5,0 cm, $\rho_s = R_s \times 81.6$.

8.1.3 Decrease of fabric surface resistance coefficient ($\Delta\rho_s$)

The decrease ($\Delta\rho_s$), of fabric surface resistance coefficient, is given by the formula (2).

$$\Delta\rho_s = \rho_{sB} - \rho_{sC} \tag{2}$$

where

ρ_{sB} is the average value, of the surface resistance coefficients from four pieces of blank test clothes

ρ_{sC} is the average value, of the surface resistance coefficients from four pieces of test clothes treated with conditioner solution

8.1.4 Decrease of fabric surface resistance coefficient ($\Delta\rho_s$)

The decrease ($\Delta lg\rho_s$), of the logarithm of fabric surface resistance coefficient, is given by the formula (3).

$$\Delta \lg \rho_s = \lg \rho_{sB} - \lg \rho_{sC} = \lg R_{sB} - \lg R_{sC} \tag{3}$$

where

$lg\rho_{sB}$ is the logarithm, of the average value of surface resistance coefficients from four pieces of blank test clothes

$lg\rho_{sC}$ is the logarithm, of the average value of surface resistance coefficients from four pieces of test clothes treated with conditioner solution

lgR_{sB} is the logarithm, of the average value of surface resistance from four pieces of blank test clothes

lgR_{sC} is the logarithm, of the average value of surface resistance from four pieces of test clothes treated with conditioner solution

8.2 Expression of results

Express the antistatic performance for fabric conditioner as the decrease of surface resistance coefficient ($\Delta\rho_s$) or decrease of the logarithm of surface resistance coefficient ($\Delta lg\rho_s$) of fabric treated with fabric conditioner. The bigger $\Delta\rho_s$ or $\Delta lg\rho_s$ implies the better antistatic performance.

9 Test report

The test report shall include the following particulars

a) sample name

b) test date

c) specification of polyester