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Spectrophotometer UV Energy Calibration Procedure for Optically Brightened Textiles

Developed in 2007 by AATCC Committee RA36; reaffirmed 2008; editorially revised 2010, 2012.

1. Scope

1.1 This evaluation procedure describes the use of the Textile UV Calibration Standard (TUVCS) for inter-instrument calibration of UV content in the light source of spectrophotometers for the purpose of measuring white or light to medium colored textiles that have been optically brightened with a fluorescent whitening agent. UV absorption properties of fluorescent whitening agents (FWAs) used for textiles differ from those of FWAs used for plastics or other non-textile materials, necessitating the use of a different reference standard than those typically used for these other materials. This procedure is based on a semi-annually replaced textile calibration standard that facilitates accurate UV content adjustment of the light source of spectrophotometers for use with textile materials independent of instrument geometry and the methodology used for adjusting the amount of UV energy in the instrument.

2. Principle

2.1 The amount of UV energy in a spectrophotometer light source is standardized by adjusting it (mechanically or by computation) until the calibrated value of the light source is in agreement with the CIE Whiteness Index (CIE WI) of the TUVCS (see 7.1).

3. Terminology

3.1 **calibration procedure**, *n.*—a method for adjusting certain parameters in an instrument so that different instruments from the same or different manufacturers produce the same results in a test for a given property.

3.2 **CIE Whiteness Index (CIE WI)**, *n.*—an index predicting the apparent degree of whiteness of a material based on tristimulus values determined according to one of the CIE standard methods, proposed by the Commission Internationale de l'Éclairage (CIE).

3.3 **fluorescent whitening agent (FWA)**, *n.*—colorant that absorbs near ultraviolet (UV) radiation and re-emits visible (violet-blue) radiation. This causes

a yellowish material to which it has been applied to appear whiter (ASTM E284).

4. Description of the Textile UV Calibration Standard

4.1 The TUVCS consists of a set of 4 layers of combed cotton broadcloth that has been bleached, mercerized and treated with a specific formulation of optical brighteners, to exhibit a CIE Whiteness Index (WI) of between 125 and 140. It measures $80 \times 80 \pm 5$ mm and is attached to an opaque white, non-optically brightened blotting paper by staples on one edge. This facilitates the handling of the TUVCS without touching the portion that is to be used for measurement. It has been found that temperature and humidity changes of normal instrument operating ranges do not significantly alter the determined WI values. These changes are normally not in excess of 0.1 WI. However, exposure to light can significantly deteriorate the FWA and cause changes in the WI. Therefore, it is important that the TUVCS be kept in its UV protective bag when not being used (see 7.4).

5. Use of the TUVCS Calibration Standard

5.1 The described procedure is applicable to large area view measurements (the recommended condition) for sphere or angular measuring geometry. Measurement on a given instrument in other conditions or configurations requires separate calibrations for the respective condition/configuration.

5.2 Any UV calibration standard must be stored in a container protecting it from UV exposure. The TUVCS should be stored in the UV protective brown plastic bag it is supplied in to keep it from becoming dirty. Also, take care not to touch the TUVCS when handling it to prevent soiling.

5.3 For multiple instruments in one location, a single TUVCS can be used. Each instrument must be separately calibrated with the TUVCS. CAUTION: This should be limited to no more than three instruments, as excessive use of the TUVCS may shorten its useful life to less than the required six months.

6. Procedure

6.1 Set the conditions of the spectrophotometer color measurement software to CIE standard illuminant D_{65} and CIE 10° (1964) standard observer (see 7.2).

Table I—Instrument Conditions

	Sphere	45/0 (0/45)
Area of view	Large	Large
UV Filter Mode	Calibrated	Calibrated
Specular component	Included	Excluded

6.2 Set the instrument conditions to those shown in Table I. Calibrate the spectrophotometer according to the manufacturer's procedure for the measuring geometry used.

6.3 In the spectrophotometer color measurement software, go to the UV calibration procedure. Enter the CIE WI value printed on the label of the TUVCS calibration standard fabric. Assume that the software is set to accept CIE WI and not another kind of whiteness index.

6.4 Mount the TUVCS on the instrument's sample mount, centered over the instrument's port. Back the TUVCS with its attached white backing card. The white backing card used in the TUVCS is sufficiently opaque that the color of the instrument's sample clamping mechanism is of no consequence (see Fig. 1).



Fig. 1—Position of the Sample at the Instrument.

6.5 Perform the instrument's standard automatic or manual method for calibrating UV energy. The value obtained should be within ± 0.5 CIE WI units of the value entered in 6.3 above.

6.6 Remove the textile standard and perform a normal black and white reference standard instrument calibration in the UV calibrated mode.

6.7 For the next six (6) months use the textile standard for bi-weekly UV cali-