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UVC exposure (278 nm) of UV sensitive material at different irradiation levels

(1 appendix)

RISE Research Institutes of Sweden has evaluated the colour shift for a 100 mJ/cm² UVC indicator after exposure to irradiation from a 278 nm UVC LED. The colour of the indicator after exposures of 0, 5, 10, 25, 50 and 100 mJ/cm² was measured and evaluated using the 1976 CIE Lab colour space.

Identification

Object	Yellow 100 mJ/cm ² UVC indicator.
Object state	Upon arrival the sample had no visual damage and were without any colour changes.
Location	Borås, Sweden
Measurement date	Jan 13, 2020

Measurement methods and procedures

Small pieces of the sample were exposed by UVC-radiation from an UVC LED with peak wavelength 278 nm (nominal). The irradiation level at the sample plane (about 1000 μW/cm²) was determined by a calibrated silicon detector with a precision aperture in front of the detector's photosensitive surface.

Each sample piece was exposed a certain time corresponding to exposure levels of 5, 10, 25, 50 and 100 mJ/cm². The colour of the exposed area was measured using a spectrophotometer Perkin-Elmer Lambda 900 equipped with an Ø150 mm integrating sphere, using the geometry 8°/total. Also, a picture of the exposed sample was taken in a light both using D65 illumination with high colour rendering index (> 95).

Based on the colour coordinates in CIE 1976 L* a* b* colour space (reference illuminant CIE D65, 2° observer), the total colour difference ΔE* relative to a non-exposed sample was determined as:

$$\Delta E^* = \sqrt{(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$$

where ΔL*, Δa* and Δb* are the differences between the individual coordinates.

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Measurement conditions

Ambient temperature	23 ±2 °C
Sample temperature (during exposure)	25 ±5 °C
Exposure wavelength	278 ±2 nm (peak wavelength)

Results

The results only refer to the object specified in this document. Pictures of the sample at the different exposure levels are shown in the appendix.

Table 1. Measured colours and colour changes at different exposure levels.

Exposure mJ/cm ²	CIE 1976 L*a*b* colour coordinates			Colour difference ΔE*
	L*	a*	b*	
0	86,9	0,3	51,2	0,0
5	82,8	6,4	43,2	10,8
10	79,0	11,4	34,9	21,2
25	72,7	20,3	23,2	37,2
50	68,1	26,8	10,9	51,8
100	63,8	32,7	-0,2	65,0

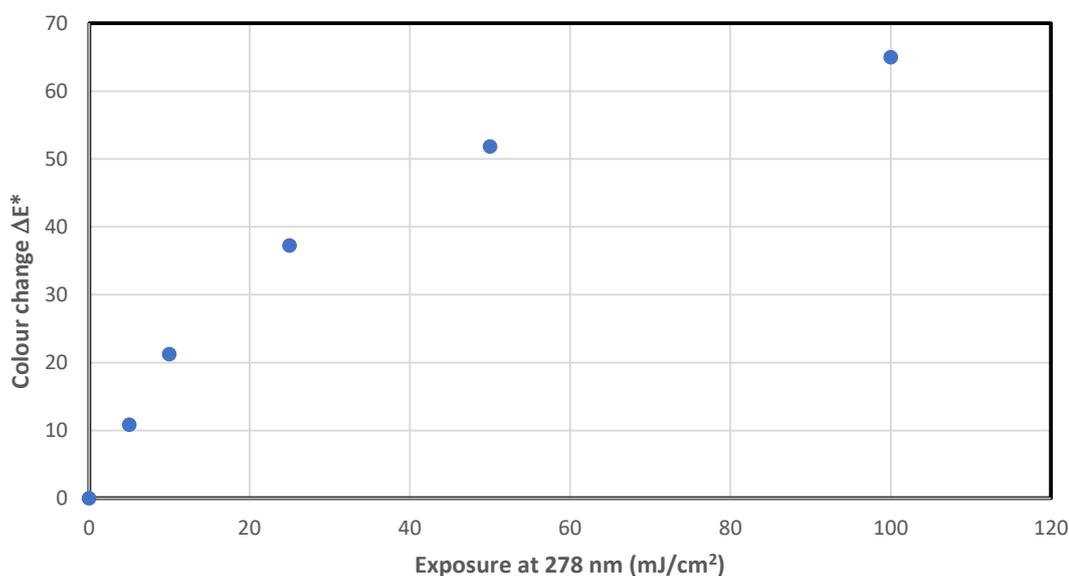


Figure 1. Colour change at different exposure levels relative to an unexposed sample-

The uncertainty is estimated to ±8 % of the reported exposure levels. The measurement uncertainty for L*, a* and b* is ±2,0.

Equipment

Reference silicon detector 10×10 mm, inv.no. 500963
LG Innotek UVC LED (278 nm), type LEUVA66H70HF00
Picoammeter Keithley 6485, inv.no 603159
Precision aperture Ø7 mm, inv.no. 502607
Spectrophotometer PE Lambda 900, inv.no. 503052
Accessory devise for geometry 8°/t, inv.no. 503059
Light booth True Color TC-60
iPhone 11Pro camera

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Performed by

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Appendix

Pictures of the samples at different exposure levels

Appendix 1

Pictures of the samples at different exposure levels