

Authors: Andrea Kapfelsberger², Sebastian Marx¹, Wolfgang Sickenberger¹, Jürgen Bischoff²
Affiliations: JENVIS Research¹, Ernst Abbe University Jena Faculty SciTec²

Introduction:

Based on current data there is a need to protect the eye from UV radiation [1,2]. Various social and environmental factors, such as increased age, holidays in southern countries, solarium use and the thinning of the ozone layer, are responsible for increasing importance of UV protection in recent years [3].

Soft contact lenses (SCL) with incorporated UV blocker have been available on the European market for more than 25 years. Their specifications are based on the European standard EN ISO 18369-3:2006 [4].

Many manufacturers are promoting UV protection for new developed disposable contact lenses. However, the protection class is often not stated and there remain unanswered questions about the measuring process.

Purpose:

- 1 Do current UV absorbing soft CL fulfil the international standards regarding UV protection?
- 2 Is the UV protection dependent on the BVP of the SCL?
- 3 Which SCL currently offer the best UV protection?

Materials & Methods:

- BVP range of -12.00 D to +6.00 D
- 3 soft contact lenses were measured per BVP 25 times
- 336 SCL **with** UV-blocker (Stenfilcon A, Somofilcon A, Senofilcon A, Senofilcon C, Narafilcon A, Etafilcon A, Nesofilcon A)
- 489 SCL **without** UV-blocker (Lotrafilcon A, Lotrafilcon B, Comfilcon A, Balafilcon A, Samfilcon A, Asmofilcon A, Nelfilcon A, Omafilcon A, Omafilcon B, Hilafilcon B, Ocufilecon D)
- Measurement setup according to EN ISO 18369-3:2017 consisting of a xenon lamp XH-100 (MÜLLER ELEKTRONIK), a grating spectrometer SPECTRO 100 (INSTRUMENT SYSTEMS), a wet cell and an integrating Ulbricht sphere (JENVIS RESEARCH)

Results:

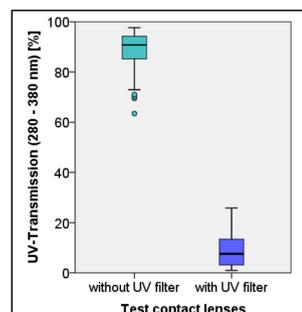


Figure 1: UV transmission of the SCL with & without UV filter

Figure 1 shows that SCL without UV filter transmit significantly more UV radiation than soft contact lenses with integrated UV filter ($p=0,001$; Mann-Whitney-U-Test).

1 The calculation of the UV protection class shows that all 336 UV-absorbing soft contact lenses meet at least UV protection class 2 (absorption: UV-A > 50 % and UV-B > 95 %) independently of their BVP.

2 A statistically significant difference in UV transmittance (280 nm to 380 nm) can be observed between the test CL of increased center thickness (+1.00 D to +6.00 D) and the CL of lower center thickness (-1.00 D to -12.00 D), both without ($p=0.043$) and with UV filter ($p=0.018$). For example, as you can see in Figure 2 and Figure 3, the UV and VIS transmission of CL with BVP +6.00 D is lower than that of CL with BVP -6.00 D.

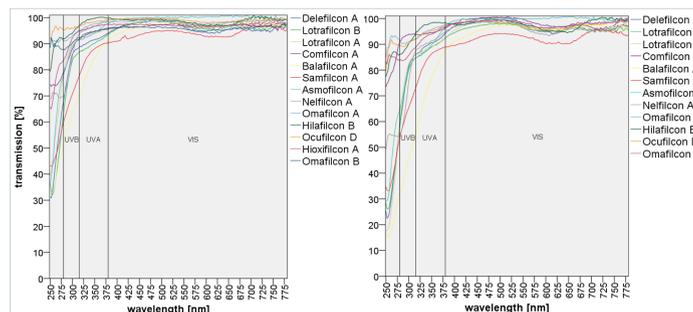


Figure 2: CL without UV protection with BVP -6.00 D (left) and with BVP +6.00 D (right)

This applies to both contact lenses without UV filter (see Figure 2) and CL with UV protection (see Figure 3).

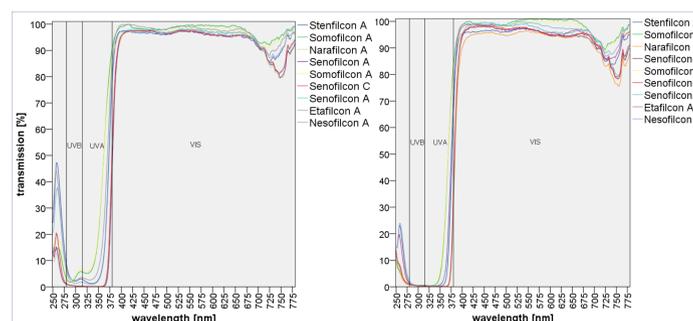


Figure 3: CL with UV protection with BVP -6.00 D (left) and with BVP +6.00 D (right)

In Figure 4 you can see the transmission curve of a soft contact lens with UV protection class 2, class 1 and without protection (each with BVP -3.00 D).

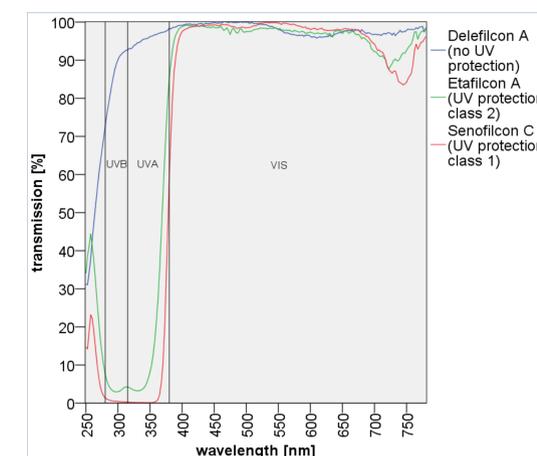


Figure 4: UV- and VIS transmission of SCL with BVP +6.00 D

3 Of all tested soft contact lenses Senofilcon A, Senofilcon C and Narafilcon A meet UV protection class 1 (absorption: UV-A > 90 % and UV-B > 99 %).

Conclusion:

With the ISO conform, diopter-independent measurement setup it can be shown that all UV-absorbing test soft contact lenses meet the current international standards regardless of their back vertex power. It can be shown that soft contact lenses with increased center thickness absorb more ultraviolet light.

Further studies may investigate differences regarding lens powers with minus contact lenses, which would require an aperture of the measurement setup larger than 6 mm in order to take a closer look to the ultraviolet absorption of the contact lens in the complete corneal area.

References:

- 1 ROBERTS, J. E., 2001: Ocular phototoxicity. In: Journal of photochemistry and photo-biology, Biology, 64 (2-3), S. 136–143.
- 2 GLICKMAN, R. D., 2011: Ultraviolet phototoxicity to the retina. In: Eye & contact lens, (37), S. 196–205.
- 3 DUMMER, R.; MAIER, T.; BLOCH, P.; BURG, G., 2001: Photoprotektion – Lichtschutzmassnahmen zum vor akuten und chronischen UV-induzierten Hautschäden. In: Schweiz Med Forum 14, S. 364–367.
- 4 Norm EN ISO 18369-3. Augenoptik - Kontaktlinsen - Teil 3: Messverfahren (ISO 18369-3:2006); Deutsche Fassung EN ISO 18369-3:2006.