APPLICATION NOTE

INVESTIGATING THE AMOUNT OF ULTRAVIOLET AND VISIBLE LIGHT TRANSMITTED BY SUNGLASSES

INTRODUCTION

The spectrum of natural sunlight that reaches the surface of our planet ranges from the infrared (IR) to visible (Visible) light, and extends down to the ultraviolet (UV).

UV light is invisible to human eye and represents a small fraction of the total amount of light emitted by the sun, yet this fraction is responsible for a wide range of adverse effects in biological systems [1,2]. Thanks to the ozone layer that surrounds our planet, these effects are not so extreme.

Shorter UV wavelengths (UV-C), which ranges from 100 to 280 nm and are extremely dangerous to biological systems, are efficiently absorbed by the protective ozone molecules in our atmosphere. Mid-range UV wavelengths (UV-B) ranges from 280 to 315 nm and contributes around 5% to the total UV light that reaches our planet's surface.

The large fraction of UV light that reaches the planet's surface (UV-A) ranges from 315 to 400 nm and contributes up to 95% of total UV light [1-3].

Keywords:

UV-Visible Spectroscopy

DWHP Light Source

FLEX Spectrometer

Transmittance

Sunglasses

Figure 1 – Absorbance Configuration

When the wavelength decreases, the spectral energy increases, and higher spectral energy raises the potential for eye damage. For ophthalmic standards, the International Organization for Standardization (ISO) 8980/3 outlines the attenuation of solar radiation for optical products at 380 nm.

However, due to the potential danger of UV-A, several organizations (World Health Organization, European Council of Optometry and Optics, and others) adopted the attenuation of solar radiation for optical products at 400 nm [4,5].

In this application note, we combine DWHP light source with a FLEX spectrometer and two lens holder to investigate the amount of ultraviolet and visible light that pass through the optical sun lens of five different sunglasses.

MATERIALS & METHODS

Instruments and Accessories:

Absorbance Configuration

(see **Figure 1**)

- DWHP light source;
- 400 µm diameter illumination optical fiber;
- Standard cuvette holder set into an absorbance configuration;
- 200 µm diameter collecting optical fiber;
- FLEX STD UV/Vis spectrometer (Slit: 25 µm)
- Solid Sample Holder

EXPERIMENTAL PROCEDURE

1. A peace of lens from different sunglasses were positioned in a standard cuvete holder using the solid sample holder.

2. The instruments settings selected for this measurement are given in **Table 1**.

Table 1 – Instrument settings used for experimental diffuse reflectance measurements.

Parameter	Used Settings
Integration time (ms)	10
Average	250
Smoothing	0

RESULTS

The UV-Visible transmittance spectra of the sunglasses are given in **Figure 3**.

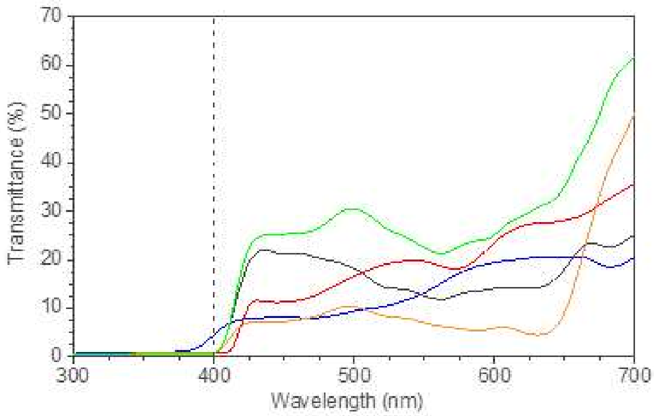

Figure 3 – UV-Visible transmission of sunglasses

According to the data presented in **Figure 3**, all sunglasses measured attenuate significantly the transmission of light in the visible region with this attenuation being dependent from the optical lens characteristics, namely the color gradient, polarization (changing the lens polarization have a strong effect on its transmittance value), and index values (lens with high-index values can yield lower transmittance values due to its effect on the optical path). The characteristics of all sunglasses measured are given in **Table 2**.

As expected, all sunglasses block the transmission of UV light (below 380 nm) and therefore fulfil the ISO 8980/3 standard. Regarding the standards adopted by other organizations, only sunglass number four fails to meet with the wavelength attenuation value (400 nm).

Table 2 – Lens characteristics of all five sunglasses.

Sunglass	Line color (Fig. 3)	Color Gradient	*Polarization*	Index
1	orange	No	No	No
2	red	No	No	No
3	grey	Yes	Yes	No
4	blue	No	Yes	Yes
5	green	Yes	No	No

CONCLUSIONS

The work presented in this application note aims to demonstrate that the combination of DWHP light source with FLEX spectrometer and two lens holder conjugated in a UV-Visible transmittance configuration is perfectly suitable to deliver an accurate and reliable transmittance curve.

REFERENCES

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