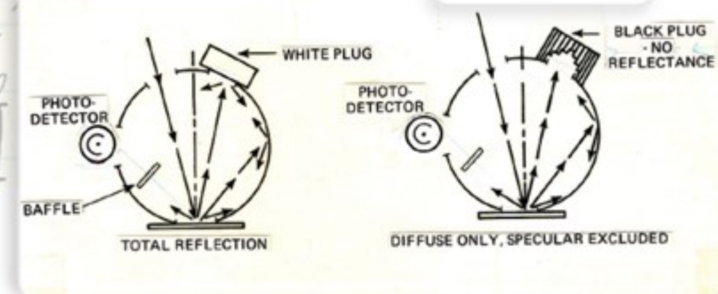
Applications Note

AN 1111



Simulating Daylight Using UV Control

Optical brighteners intensify the whiteness of products by absorbing the UV part of the daylight spectrum and re-emitting the energy as visible light. This is known as fluoresce.

Abstract

Ultraviolet (UV) is a form of electromagnetic radiation with a wavelength between 10nm to 400nm. It's shorter than the visible light spectrum but not as long as X-rays. UV is present in sunlight; it comes in both long and short wavelengths. Fluorescent Optical brighteners are often used in the textile, paper, and plastic industries to make products appear more brilliantly white when viewed in sunlight or other light sources containing UV light.

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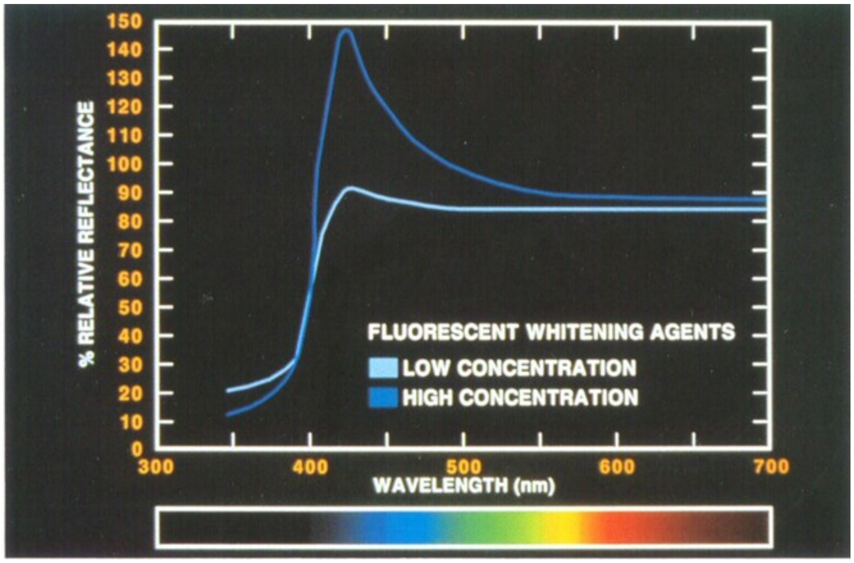
The graph below illustrates the spectral effect of such whitening agents. Note that the high concentration of optical brighteners (a.k.a fluorescent whitening agents) boosts the spectral reflectance well over 100% at about 420 nm.



HunterLab Agera, UltraScan PRO, and UltraScan VIS may be purchased with an ultraviolet (UV) control option that permits the measurements obtained with the instrument to more closely match visual evaluations made under daylight illumination and allows the instrument to more repeatably measure FWA-enhanced samples over time.

The spectral distribution (specifically, the ratio of UV light to visible light) can be adjusted to more closely match the D65 daylight illuminant using UV filters and a calibrated fluorescent white standard. This permits measurements of whitened products to more closely match the color seen outdoors by eye, improves agreement of the illumination of different instruments, and compensates for the aging of the illumination source. Regularly performed UV calibration continually adjusts the properties of the light striking samples to a consistent level even as the source changes. The spectral properties of the source light can be kept consistent throughout its lifetime.

How is UV Control Performed?

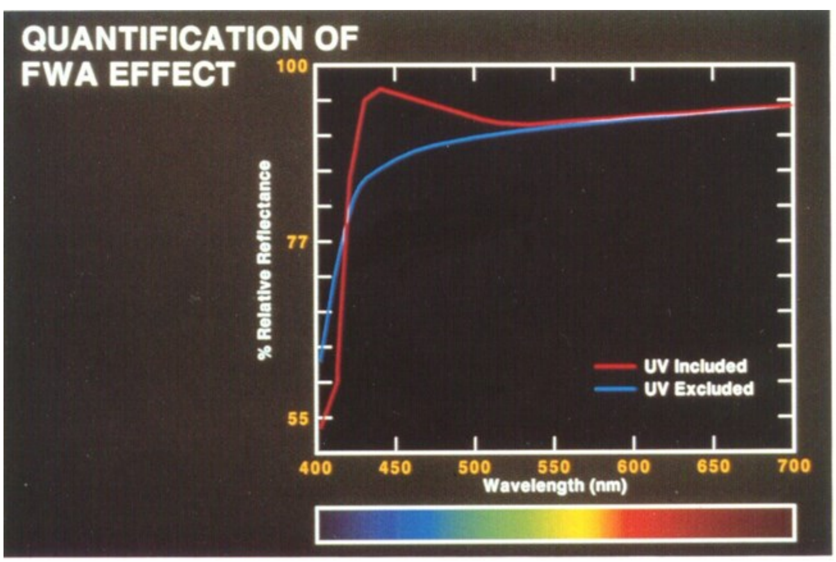
The UV control process begins at HunterLab before your instrument is even shipped to you. HunterLab maintains a master UV control instrument, as well as current sets of bleached, white cotton standards obtained from the Hohenstein Institute in Germany. HunterLab uses those cotton standards and the master instrument to apply a calibrated Ganz whiteness value to a fluorescent transfer standard that will then be given to you with your instrument.

To begin, standardize the instrument and indicate that you wish to use the calibrated UV filter position, and then initiate UV calibration after standardization is completed. Read the fluorescent transfer standard and indicate the calibrated value to the software. Then, the software automatically adjusts the position of the UV filter(s) until the whiteness value read by the sensor matches the calibrated value for the fluorescent standard. That UV filter position is then maintained until the next time UV calibration is performed. Specific instructions on performing UV calibration are given in the User's Manual for your software.

The UV calibration procedure should be repeated weekly. The fluorescent standard should also be replaced periodically, as it will fade with repeated exposure to UV light. You can periodically assess the degradation of the area of the standard used in calibration by comparison to an untouched area of the standard. Follow the instructions in your User's Manual to perform this comparison.

If you choose to use a calibrated UV filter position for some measurements, it should be used for all routine measurements made with that instrument.

You may also completely eliminate the UV component from your source light by inserting the UV filter(s) all the way. This eliminates all UV-induced fluorescence, since no UV light can then reach the sample to excite it. If you compare a reading of the sample with the UV filter all the way in to a reading of the sample with the UV filter in its nominal[1] position, you can quantify the effect of your FWAs. A method for doing so is described in ASTM Method E1247, "Standard Test Method for Identifying Fluorescence in Object-Color Specimens by Spectrophotometry." Example spectral curves with UV included and excluded (the UV filter out and in, respectively) are shown below. The UV excluded curve drops well below the UV included curve at lower wavelengths.



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[1] The nominal UV filter position is the partially-in position determined (and set) at the factory as providing the best and most consistent approximation of D65 daylight for measuring non-fluorescent samples.

References:

"Ultraviolet-Absorbing Filters and Fluorescent Whites," *HunterLab Applications Note*, Volume 6, No. 4, February, 1995.

Griesser, Rolf, "Assessment of Whiteness and Tint of Fluorescent Substrates with Good Inter-instrument Correlation," *Color Research and Application*, **19**, 446 (1994).

About HunterLab

HunterLab is the technology leader in color measurement solutions, providing instruments, software, knowledge and service to a wide variety of industries.
With over 5 decades of experience in more than 65 countries, HunterLab applies our leading edge technology to your products helping you measure and communicate color simply and effectively.

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