Application Note - Color perception

The Importance of Light Sources

Color observation and perception

How Light Shapes the Colors We See

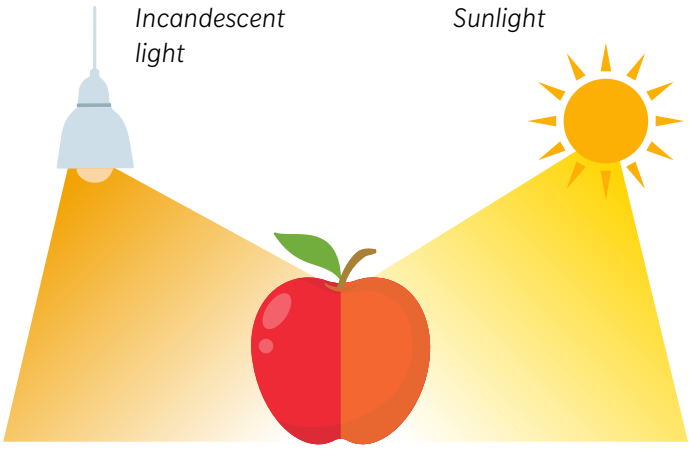
Color perception is not only determined by the object itself but also by the light source and the observer. In total darkness, color cannot be perceived; light, vision, and the object must all be present. The color we see is the result of light reflecting off an object and entering our eyes, where it is interpreted by the brain. Different light sources, such as sunlight, fluorescent, or LED lighting, have unique spectral distributions, which can significantly affect how colors appear to the human eye.

Standard Illuminants and Measurement Consistency

To ensure consistent color evaluation, the CIE (Commission Internationale de l'Eclairage) and JIS (Japanese Industrial Standards) have defined several standard illuminants. Common examples include:

D65: Average daylight (including UV), correlated color temperature 6504 K.
A: Incandescent light, correlated color temperature 2856 K.
C: Average daylight (excluding UV), correlated color temperature 6774 K.
F Series: Various types of fluorescent lights.

Color-measuring instruments often use built-in light sources, but to match standard conditions, they calculate measurement results under selected illuminants using stored spectral data. This allows for accurate and repeatable color measurements, regardless of the actual light source used during measurement.



User Light Source Function

We have introduced new indices in our portable spectrophotometers that allow users to set their own observation light sources. This enhanced flexibility enables users to simulate specific lighting environments tailored to their needs, such as retail stores, galleries, or production lines. Users can define a custom illuminant by measuring ambient light with our Illuminant Spectrophotometer CL-500A*, or select from nine newly added CIE LED illuminants. The available LED options - LED-B1, B2, B3, B4, B5, BH1, RGB1, V1, and V2- cover a broad spectrum of LED lighting conditions, reflecting the increasing prevalence of LEDs in commercial and industrial applications. This feature empowers users to achieve more accurate and relevant color evaluations under real-world lighting scenarios.

*with the use of SpectraMagic™ NX2

Application & Benefits

User Light Source Function

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Quantitative Color Evaluation

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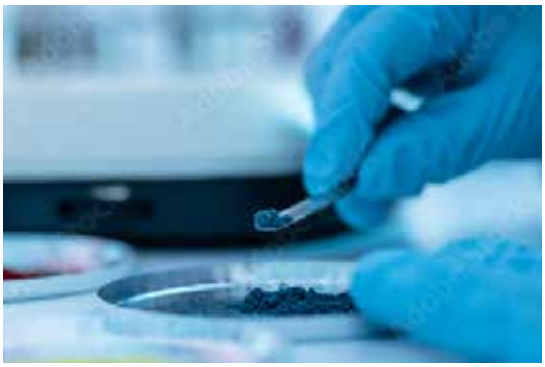
Metamerism Detection

The ability to measure under multiple illuminants helps identify metamerism - when two colors match under one light source but differ under another - ensuring reliable color matching in real-world conditions.

Cosmetics Example: Eye Shadow Color Appearance Across Environments©

When developing a new eye shadow product, researchers in the laboratory carefully select pigments and formulations under controlled lighting conditions, often using standardized illuminants such as D65 (daylight) to ensure accurate color evaluation. Once the product moves to the factory, quality control teams may use color-measuring instruments to verify that each batch matches the intended shade, again under specific lighting setups. However, when the eye shadow is displayed in stores, the lighting can vary widely - ranging from warm incandescent bulbs to cool LED fixtures. Even if the product's color is consistent from batch to batch, its appearance can shift dramatically depending on the store's lighting environment. For example, a shade that looks vibrant and true-to-color under daylight in the lab may appear duller or take on a different hue under certain LED lights in a retail setting. This highlights the importance of measuring and managing color under multiple light sources, ensuring that customers see the intended color regardless of where the product is sold.



During the research

During the making

In the shops

Portable instruments with the ability to set up the User-defined illuminant

CM-17d
Fast and accurate color measurements on small, curved, or flexible surfaces, with dual aperture.

CM-26dG
Dual capability: high-precision color measurement and integrated 60 degree gloss measurement in one. shot.

CM-36dG
Simutaneous color measurement including transmittance measurement and 60 degree gloss measurement.

CM-25cG
Measure color by using a 45°c:0° illumination / viewing system and gloss in one shot.