

Ambient Light and Color Measurement - an01_08

Perfectly opaque samples, when measured in a reflectance mode, reflect all the light from the source lamp back to the instrument's detector. No light is lost to transmission, nor is room—or ambient—light able to be transmitted through the sample to the detector.

Transparent samples (such as clear liquids and clear glass) transmit all the light from the source lamp to the instrument's detector. Generally, no light is lost to reflection, though ambient light may be transmitted to the detector along with the light from the source lamp. This ambient light could potentially affect the color measurement, as the amount of light transmitted to the detector is increased.

Translucent samples (such as plastic plaques, citrus juices, and semi-solids like salad dressing) reflect enough light that their reflected color may be measured by an instrument, but they also transmit light. Some of the light from the source lamp is lost to transmission, plus ambient light may be transmitted back through the sample along with the light from the source lamp. As with transparent samples, this ambient light could potentially affect the color measurement, as it increases the amount of light sent to the detector. (The light lost to transmission of the light from the source lamp is typically blocked by a sample backing; see the Applications Note titled “Backings for Translucent Samples”.)

(illustrations)

So, how is ambient light eliminated from measurements of transparent and translucent samples? That varies depending on the type of sample.

For measurements of transparent solids and liquids using a sphere instrument, the transmission compartment door is usually closed over the sample to prevent ambient light from outside the instrument from leaking into the detector.

In order to show the difference between shutting the transmission compartment door and not shutting the transmission compartment door, two measurements of a transparent liquid were made on an UltraScan PRO. For both measurements, the liquid was poured into a 20-mm transmission cell and the cell placed over the sphere (TTRAN) port. For one measurement, the transmission compartment door was closed, and for the second measurement, the door was left open. The results are shown below. The values indicate that the sample appears lighter (has a larger L^*) and slightly more saturated (larger a^* and b^*) to the instrument when the door is open.

(illustration)

Note: Closing the transmission compartment door while making transmittance measurements is the best practice for a HunterLab benchtop sphere instrument. However, when measuring the transmittance of liquids that are volatile and/or toxic, it may be more important to measure the samples quickly than to eliminate ambient room light. To see if leaving the door open will adversely affect your color measurements, standardize the instrument in the desired transmittance mode with the transmission compartment door closed, then measure either air or a typical sample with the door open and then with the door closed. Compare the measurements. If the difference is acceptable under your measurement method, you may measure your samples with the door open. This test should be repeated if the instrument is moved to a new location.

For measurements of translucent pellets, liquids, powders, and semisolids using a $45^\circ/0^\circ$ instrument, an opaque black sample cup cover (HunterLab Part Number 04-4000-00) is usually placed over a 2.5-inch sample cup filled with sample to prevent ambient light from outside the instrument from leaking into the detector.

(illustration)

In order to show the difference between covering the sample cup and not covering the sample cup, two measurements of plastic pellets (calculated as the average of three separate readings with replacement) were made on a LabScan XE. For both measurements, pellets were poured into the sample cup, filling it to the top. For one measurement, the sample cup was covered with the opaque cover at the sample port, and for the second measurement the opaque cover was not used. The results are shown below. No significant difference was seen between the measurements. This may be because the thickness of the layer of pellets presented to the instrument was sufficient to render the sample almost opaque. This may not be true for all samples, though, and use of an opaque light cover to eliminate ambient light is recommended, particularly for measurement of near-clear liquids.

(data Table)

For measurements of translucent pellets, liquids, powders, and semisolids using a sphere instrument, a light cover is placed over a transmission cell filled with sample that rests on the reflectance sample shelf (HunterLab Part Number B02-1005-172). This prevents ambient light from outside the instrument from leaking into the detector.

(illustration)

In order to show the difference between covering the sample cell and not covering the sample cell, two measurements of plastic pellets (calculated as the average of three separate readings with replacement) were made on a ColorQuest XE. For both measurements, the pellets were poured into a 50-mm sample cell, filling it to the top, and the cell placed on the reflectance sample shelf. For one measurement the light cover was put in place, and for the second measurement the light cover was not used. The results are shown below. The L^* (lightness) value is most affected. The chroma (a^* and b^*) differences are not significant. Use of an opaque light cover to eliminate ambient light is recommended, particularly for measurement of near-clear liquids.

(data table)

So, what does all this mean? It means that for each type of transparent or translucent sample you measure and compare, you should use an opaque cover over the sample if at all possible, and record the means of covering as part of your measurement. If you measure some samples covered and others uncovered, you will not be able to compare the measurements.

(See attached pdf file for the complete article with data tables and illustrations)