



The Hindu tradition of Holi is also known as the festival of colors owing to the brightly colored powders flung into the air as a celebration of spring. Image Source: Flickr user Steven Gerner

Spring is a time of rebirth and regeneration when color returns to our world vividly after the grays and whites of winter. And perhaps there is no better expression of this than the Hindu celebration of Holi, also known as the festival of colors. A few weeks ago, people around the world, Hindu, and

non-Hindu alike, marked the coming of spring in a brilliant display of colorful powders thrown in the air and streaked across revelers. This colored powder is essential to the celebrations, originating with the legend of Krishna who colored his lover's face to match his own blue skin. Today, four primary powder colors are used during the festival, each representing a unique aspect of the Holi celebration. As the Telegraph explains, "Red reflects love and fertility, blue is the color of Krishna, yellow is the color of turmeric, and green symbolizes spring and new beginnings."¹

While traditionally these hues were created using real turmeric, flower extracts, and sandalwood paste. Today, however, they are largely produced using artificial colorants. This is a controversial practice that has led to health and environmental concerns after reports that hazardous materials were being used in the production of the powders. "Some colors are highly toxic and can even cause cancer," says Dr. Vikas Goswami, a senior consultant oncologist at Fortis Hospital. "People who handle colors or play Holi often end up complaining about conjunctivitis, visual impairment, asthma, and brutal skin conditions."² As a result, a number of commercial powder suppliers have recently returned to more [natural, plant-based color sources](#). In order to promote safer, more eco-friendly products, however, powder suppliers must ensure that their powders accurately reproduce the vivacious colors we have become accustomed to. This is vital in order to allow customers to obtain healthier products without compromising appearance. This requires careful monitoring of color behavior throughout the production process.

Reflectance spectrophotometers are ideal instruments for measuring the color of all types of loose powders, regardless of their end use. Using a [45°/0° geometry](#), these spectrophotometers mimic the way the human eye sees color, only better. Without vulnerability to [social, biological, or environmental interferences](#), spectrophotometric instruments are able to objectively analyze samples for the highest level of accuracy and repeatability. As such, they serve a critical role in the development and production of loose powders across industries, from cosmetics to pharmaceuticals. However, there are a number of special considerations for loose powder color measurement that must be kept in mind during the analytical process.



Analyzing loose powder hues comes with unique challenges due to the innate qualities of the powders. Source: Flickr User FaceMePLS

The Challenges of Loose Powder Color Measurement

Loose powders present unique challenges to the color measurement process as the result of their inherently [textured, non-uniform characteristics](#). Due to their particulate form, these powders are susceptible to light trapping, shadowing, and ambient light interference, opening the door to inaccurate and inconsistent analysis. As such, it is not possible to measure loose powders as-is. Instead, they must be carefully prepared and [“measured through the side of a clear glass sample cell in order to be effectively made into a solid.”](#)

The preparation demands of loose powders make them particularly vulnerable to operator inconsistencies. It is vital to employ the same preparation and measurement techniques each time a sample is analyzed to eliminate variation and ensure batch-to-batch accuracy. To facilitate consistency, choosing a highly accurate yet user-friendly spectrophotometer that minimizes the possibility of human error is imperative. Additionally, some powders may exhibit a degree of fluorescence, making them vulnerable to any UV content in the light source and requiring the use of an instrument with a UV control option.

Sample Averaging: A Simple Solution

When working with loose powders, sample averaging is often an essential part of the process, allowing you to overcome texture and size variations via simple measurement protocols. Fine powders may allow you to create a smooth, uniform surface within the sample cell capable of being analyzed in a single measurement. However, samples with larger or irregular particles can suffer from shadowing even within the sample cell, compromising the ability of the spectrophotometer to capture accurate color information in a single reading. In these cases, averaging the results of multiple measurements, or sample averaging, can compensate for these particulate qualities. The Stothard Group explains, “Generally speaking, the more measurements taken, the more accurate the representation of the visual characteristics of the sample.”³ You may either “turn the sample between measurements, shaking the sample gently to reposition the particles or discard the sample after measurements and re-fill the sample cup with more of the sample from the same batch.” The exact number of measurements depends on the nature of the powder and your own tolerance.



Small samples of loose powders may require special sample cells to ensure accurate measurement.
Image Source: Flickr user Kurtis Garbutt

Working With Small Samples

When working with scarce, hazardous, or expensive powdered materials, minimizing sample size may be preferable or even necessary. However, these conditions also demand highly reliable color measurement to ensure no materials are wasted or used unnecessarily as the result of an inaccurate analysis. Due to the challenges inherent to powders, it is particularly important to choose both a high-quality spectrophotometer and appropriate sample preparation methods. This includes selecting the appropriate sample cell when [analyzing small powder samples](#). HunterLab's semi-micro powder sample accessory paired with our specialized SAV port plate is the perfect solution for small sample powder measurement. Designed specifically to analyze small quantities, this apparatus allows you to consistently arrange powdered materials in the densities and heights necessary for accurate analysis of samples as small as 0.4cc. This facilitates precise capturing of color data while preserving materials or limiting operator exposure to harmful substances.

HunterLab Quality

HunterLab has been a leader in the field of color measurement for over 60 years. Our innovative [range of spectrophotometers](#), accessories, and software packages give our customers extraordinary insight and control over their products throughout the manufacturing process, even in the most challenging conditions. Whether you are working with large or small samples, solids, powders, or liquids, we have the tools you need to rapidly capture and analyze color data in a way that makes sense for your organization. [Contact us](#) to learn more about our renowned range of spectrophotometers and let us help you select the ideal instrument for your purposes.

1. "What is the Holi Festival and Why is it Celebrated by Throwing Coloured Powder?", March 13, 2017, <http://www.telegraph.co.uk/technology/0/holi-festival-celebrated-throwing-coloured-powder/>
2. "Beware of Toxic Colours This Holi", March 22, 2016, <http://www.thehindu.com/news/national/other-states/beware-of-toxic-colours-this-holi/article8382747.ece>
3. "How to Measure the Colour of Powders", February 9, 2016, <http://www.colourmeasure.com/knowledge-base/2016-02-09-how-to-measure-the-colour-of-powders>