Spectrophotometers can help ensure batch-to-batch consistency of candle color. Image credit: Flickr user Lindsay (CC BY 2.0)

Gifts sometimes go further than the giver can imagine. In 1969, a high school kid in Massachusetts had no money to get his mother a Christmas present. So, using household materials—wax, red crayon, a bit of string, and a milk carton for a mold—he made his mother a candle. But before he gave it to her, he showed it to his neighbor, who was so impressed she bought the candle from him, leaving him with enough money to make two new candles: one for his mother, and one to sell. Almost fifty years later, that Christmas present has grown into Yankee Candle, the largest candle manufacturer on the planet[1].

In other words, candle makers know that small acts can have big effects. Since Yankee Candle first pioneered the candle manufacturing process, the industry has grown significantly, generating roughly $2.3 billion in U.S. sales per year[2].

And with 400 players in the game, candle manufacturers must work hard to gain an edge, paying close attention to their processes to ensure that small mistakes—such as losing batches due to poor color quality—don't have far-reaching effects.

Different waxes are affected by dyes in different ways. Image Credit: Flickr User midnightcomm (CC BY 2.0)

Wax Properties Cause Color Control Difficulties

As you adjust your offerings to reflect the fashion and palette of new seasons, you'll probably cycle through hundreds of colors each year[3]. And with so many unique offerings, the margin for error in color quality is notably slim. Winter Berry must be different from Winter Sky; both must be different from Seagull's Plumage. The mixing process must be carefully controlled to make certain your dyes are proportioned correctly while the wax is in its molten state.

This challenge is rendered doubly difficult by inconsistency in wax supplies. Your manufacturing process might filter impurities from the wax after you've received it from the supplier, but the wax itself can still range from dark yellow to white.

The wax's oil content, and the amount of stearin included[4], also contribute to the difficulty of accurately predicting the final color of a batch of wax from formula alone. This is true for paraffin as well as for less commonly used waxes[5], such as beeswax, vegetable, soy, palm, gel, and synthetic waxes or blends. While varying base colors affect dye results directly, the varying chemical makeups of waxes also affect final color due to their different reactions to different dyes[6]. This is why certain dye colors may require more mixing time to guarantee equal dispersion in one type of wax versus another, or larger proportions of dye might be required to achieve the same color strength.

The Pioneer Valley, home of Yankee Candle, as seen from the North. Image Credit: Flickr User Mark Goebel (**CC BY 2.0**)

On-Line Spectrophotometry Allows Manufacturers to Make Real-Time Adjustments

To prevent creating batches of candles that will be later rejected due to color failure, you can integrate the use of modern spectrophotometric color quality control instruments during the molten wax stage of your process—before the wicks are dipped. A d/8 integrating sphere spectrophotometer, which measures color independent of the effects of texture, lustre, and gloss, can quickly ascertain the exact color of candle wax from samples, allowing manufacturers to make adjustments as needed during the mixing process. Given the uneven texture of wax in its liquid state, this is the most precise method of measurement.

By measuring without interference from texture, d/8 spectrophotometry can also ensure consistency batch-to-batch by communicating numerical color coordinates. This can save significant time by reducing the test samples each batch needs to achieve the same color. It also ensures that different mixes, even in different facilities, will turn out exactly the right shade. While the wax will harden to a solid from a liquid after color measurement, because this is a change in state and not a chemical change[7], the color will stay the same.

Yankee Candle enjoys an approximate 50% market share[8], so candle makers competing for space can ill afford to face batch rejections due to poor color quality control. A small change in wax color, without proper precautions, can shift the color of a line of candles past specified tolerances. By integrating a spectrophotometric system into the pre-dip production process, you can make sure that no batch of coconut candles comes out eggshell white. HunterLab has over sixty years of experience in manufacturing spectrophotometers for industry leaders. Get in touch with our team to learn more about which of our instruments would best suit your processes.

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