



Crayons come in a staggering number of colors. Image credit: Flickr user Phil Roeder (CC BY 2.0)

Photographer Mark Meyer was a curious kid, and in kindergarten, he had a couple of questions for Crayola¹. Even before he could count, he was wondered about yellow-green crayons. How did they differ from green-yellow? Were there really only sixty-three colors in a box of sixty-four crayons? These questions were sidelined and forgotten—until he grew up and gained access to a spectrophotometer. Finally, certifiably, by measuring the light reflected off a crayon's paraffin and calculating the resulting $L^*a^*b^*$ values, Meyer had his answer. Yellow-green is not green-yellow.

In capturing these results, Meyer duplicated the exact method² that the Crayola corporation (formerly Binny & Smith) uses to make certain each of its yellow-green crayons comes out exactly right. After the paraffin is melted into vats, mixed with pre-measured dye blends, stearin, and other additives, and extruded and cooled in crayon molds, plant employees scan each crayon with a handheld spectrophotometer, similar to HunterLab's [Miniscan EZ 4000S](#). Because employees know the exact CIE $L^*a^*b^*$ value the crayons are supposed to have, with the touch of a button they can determine if the crayons are within the tolerance standards established for their color. If a crayon doesn't match, it gets separated, remelted, and made into another crayon³. Manufacturers seeking to emulate Crayola's efficiency should consider integrating a similar process into their production lines.



Is that dijon or french mustard? Image Credit: Flickr User nathanmac87 ([CC BY 2.0](#))

Color Quality Difficulties in Crayon Manufacture

Crayola didn't invent the crayon, but in the one hundred years they've been the business, they've learned how to make them right. As a result, they dominate the worldwide market, with an astounding estimated 80% share⁴. To match that demand, Crayola's factory in Easton, PA pumps out roughly twelve million crayons a day. Operating at such a massive scale, the company faces complex quality control issues, and must constantly seek to improve the efficiency of their processes to maintain their profit margin⁵.

But keeping crayons the same color is not a simple process for any manufacturer. Many variables can mistakenly alter the color of a crayon or batch of crayons, even if the same formula is followed each time. Paraffin wax, the primary substrate, can range in color from white to dark yellow, altering your results. Poorly cleaned mixing vats can contaminate batches with residue from earlier, differently colored mixes. Batches mixed for too short a period may not display color consistency due to incomplete dispersion. Inconsistent quality from powder dye suppliers can also miscolor batches—to say nothing of human error in proportioning mixes.

Difficulties in measurement can cause issues as well. Just because an employee is given a spectrophotometer doesn't mean they know how to use it. The instruments must be correctly calibrated and programmed with the proper tolerance standards. These right tolerance settings must also be selected for each batch. The instrument can display the words PASS or FAIL on the screen and the printout. Employees using specular inclusion mode will get an objective color assessment, which includes the wax gloss, luster, and texture. Crayola, for example, has over 300

crayon colors⁶—differences between adjacent shades can be minute and require accurate spectrophotometric operations.



Crayola's competitors face stiff competition. Image Credit: Flickr User cdncoralie ([CC BY 2.0](#))

Spectrophotometers Solve Color Consistency Issues

While one wrong crayon won't cause a factory to go under, repeated failures create inefficiency that can be seriously damaging to manufacturers who cannot match the efficiency of scale that Crayola commands. And Crayola itself, whose dominance in the market is founded on brand recognition and loyalty, could suffer damage to its reputation and market share if too many yellow-greens do in fact end up as green-yellows.

HunterLab spectrophotometers are the ideal solution for the color quality control needs of crayon manufacturers. And with over sixty years of experience, we have the knowledge necessary to guide you to the right instruments. We're also proud to offer excellent customer support [and informational resources](#) so that you can be certain your employees have the knowledge they need to use your spectrophotometric system correctly. For more information, [contact us today](#).

1. "Crayons Under the Spectrophotometer," 2017, <http://www.photomark.com/notes/crayon-colors/>
2. "Best in Class Quality and Value," 2015, <http://www.crayola.com/~media/Crayola/PDF/2015BestInClassGuide.pdf>
3. "Crayola Crayons Raw Materials," 2014, <http://www.designlife-cycle.com/crayons/>

4. "About Crayola LLC," <http://www.vault.com/company-profiles/toy-games/crayola-llc/company-overview.aspx>
5. "The Color of Quality. How Crayola Uses Data to Deliver the Perfect Crayon," 2017, <https://www.minitab.com/en-us/Case-Studies/Crayola/>
6. "List of Crayon Colors," 2017, <https://www.minitab.com/en-us/Case-Studies/Crayola/>