“C’mon, Lillian, just pick one,” says Jim. “It doesn’t really matter. We shouldn’t need to spend a half an hour in Walgreens every time.” Lillian, ignoring him, continues to scrutinize a bottle of metallic blue nail polish and a bottle of alloy blue nail polish, her face twisted in concentration. Jim looks at his watch. He’s already missed kick-off. “Lillian, c’mon,” he says. “They’re both blue.” Lillian clenches her fists around the bottle. “Da-ad!” she wails. “No, they’re *NOT!* You don’t *understand!”*

What Jim doesn’t understand, nail polish manufacturers do[1]: they’re not the same color. With designers large and small ordering mixes of anywhere from a dozen to some hundreds of different colors every year, it’s important for manufacturers to be able to distinguish and reliably produce minute differences in the shading, gloss, and lustre of nail polish. If Jim’s eyes can’t tell the difference, designers can. And manufacturers unable to do so stand to lose a lot more than missing the first quarter; batches that fail color standards cause lost production time and a waste of materials that can’t be reused. That’s why careful spectrophotometric measurement is an essential part of a nail polish manufacturer’s process.

Metallic shades differ in luster and gloss. Image Credit: Flickr User Justiff Jones. (CC BY 2.0)

Spectrophotometers Assure Objective Color Communication With Designers

The manufacturing of nail polish is a process with only a few stages[2]. Liquid and powdered ingredients are mixed, agitated, and bottled. Ingredients go into the machine; nail polish comes out. The devil's in the details.

The first obstacle to executing your lab derived formula on a bulk scale is communication. Without objective, numerical standards to use as guidelines, you're exposed to the risk of failed batches due to subjective color analysis. Even when comparing the color of a batch to a printed swatch, differences in illumination can cause human inspectors to see different colors. Swatches printed on paper or plastic can vary from liquid nail polish in terms of opacity, rendering color matching necessarily inexact. In addition, the sheer volume of different shades[3] produced by designers every year requires fine distinctions between each of this year's shades, last year's shades, and the shades of competing designers. The distinctions between these require a refinement in detection that is difficult for the naked eye.

HunterLab spectrophotometers assess color on an objective, three coordinate scale, by hue, value, and chroma. With certain optics, the effects of gloss, lustre, and texture can also be taken into consideration. By streamlining color specifications with the three coordinate CIE L*a*b* scale, manufacturers can create objective numeric targets to reach. Then, samples from each bulk batch can be tested to ensure they meet the color standard before the batch is bottled. This prevents the waste of time and material in the bottling stage, and cuts down on expensive hazardous waste[4] disposal.

Hundreds of new colors are specified each year. Image Credit: Flickr User Travis Wise (CC BY 2.0)

Troubleshooting the Execution of Design Formulas with Spectrophotometric Assay

Even though there are few stages to the process, many issues may arise that throw off the proper execution of a designer's formula. Differences in the suppliers of materials, such as colorants, solvents, or resins[5], or in suppliers of suppliers, can cause slight alterations in a mixture's color. Leftover residue from earlier batches in the mixing chamber or injection hoses can contaminate a new batch. While a spectrophotometer can't prevent such issues, it can assess the results before they get to the bottling phase, saving money on wasted glass and brushes. Also, spectrophotometric assessment can help indicate where in the process something went wrong, such as by detecting colors left over from previous batches, and thereby improving operations as a whole.

Any machine is only as good as its operator, and care must be taken to use a spectrophotometer correctly to ensure proper sample measurement. Illumination settings should be standardized between the designer and manufacturer, and between each instrument within an operation. We recommend an instrument with d/8° optics, like the UltraScan VIS, to assist you with these measurements. To learn more about the proper instrumentation and usage procedures for the measurement of nail polish, contact the experts at HunterLab.

1. "The Life of a Bottle of Polish, from Manufacturer to Your Salon," 2000, http://www.nailsmag.com/article/40824/the-life-of-a-bottle-of-polish-from-manufacturer-to-your-salon
2. "Nail Varnish Manufacture," http://www.silverson.com/images/uploads/documents/TNailVarnish.pdf

3. "The Expert Touch," 2017 http://www.fiabila.net/
4. "What's in Nail Polish?" 2010, https://www.greenlivingtips.com/articles/nail-polish-and-nature.html
5. "Cosmetic Preparations for Nails," http://www.srmuniv.ac.in/sites/default/files/files/cosmeticsfornail.pdf