



A color spectrophotometer can help you create bright, pigmented paintballs that can be seen from a great distance. Image source: Flickr user Lori Ho

The leaves of a nearby tree rustle as a tiny orange paintball whizzes toward its target. Milliseconds later, the thin gel capsule bursts onto the target's deep green camouflage jacket, spreading neon orange paint all over his shoulder. The paint is so bright and vibrant that you can easily spot it, even from hundreds of feet away; every player in the vicinity immediately knows that the paint-splattered player is officially out of the game.

In a paintball competition, the vibrancy of the paint is often the only thing that keeps players honest.¹ The only way to determine whether a player is out of the game is to see whether they're covered in paint—if this paint is too dull, the game's judges may not see it. This is why the most trusted paintball manufacturers are those who focus on crafting the most vibrant ammunition on the market. Using a color spectrophotometer, you can ensure that your paintballs are opaque and impossible to miss, which in turn will earn you a high degree of respect in the competitive paintball community.



Most paintballs contain neon dyes because these show up more clearly against dark camouflage gear. Image source: Wikimedia user BraNewbz

Quality Paintballs Require Vibrant, Water-Based Dye

To manufacture quality paintballs, you need to find a delicate balance between color vibrancy and washability. Generally, the fill inside of a paintball is made from a water-soluble dye surrounded by polyethylene glycol.² Because the dye is water-soluble, it can be washed off fairly easily, which is ideal for paintball enthusiasts who need a fresh, paint-free set of camouflage clothes every time they play. However, if you make your paintballs too water-soluble or washable, you risk creating a product that most competitive paintballers will find useless. It's too easy to wipe these types of dyes off of your paintball gear before it has the chance to settle. Some paintball players cheat by wiping off poorly-made paintball dye before anyone sees that they were hit.

While lower-quality paintballs use dull, oil-based colors that are naturally slippery and easier to wipe off, high-end paintballs never use oil as a base for their colors. Instead, quality paintball manufacturers use deeply pigmented, [non-toxic water-soluble dyes](#) that will [cling more strongly to clothes](#) without permanently staining them. In order to find the best ingredients possible for your paintballs, you'll first need to measure the vibrancy of these water-soluble dyes using a color spectrophotometer. Many spectrophotometers can measure the precise color of your paintball

fill, [as well as its opacity](#). Your goal is to create a paintball fill that is completely opaque, even when spread in a relatively thin layer, but that still washes off in a washing machine.³

Test Your Paint Colors Against Camouflage

Once you've found [the most opaque dyes](#) for your paintball fill, you'll also want to test these colors against some of the most popular camouflage patterns on the market. Most serious paintball competitions require players to wear dark clothing, so you should begin by testing a thin swatch of your paintball fill against a dark sample background. Using a color spectrophotometer, you can easily see whether your paintball fill lost opacity or color vibrancy after being spread against a dark piece of cloth. Most bright, neon colors, such as orange, yellow or red, will contrast well against a dark sample background—this is also why most paintballs are made using one of these three colors.⁴

However, other colors, like purple, blue or certain shades of green, may not show up as easily against purple, blue, and green backgrounds. This is why it's especially important to test these three shades using a color spectrophotometer. You may find, for instance, that your neon purple paintball dye appears vibrant when it bursts open on a white background, but when it hits a dark green or black camouflage jacket, the purple isn't as visible. The complex pattern on some camouflage jackets may also disguise your paintball colors. Your best insurance against dull paintballs is to test all of your colors using a color spectrophotometer in advance and to observe how each new color formula performs against a variety of camouflage backgrounds. As an added benefit, if you manage to create consistent, truly vibrant versions of relatively rare paintball colors, like purple or blue, you may attract more customers in the process.



Color consistency is important for paintballs because players rely on every round in order to win the game. Image source: Pixabay user padefiance

Use a Color Spectrophotometer to Achieve Consistency

Unlike many other competitive sports, where the game is relatively easy to watch and judge, paintball competitions tend to be more chaotic. Most players are hiding behind trees or other objects, and from a distance, it's hard to see whether a player actually got hit, or if the shooter missed by a few inches. In this type of environment, color consistency is absolutely essential — just one poorly-made paintball could cause a team to lose the entire game. If the paintball hits, but the color doesn't stick to the target's clothes, or the paint isn't visible against the camouflage, the target may not get called out of the game.

By measuring your paintballs using a color spectrophotometer, you do more than just perfect your initial formula and neon color palate; you can also test every future box of ammunition for color consistency. By having a specific, data-driven color standard for each type of color in your product line, you can test your future products against this standard to protect against unwanted color variation and detect process errors. For instance, if you see that your rich, neon orange dye suddenly appears lighter in color than usual, you can quickly diagnose the problem and re-mix your dye formula before these faulty products end up in your customer's hands. By focusing on color consistency, you show your customers that you care about quality above all else and that your paintballs will always be reliable.

HunterLab Quality

HunterLab's spectrophotometers are among the most reliable instruments on the market for [measuring paint and dye color](#). For more than 60 years, our company has created solutions to challenges faced by a wide range of industries, including those that work with paint and [dye-based products](#). With our decades of experience in the field of color measurement and spectrophotometry, we can help you find the perfect instrument for your needs, allowing you to manufacture some of the highest quality paintballs in the world. [Contact us](#) today to find out how you can implement your own color measurement system.

1. "Safety & Game Rules", <http://www.lonewolfpaintball.com/safety/>
2. "What Are Paintballs Made Of?", <http://www.lonewolfpaintball.com/safety/>
3. "How to Clean Your Paintball Clothes", July 23, 2017, <https://www.thoughtco.com/how-to-clean-paintball-stains-2565580>
4. "Your Guide to Buying Paintballs", March 3, 2016, <http://www.ebay.com/gds/Your-Guide-to-Buying-Paintballs-/10000000177627862/g.html>