

# Using the Gardner Scale to Enhance Quality and Create Color Consistency in Edible Oils

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The Gardner color scale is frequently used to measure color consistency in naturally yellow products, such as olive oil. Image Source: Unplash user Joanna Kosinska

To a gourmet chef, a fine bottle of high-quality extra virgin olive oil is a thing of beauty. Many of these high-end oils are deep gold in color, with an appearance that's rich, thick and almost honey-like. But this isn't the only color that olive oil can be; some oils are the color of pale straw, while others are so dark brown that they appear nearly purple.<sup>1</sup> The color of olive oil differs significantly depending on the type of olives the manufacturer uses, how the product is handled during manufacturing, and how the final product is stored before it reaches customers. In the case of olive oil, extra virgin varieties are almost always much darker in appearance compared to more heavily-processed oils, like pure, refined, or pomace products.

Because the color of the oil can tell customers a great deal about how it was processed and stored, color consistency in edible oil products is an essential part of your manufacturing procedure. However, you can't always use the same color classification for oil as you would for clear, transparent liquids like water or certain [polymers](#). Oils used in cooking products are often naturally yellow to brown in color, and as such, they may require you to use [the Gardner scale](#) in order to accurately analyze and classify your product's color consistency. Unlike [the APHA/Pt-Co/Hazen color scale](#) (which measures the purity of colorless or nearly-colorless liquids), the Gardner scale is designed specifically to measure color consistency in yellow or brown transparent samples. There is some overlap between the APHA and Gardner scales at the lowest end of the Gardner scale (below

Gardner 2). However, if your sample is darker than Gardner 2, then the Gardner scale may be the best classification method for your edible oil products. Using this scale, you can attain a more accurate understanding of your edible oil products while ensuring that every batch of product is consistent and aesthetically appealing.



The Gardner scale can be used to give you greater insight into your edible oil products. Image Source: Pexels user Pixabay

What is the Gardner Color Scale?

The Gardner color scale is a well-established method for identifying and categorizing the color of transparent liquid products that fall naturally in the yellow to brown color range, such as [cooking oils](#), resins, fatty acids, and wood varnishes. When the Gardner scale was originally developed in the 1920s, it consisted of 18 different liquid color standards against which manufacturers could compare their own products. Each color standard was contained inside of clear glass tubes, and the 18 different liquid colors were made from a mix of potassium chloroplatinate, potassium dichromate, ferric chloride and cobaltous chloride.<sup>2</sup> Each tube represented a slightly different color, ranging from pale yellow (Gardner 1) to very dark brown (Gardner 18).

However, the earliest forms of the Gardner scale were imprecise and vulnerable to human error. To use the scale, you had to perform a visual comparison of the product sample against its matching Gardner liquid. Because [the human eye can be biased](#) when it comes to accurately detecting colors, these versions of the Gardner scale were not completely reliable. Moreover, the liquid inside of the

glass vials was prone to natural changes in color over time, and manufacturers of Gardner scale vials couldn't always replicate the liquid colors perfectly.

Today, [the Gardner scale](#) has been integrated into more advanced color measurement instruments, solving many of these past inconsistencies and challenges. To use the scale, you no longer have to rely on the subjective human eye to test for color consistency between products. Rather, the Gardner scale has been converted into precise digital color data that can be included in a spectrophotometer's software. Using spectral analysis and a 10 mm or 20mm path length transmission cell, modern spectrophotometers can triangulate chromaticity coordinates for a given sample, then compare the data to the corresponding color on the Gardner scale. If the sample falls outside of the desired scale placement, the instrument will alert the operator to the problem right away. This can help you identify inconsistencies in your manufacturing process or in the raw oil material you use to create your products. In short, the Gardner color scale can work alongside the most advanced spectrophotometers to detect even the slightest color variation for yellow or brown edible oil products.



The Gardner color scale allows you to compare multiple transparent and translucent edible oil samples to ensure that your products are consistent in color from batch to batch. Image Source: Unsplash user Matthijs Smit

#### The Gardner Scale Helps Edible Oil Manufacturers Create Consistent Products

Using a spectrophotometer with Gardner scale capabilities provides a number of benefits that can help you create higher-quality, more consistent edible oil products:

##### Raw Material Selection

During the selection process for your raw materials, the Gardner color scale may help you identify materials that are most likely to produce the final color you desire. For example, if you want to

manufacture [extra virgin olive oil](#) that is as dark yellow as possible without adding artificial coloring to your final product, then you may choose to test the raw oil produced by a number of different olive species first. This testing process will help you identify the olive variety that consistently produces your ideal oil color on the Gardner scale.

### Refined Manufacturing

Another use for the Gardner scale among edible oil manufacturers is to ensure color consistency from batch to batch. Various steps in the manufacturing process can impact the final color of the oil product, which may impact both the real and perceived quality of the oil. When making olive oil, for example, manufacturers press the olives in order to extract liquid fat from the fruit. If the olives are exposed to too much oxygen during this process, the oil may oxidize and change color, resulting in a lower-quality product.<sup>3</sup> Similarly, the process of bleaching or refining the oil may cause it to appear lighter in color compared to an oil that has not been through this process. By testing your edible oil for color consistency throughout the manufacturing process, you can ensure that your products are being processed exactly as intended, as discoloration could be a sign of an inconsistency in the pressing or bleaching process.

### Safer Storage

Finally, the Gardner color scale can help you identify improper storage conditions. Edible oil products are highly sensitive to changes in temperature, lighting, and air quality. For instance, food-grade oil that has been stored in temperatures above 65 degrees is prone to heat damage, which may cause it to lighten significantly in color.<sup>4</sup> Likewise, oils exposed to too much oxygen as a result of an improper container seal and oils that are exposed to bright lights or natural sunlight are also likely to undergo undesirable color changes before they reach your customers. Using a spectrophotometer that is capable of measuring edible oil against the Gardner color scale, you can ensure that your products are being stored properly before they are shipped to your customers or distributors. Additionally testing a sample of your oil while it's in storage may help you identify storage problems before they negatively impact your future products.

### How to Use the Gardner Scale

If your edible oil products fall somewhere within the pale yellow to dark brown range of the color spectrum, then the Gardner scale can help you identify the precise color of your sample with a high degree of accuracy. To ensure that your spectrophotometer is accurately measuring your edible oil samples against the Gardner scale, you may choose to standardize the instrument against a physical liquid Gardner color standard. This performance qualification step is optional, but it may help you monitor the accuracy of your measurements over time. Once you've standardized your spectrophotometer and ensured that it is accurately measuring your samples against the Gardner scale, you can then use this scale in the future to detect the color consistency of all of relevant samples.

Generally, the Gardner scale is an accurate comparison tool when measuring the color of yellow or brown translucent liquids. If, however, your products are mostly colorless, the APHA color scale may be a better color measurement tool. For example, if you manufacture refined soybean oil, you may find that the APHA color scale is perfectly adequate for your needs. This is because refined soybean oil is virtually clear, with only a very slight, pale yellow tint.<sup>5</sup> Since this oil product is nearly colorless, the APHA scale can help you identify color variations or imperfections in your sample; you don't necessarily need the Gardner scale for this process.

However, you don't necessarily have to commit to one scale or the other right off the bat. [EasyMatch QC software](#), which is included with HunterLab's spectrophotometers, is capable of capturing APHA and Gardner color scale data simultaneously, giving you a higher degree of flexibility. This is particularly useful in the case of edible oils, as some manufacturers initially use the Gardner scale to analyze raw oil, which may still contain a great deal of yellow pigment. The APHA scale may then be used as the oil becomes clearer and less yellow via refinement or bleaching. HunterLab's innovative technologies make it easier than ever to analyze your edible oil samples in the best way possible for your purposes.

#### HunterLab Technology

For more than 60 years, HunterLab has been a pioneer in the field of color measurement. In that time, we have worked closely with a wide range of industries—including those in the food and chemical sectors—to create the tools necessary to ensure color consistency in every product. Today, we offer a comprehensive line-up of [portable, benchtop, and on-line spectrophotometers](#) designed with the diverse needs of our customers in mind, giving you the highest level of insight into your products and processes. [Contact us](#) to learn more about our renowned instruments, customizable software packages, and world-class customer support services and let us help you select the right tools for your needs.

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