

In some transparent liquids, [colorlessness is king](#) and manufacturers rely on the [APHA/Pt-Co/Hazen color scale](#) to ensure both chemical purity and aesthetic appeal of colorless and near colorless liquids. Other transparent liquids, however, have different color properties, either by nature or by design, that require a separate, specialized color measurement scale for yellowness beyond that offered by the APHA. Yellow to brown transparent chemicals, liquid pharmaceuticals, food products, and beverages are ideally suited for Gardner Scale measurement.

## The Gardner Scale and Color Consistency

The Gardner Scale was developed in the 1920s to classify the color of drying oils, varnishes, fatty acids, polymerized fatty acids, and resin solutions. The scale originally consisted of 18 liquid standards composed of potassium dichromate, ferric chloride, cobaltous chloride, and potassium chloroplatinate and represented in sealed glass tubes for visual comparison, ranging from light yellow (1) to dark brown (18). These liquids were vulnerable to instability, color variation, and reproduction difficulties, and were eventually replaced by glass filters in 1958 in an attempt to enhance precision. However, the Gardner Scale remained a visual evaluation method relying on [the subjective human gaze](#), leading to inaccuracies and difficulties maintaining color consistency.

## Integrating Spectrophotometric Color Measurement

With the advent of more advanced color measurement technologies, the Gardner Scale became correlated with colorimetric scales, most importantly the CIE Chromaticity Coordinates. The articulation of this relationship led to the development of ASTM D1544, Standard Test Method for Color of Transparent Liquids (Gardner Color Scale).<sup>1</sup> [The conversion of the scale to precise color data also allowed for integration with sophisticated spectrophotometric instrumentation.](#) In 1997, a new spectrophotometer-based Gardner Scale methodology was introduced to provide even more precise color measurement via spectral analysis. Using a 10 mm path length transmission measurement, the Gardner value is calculated by [“triangulat\[ing\] the chromacticity coordinates and expand\[ing\] the values to include a decimal.”](#) This measurement method is described in ASTM D6166, Standard Test Method for Color of Naval Stores and Related Products (Instrumental Determination of Gardner Color)<sup>2</sup>

The detailed chromatic data offered by spectrophotometric analysis provides important information for manufacturers across industries. Divergences from color standards serve as warnings that something has gone awry either with the raw material or in the manufacturing process, and can help operators pinpoint the variables creating undesirable results. Objective analysis allows for increased efficiency and accuracy, ultimately enhancing both your production process and finished product, whether you are manufacturing liquid pharmaceuticals, soft drinks, perfumes, or wood finishing varnish.

## The Relationship Between the APHA and Gardner Scales

The APHA scale offers more precise measurement for colorless and near colorless liquids while the Gardner scale provides detailed chromatic information for liquids with more yellowness. However, the two do overlap at the top end of the APHA scale and low end of the Gardner scale; [“an APHA/Pt-Co/Hazen 500 color standard is considered to be just under a Gardner 2.”](#) In some applications, a liquid that starts out requiring Gardner color measurement by virtue of its high level of yellowness may necessitate APHA measurement as refinement processes remove contaminants and produce greater water whiteness. As such, the two standards can work hand in hand to cover a full spectrum of color quantification throughout production.

Full article with photos available here:

<https://www.hunterlab.com/blog/color-measurement-2/the-gardner-scale-modern-applications-for-color-measurement-of-transparent-liquids/>