

Caustic liquids play many critical roles in our lives, whether in the form of pharmaceuticals, automotive chemicals, or everyday cleaning products.<sup>1</sup> For example, many swimming pools are disinfected with liquid chlorine, even though this substance is highly caustic and corrosive when handled on its own. How do manufacturers ensure that a highly acidic gas like chlorine is safe to use in a public pool? By testing it thoroughly during the manufacturing process. Liquid chlorine manufacturers add a strong base (like caustic soda) to their products to counteract the high acidity of natural chlorine gas.<sup>2</sup> From here, they also thoroughly test the final liquid product for pH balance, color consistency, and purity, ensuring that each batch of liquid chlorine is the same exact shade of translucent yellow.

However, performing color quality control tests on chlorine and other caustic chemicals can be a challenge for liquid chemical manufacturers. That's because these materials need to be handled and tested with extreme care; if a caustic substance comes into contact with your skin, it could cause a painful chemical burn. Substances like chlorine also have corrosive properties, meaning that the chemical has to be stored in a nonreactive container (like glass or anodized metal) when you perform color quality control tests on the sample.

Yet despite these challenges, there is a simple way to test the color of these caustic liquid chemicals without putting your equipment or your staff at risk. By refining your testing procedures and using a durable spectrophotometer that is designed to handle harsh chemical samples, you can safely test the color of your products.

## The Challenges of Working with Caustic Liquid Chemical Samples

Although manufacturers of caustic detergents, cleaners, or other harsh liquid products work with fairly dangerous materials, they still need to test for color consistency. Not only can consistent color act as a sign of [chemical purity and a refined manufacturing process](#), color also impacts a customer's perception of the product. For example, in commercial [liquid detergent products](#) and industrial cleaning agents, manufacturers often choose bright, bold colors to help their products stand out. However, even if your product is completely clear, measuring your chemical samples for consistency is still important. A clear sample that is free of haze or other particles, for example, may appear to be more pure compared to a product that is cloudy.

The importance of consistent color and clarity in your liquid chemical products can't be understated. However, measuring this color in your lab becomes much more challenging when you work with caustic substances. There are two main challenges that manufacturers face when they test the color of their caustic liquid chemical products. First, the caustic chemicals can cause damage to the skin, eyes, and airway of the person testing the sample for color consistency. Second, many caustic liquid substances can corrode some types of metal, which in turn will cause the chemical to leak from a metal container or damage the metal components of a spectrophotometer. Although some caustic substances can be safely stored in glass or plastic sample holders, this option isn't available for every spectrophotometer. Moreover, some caustic liquids can damage plastic as well.<sup>3</sup> This is why manufacturers need to solve both of these problems in order to safely test their caustic products for color consistency.

## How to Measure the Color of Harsh Liquid Chemical Samples

To solve the challenges inherent to harsh liquid chemicals, manufacturers need to refine their sample preparation protocol and use spectrophotometers that are durable enough to withstand a caustic or corrosive sample. This is where the [Vista transmission color spectrophotometer truly shines](#). The instrument has sealed sample compartments, a sloped design, and anodized materials to meet the many needs of the chemical industry. To use the Vista to improve your color quality control testing process, follow the three steps below:

### *Step 1: Refine Your Sample Preparation Process*

By wearing protective clothing and goggles as well as ensuring that the lab is properly ventilated, you can make the testing process safer when handling caustic chemical samples. The Occupational Safety and Health Administration (OSHA) has a list of guidelines for proper sample preparation that you can follow in order to safely measure the color of your products, including having emergency facilities in the event of a chemical spill or accidental exposure to the sample.<sup>4</sup>

### *Step 2: Use a Durable Spectrophotometer*

Once you have your safety measures and sample preparation protocols in place, you should ensure that your spectrophotometer is capable of holding and testing a caustic sample. Not all spectrophotometers are able to withstand exposure to these types of substances. That's because certain parts of the spectrophotometer like metal components and paper backing materials can be severely damaged by caustic liquids.

For example, a sample that's highly acidic could cause rapid oxidation in some metals.<sup>5</sup> This means that if you place your acidic sample inside a sample holder with metal parts or you accidentally spill the sample onto a metal section of your spectrophotometer, the liquid will corrode your equipment, leading to permanent damage or costly repairs. Moreover, some caustic chemicals release a corrosive vapor over time that can damage your equipment. This happens if your liquid sample spills and collects inside the crevices of your spectrophotometer. Because these areas are so difficult to clean, the corrosive liquid could continue to accumulate inside your instrument, slowly damaging it over time.

The Vista is the best transmission color spectrophotometer to use to solve this complex set of challenges. The instrument addresses these problems in three ways:

- The instrument is sealed and electronics and optics would not be affected by [small spills](#).
- The Vista's transmission compartment can be sloped at a forward angle. This unique shape prevents liquid samples from collecting inside the compartment and allowing you to quickly wipe up the spilled sample.
- The Vista is equipped with an anodized metal compartment. The anodized metal prevents the compartment from being easily damaged by corrosive materials. When a metal is anodized, it's submerged in an electrolytic solution, causing the metal to form a thick layer of protective oxide on its surface.<sup>6</sup> As a result of this protective oxide layer, the Vista can easily cope with chemical spills, even from highly corrosive materials that damage most other metals and instruments.

### *Step 3: Measure Color and Haze Simultaneously to Limit Operator Exposure Time*

With a corrosion-resistant spectrophotometer, you can safely measure most types of [liquid samples](#), including highly caustic chemicals. However, while the instrument itself is more resistant to damage, you still need to ensure that your operators limit their exposure to these caustic chemical samples as well. To do this, you can use the Vista's simultaneous transmission color and haze measurements. This feature allows you to test both the color of your chemical products and your product's clarity at the same time. Using simultaneous haze and color measurement, you will limit your operator's exposure to the caustic liquid sample, as your operator only has to take one measurement. Your staff will spend less time preparing caustic samples, and they won't have to take separate measurements to test for color and sample clarity.

Whether your products are non-corrosive solvents or abrasive industrial-grade cleaners, a durable spectrophotometer will help you get the most accurate, reliable color measurement results. The flexibility and durability of instruments like the Vista could dramatically improve your lab's testing process, allowing you to refine your products and maintain high quality standards.

Full article with photos available here:

<https://www.hunterlab.com/blog/color-chemical-industry/the-best-methods-for-measuring-the-color-of-caustic-liquid-chemical-samples/>