measuring Chlorine

Choosing a chlorine testing & monitoring method that works best for your situation

By Marianne R. Metzger

There are a multitude of reasons for measuring various disinfectants that are used in different applications. Let's focus on chlorine because it is a widely used disinfectant, especially for potable water, including private wells and public water supplies. Typically homeowners do not monitor their water supplies as closely as do public water utilities. Homeowners may test the chlorine level if they notice a chlorine taste or odor in the water, but public water supplies are required to maintain a certain level of disinfectant in the water, so they typically measure the level of disinfectant continuously with an inline monitor. They test frequently—usually daily or weekly.

How to Measure

Depending on the application, there are various methods used to measure chlorine. For homeowners concerned about chlorine levels or for those wanting a general idea of chlorine level, there are test strips, which are dipped into the water and change color based on the level of chlorine. You then compare the color to a chart to determine the level, much like the chlorine testers used for swimming pool applications. Usually this is a good way to get a general idea of the level, as it is not the most accurate because color change is subject to interpretation; however, the EPA has approved specific test strip methods to comply with monitoring regulations under the Safe Drinking Water Act.

Public water supplies are required to measure the level of residual disinfectants to ensure the water is adequately disinfected. Many water supplies are opting to go with inline monitoring to constantly measure the chlorine levels, which gives their customers a better level of protection. There are a couple of methods for inline monitoring, each with their own pros and cons.

The first technology we will discuss is the colorimeter that uses the DPD method—the same method employed by many of the available test strips. DPD is a chemical indicator that reacts with the chlorine present and basically dyes the water a pink color that will indicate the chlorine level. For inline monitoring the difference is how the color change is read. While just the human eye reads the test strip, the inline test measures color change using an electric eye (also called a photodiode), making measurements more consistent and accurate. A light beam is passed through the sample and the amount of light transmitted is dependent on the amount of color in the sample. For example, if the sample is dark in color, less light will be able to pass through the sample and will indicate a high level of chlorine, while a lighter color will allow more light to pass through indicating a lower level of chlorine. Colorimeters can produce an output signal commonly of 4 to 20 milliamp (mA) to monitor, or control remotely. Colorimeters typically detect chlorine in the range of 0 to 5 parts per million (ppm).

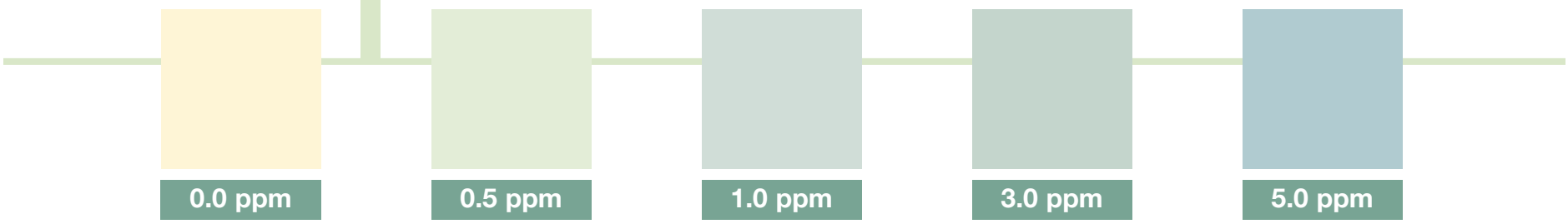
A more sophisticated technique to measure chlorine inline is based on the amperometric method. In this method, chlorine is measured by a sensor probe containing the electrolyte potassium chloride (KCl). The probe is placed in the distribution system where water passes by. The chlorine present in the water moves across the membrane on the bottom of the probe and reacts with the KCl to generate an electric current. The probe measures the current produced to determine the level of chlorine. The stronger the current, the higher the level will be of present chlorine. This system is also capable of remote monitoring and/or control, using 4 to 20 mA output. This system can measure chlorine levels from 0 to 20 ppm.

Choosing the Right Method

Each of these methods has advantages and disadvantages based upon the application in which they are being used, as well as financial resources available.

Test strips. These tests are simple to use and are an inexpensive way to measure chlorine, but water utilities that routinely use these strips should consider the cost associated with technicians having to collect and analyze samples. Also, keep in mind there is no equipment maintenance that is typically required for a more complex system. It does give you a fairly accurate reading of chlorine, but note that color changes are subjective to the human eye and can be read differently from person to person. If samples are already discolored, this can interfere with getting an accurate result. Oxidized manganese is known to cause a false positive for chlorine when using the DPD indicator.

Another drawback to this method, specifically for public water utilities, is that it's only a single test and does not provide a continuous reading. A continuous reading allows correction so that when chlorine levels are low, more chlorine can be added. This can also be automated by



using a controller to turn on a chlorine pump when the chlorine level reaches a designated low level. Pumping stations located in remote areas or water supplies with limited staff may consider using a method that provides a continuous reading rather than having to perform test on a designated schedule.

Colorimeter. This method allows for continuous testing with instantaneous results, and readings can be forwarded to a system that can collect data or set off an alarm notification. This method eliminates the need for an operator to perform a visual analysis, thus limiting the possibility of human error and subjective reading. That being said, the level of accuracy is dependent on other criteria including a constant supply of clean water for taking samples, large quantities of chemical reagents and perfect operations of components such as pumps and tubing. Potentially hundreds of gallons of water could be used because this system is constantly taking water samples, and therefore, large quantities of the DPD chemical indicator and pH buffers are also being used. This type of system requires a great deal of maintenance and ongoing cost of chemical reagents. Ultimately, this method allows a greater level of accuracy than would the test strips.

Amperometric. The amperometric method is a newer technology, which is a true continuous system because it does not take samples like the colorimeter; thus it does not result in the wasted water used for analysis in the colorimeter method. It provides continuous results with less maintenance and is the most accurate out of all three methods. While the sensor probe may be initially expensive, it does not require the chemicals needed for the colorimeter, reducing operating cost. This method is not suitable for water that has been treated by reverse osmosis (RO). The aggressive nature of RO-treated water attacks the electrolyte found in the sensor, causing it to diffuse out of the probe. Without the electrolyte there is no indicator to generate an electric current, making any measurement inaccurate.

Consider Before Choosing

There are many things to consider when choosing a monitoring system. First, you must consider your budget and as I mentioned earlier, water supplies should take into consideration the time it takes for employees to perform onsite analysis, including the cost of travel between stations. This can be significant for pumping stations that are remotely located especially because fuel costs continue to increase.

Next, consider the application because each is different. For example, when testing wastewater, consider that dirty water can clog the pumps and tubes in the colorimeter test, thereby increasing operating costs. There are many different applications for chlorine monitoring, so remember to take everything into consideration, including possible controllers, communications systems, location, size, source to be monitored, etc. If you have questions about a particular system and whether it works with your application, contact the local representatives because they will have the most knowledge about their system and on what applications they work best.

Once you've determined the application, financial resources and system needs, you will be prepared to make the best decision for your project. *wqp*

About the Author

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