



Colorimetric Testing

The Ideas Behind the Meters

Many of the substances in water which must be measured are colorless and so they are invisible. So, how do you determine how much of that substance is there if you can't see it? A common method for testing how much of a substance is in the water is to run a colorimetric test. A colorimetric test is a test which forms a color. The amount of the color is then measured. In most tests the more color formed, the more of the test substance there is in the water.

But how do you measure the color which has been formed? You could look at the color with your eyes and compare the color formed with some standards. This is a visual measurement of the color. Visual methods can give very good results when applied in an appropriate manner. However, visual measurements of color are subjective. Everyone's eyes are different. Some people are color blind. Colors might look different when there is different lighting.

When your testing protocol requires the utmost accuracy and precision these problems must be solved. How do you do that? You use a colorimeter.

LaMotte colorimeters were developed to make measuring color differences in water easy. The detectors in these colorimeters are very sensitive and can detect very small differences in color. These measurements do not depend on the eyes of the person making the measurement. The intensity and color of the light used to make measurements are carefully controlled with electronic circuitry and light filters. This eliminates problems caused by different lighting situations.

To use a colorimeter for colorimetric testing, the color being measured must be proportional to the concentration of the substance being tested. The greater the intensity of the color observed, the greater the concentration of the substance. Beer's Law is used to make this relationship quantitative.

Beer's Law says that the absorbance measured with the colorimeter depends on three things: 1) the substance being measured; 2) the concentration of the substance; 3) the pathlength or distance the light travels through the substance.

Absorbance is the measure of how much light is absorbed by a substance compared with a blank (usually clear, colorless water).

The substance determines the color of light which is absorbed and consequently, the color which must be measured. When white light passes through a colored substance, the substance absorbs one color and transmits the rest. Your eyes see the transmitted color. You must measure the absorbed color since that is the color of the light which interacts with the substance

being tested. For instance, a blue substance absorbs yellow light and transmits blue. You see the blue color but yellow light is used to measure the absorbance of the blue substance. LaMotte colorimeters use special light filters to select the color of light used to measure the absorbance.

As mentioned above, the concentration of the substance determines how much colored light is absorbed. The more substance present the more light is absorbed. LaMotte colorimeters are calibrated to determine concentrations directly.

The longer the distance (the pathlength) that the light travels through the substance the more light is absorbed. This means that a calibration for a colorimetric test must always be performed using the same pathlength. All LaMotte colorimeters have a fixed pathlength for each test.

LaMotte colorimeters apply the principles of Beer's Law to give you the result you want. The concentration, the color of light, and pathlength are set for the colorimetric test being performed. You measure the absorbance. The concentration is given from a calibrated look-up table, a calibrated direct-reading scale or a calibrated direct-reading display.

LaMotte's SMART Colorimeter uses innovative microprocessor technology to give the analyst 42 colorimetric tests at the press of a button. Plus, the analyst can enter up to 25 of his own colorimetric tests. The meter's memory will store 500 test results.

Maintenance Tip

Before inserting the colorimeter tube into the colorimeter, wipe it with a lint-free tissue to remove water drops, fingerprints, dust, and other particles. This simple step will reduce errors that fingerprints and dust cause, and help assure accurate results. Additionally, removing water drops will reduce the possibility of water damaging the meter components.

Testing Hint

Before starting a test or series of tests, run a reagent blank. To run a reagent blank simply substitute distilled or deionized water for the sample, and add the reagents as specified in the instructions. Insert the tube into the colorimeter and follow the instructions for performing a reagent blank in your meter manual. Remove the tube, dispose of the reagent blank, and use the same tube to run the test. Running a reagent blank eliminates errors that may result from small differences in reagent color. Using the same tube eliminates glassware errors.