POU

FIELD TESTING:

Assesing your customers' water quality

By Michelle Tice

The "universal solvent," water by its nature is easily con-taminated. Yet whether cons-umed or used in a process—water must meet certain quality standards. Treatment cannot be undertaken until the water's characteristics have been identified and quantified. With a little training and a test kit from a reputable manufacturer, many of these tests can be performed on site at the point-of-use (POU).

Method selection

The advantages of POU testing include lower costs, quick results, no degradation of the sample and the opportunity for your customer to observe the tests and learn more about water quality from you. Reliable, cost-effective results can be obtained with an understanding of the advantages and limitations of the various test methods and test equipment on the market.

Colorimetric testing

Visual colorimetric testing, or color matching, involves adding reagents to a water sample which react with a specific chemical in the sample to produce a colored product. The sample's color and intensity are then matched visually with liquid, plastic or printed color standards to obtain a reading.

Test strips also fall into this category. When dipped in the water sample, strips presaturated with reagents produce colors that are coin-pared to printed standards.

Test strips are widely used in the water conditioning industry in direct mail packages as a means of spurring a potential customer's interest in learning more about the quality of his or her water

Visual colorimetric test kits are more subjective than other methods and difficult to read for a few color-impaired individuals. However, they are compact and ruggedly constructed. Easy to perform, the tests also are relatively inexpensive—making them ideal for field testing dozens of analytes including pH, chlorine, nitrate, iron and copper

Titrimetric testing

In titrimetric tests, a solution of known concentration (the standard reagent) is added to a precisely measured water sample until a color change occurs (the end point). The volume of the standardized reagent and the concentration of the chemical are directly proportional, allowing the sample's chemical concentration to be determined by the amount of the standard used to create the color change. Titrations can be performed with burets or dropper bottles. Although a more precise reading can be achieved from buret titrations, drop tests are cheaper and more portable—and, therefore, lend them- selves to POU field testing of alkalinity, hardness, chloride, sulfite and nitrite.

Turbidimetric testing

Turbidimetric testing describes the insoluble compound that forms when a reagent is added to water and causes cloudiness in the sample. The amount of turbidity is directly proportional to the concentration of the analyte. Turbidity can be read visually, which is a subjective method, or electronically. Turbidity meters are much more widely used than visual methods in all industries except the swimming pool industry.

Electronic testing

Portable electronic equipment—notably spectrophotometers, colo-rimeters, turbidimeters, digital titra-tors, and handheld pH and conduc-tivity/TDS meters—are found in the most comprehensive water quality testing systems. Electronic equipment can be used to measure the absorption, transmission, or concentration of a selected wavelength of light by the specific parameter being tested. Because the reaction to the wave length is directly related to the analyte's concentration, instrumenttation can be used to determine the amount of analyte in the water.

Electronic equipment is more expensive and must be calibrated regularly, but generally provides greater accuracy. However, the degree of accuracy afforded may not be necessary for most POU applications such as the correction of pH, hardness, iron, alkalinity or turbidity problems

When selecting your testing method, consider which one will allow you to assess your customers' water quality accurately and in the most cost-effective manner.

Color and odor

A strange color or odor is often one of the first indications that a water supply needs treatment. Colot in water can cause staining and be otherwise uninviting in domestic and commercial uses. The U.S. Environmental Protection Agency (USEPA) has established 15 color units as a secondary maximum contaminant level (or SMCL, a non-enforceable federal guideline for aesthetic quality) for color in water. Determined colorimetrically, a standard unit of color is produced by 1 mg platinum/L in the form of the chloroplatinate ion.

Living organisms, organic matter, and gases can all be sources of odor in water supplies. Odors can be classified by scent (nasturtium, geranium, earthy, musty, etc.) and potency (very faint, faint, distinct, very strong). Odor is measured by the threshold odor test, which, like colorimetric testing, is subjective since it relies on an individual's olfactory sense. The test requires dilution of a sample with odor-free water until the least amount of odor is detectable.[3] The SMCL for odor is 3 TON (threshold odor number).

Common culprits

Water unsafe to drink or harmful to equipment and laundry cannot always be seen or smelled. Periodic testing for other parameters is therefore essential to a successful treatment program. The basic tests for water conditioning measure hardness, pH, alkalinity and iron.

Hardness

Water that contains high levels of calcium and magnesium salts (generally over 120 ppm as calcium carbonate—CaCO,) is called "hard" water. The scourge of commercial laundries and homemakers alike, these minerals make it hard for soap to lather. Calcium and magnesium compounds are relatively insoluble in water and tend to precipitate easily, causing scaling and turbidity which will increase heating costs and speed equipment and pipe deterioration. Softening the water eliminates this problem.

In some applications, such as in pool water, a degree of hardness is desirable. Here it is needed to maintain a proper chemical balance to prevent dissolution of plaster surfaces and corrosion of metal equipment.

The most effective way to test for hardness is by titration using EDTA (ethylenediaminetetraacetic acid), an organic compound which reacts with both calcium and magnesium ions. After combining with these ions, the excess EDTA reacts with an indicator to produce a blue color (the end point). The reading will determine the amount of hardness in the water (see *Table 1*), providing the necessary information for treatment.

pH

To determine acidity or basicity of water, one measures pH. It is measured on a scale from 0-14. A pH of 7 indicates the water is neutral, while a reading below 7 is acidic and above 7, basic. It can be measured colori-metrically or electronically. To test pH colorimetrically—the most common, least expensive way—use an indicator designed for a specific pH range. The goal for drinking water would be a pH of 6.5 to 8.5; therefore, the choice of phenol red which reads from 6.8 (yellow) to 8.4 (purple) would be appropriate.

Alkalinity

A test for alkalinity measures the acid-neutralizing capacity of water.

Total alkalinity is primarily a mixture of carbonate, bicarbonate and hydroxide ions. Alkalinity is determined by titration (drop or buret) with a standard acid to a designated pH, then recorded as either "P," "M" or "T," (P stands for phenolphthalein, M for methyl orange, and T for total alkalinity) with an end-point equivalent to the corresponding al-kalinity concentrations of carbonate (CO_3^{2-}), bicarbonate (HCO,;) and hydroxide (OH).

Metals: A testing "must"

In addition to the standard tests of hardness, pH and alkalinity, other parameters may be of concern de

TABLE 1

Amount of Hardness (mg/L)	**Level of Hardness**
0-60	Soft
61-120	Moderately hard
121-180	Hard
above 180	Very Hard

Source: Water Treatment and Design, 1985.

TABLE 2

	Source	Common testing method	Indications	SMCl (mg/L)
Copper	nature; corrosion of copper brass, or bronize pipes and fittings	Colorimetric	bluish-green stains (drip marks)	1.0.
Iron	Nature; flaking of rust from pipes	Colorimetric	Metallic taste; Reddish-brown stains	0.3
Maganese	Nature; mine drainage	Colorimetric	Staining; black sediment; trunidity	0.05
Zinc	Mine drainage; corrosion of galvanized steel pipes	titrimetric	bittertaste	5.0
Lead	Industrial discharge; dissoultion of lead plumbing	Colorimetric		N/A

Secondary maximum contaminant levels as established by the USEPA.

Lead has no SMCL; rather is maximum contaminant level as established by the USEPA is 0.015 mg/L.
Note: The presence of these metals other than manganese, may indicate corrosivity of piping that can be cured with a pH a conplete tabtest performed.
Sources: D.C. Brandvold, Water treatment 1993 and UsePS Region 1997.