

The **TREND**

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PHOSPHONATE TESTING

- ◆ Have you checked out our new website? Go to www.chemtexcorp.com and see the new content we have there, including this issue of *The Trend*
- ◆ If you haven't already, take a look at the new Chemtex Test Kit and Reagent Catalog. It's your single source for part numbers and pricing for hundreds of reagents, test kits, lab equipment and testing supplies, including Chemtex, Hach, Taylor, LaMotte and others. You can also access the Catalog on our new website!
- ◆ With cooling season soon drawing to a close and boiler season coming up, help your customers prepare for a smooth transition. Our website has several Technical Topics and Newsletter articles your customers will find useful in protecting their systems during start-up and shut-down.

Watch For:

- ◆ More information on the 2008 International Chemtex Spring Sales Meeting!



Is Phosphonate Testing giving you fits? Check out the article inside to find out which Phosphonate test to use, and get some tips on what to watch for to be sure your Phosphonate test results are accurate.

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For years, molybdenum has been used both for corrosion control and product tracing in cooling water scale and corrosion inhibitors. Molybdenum is a good ferric metal inhibitor, and the molybdenum test is an easy and accurate means of controlling product residual.

More recently, two factors have come into play that have significantly reduced the use of molybdenum in cooling water inhibitors. Since 2001, the price of molybdenum has risen by 700%, greatly increasing the cost of molybdenum-based products. The price of some cooling water products jumped by as much as 50%, making them too expensive for many customers to use.

The other factor in decreased use of molybdenum-based products is regulatory: many municipalities have substantially reduced the level of molybdenum allowed in discharge to the sanitary sewer; some have banned the use of molybdenum entirely.

Whether their reasons for doing so are economic or regulatory, water treaters are increasingly replacing molybdenum-based products with “all-organic” scale and corrosion inhibitors. These new products perform extremely well. Advanced technology organic corrosion inhibitors provide powerful corrosion resistance, equaling and often exceeding the performance of molybdenum as a ferric metal inhibitor.

The primary building blocks of all-organic cooling water inhibitors are phosphonates, or organically bound phosphate compounds. Hydroxyphosphono acetic acid (HPA), manganese/aminophosphonic acid (MAPA) and Phosphonocarboxylic acid (POCA) are three phosphonates that have been shown to provide excellent corrosion control. In addition to corrosion inhibition, POCA also provides effective scale control, and MAPA also affords yellow metal corrosion protection.

Other phosphonates, including hydroxyethylidene diphosphonic acid (HEDP), aminotri methylene-phosphonic acid (AMP) and phosphonobutane tricarboxylic acid (PBTC) are effective scale control agents, and have been used for this purpose for years in cooling water additives.

All-organic inhibitors utilize one or more of these phosphonates in combination with polymers and azoles to make complete scale and corrosion control formulations. As effective as the all-organic inhibitors are at scale and corrosion control, testing for product residuals is more difficult than it is for the molybdenum-based products. The phosphonates are the only components in the organic inhibitors that can be analyzed using field testing methods, and the most commonly used phosphonate tests are subject to erratic results due to numerous interferences from various water chemistry characteristics.

A number of phosphonate drop titration tests have been developed over the years, most of which are complex and cumbersome, utilizing four separate reagents and requiring precise pH adjustment to achieve any sort of accuracy. In addition, the endpoints are often difficult to detect, making results questionable. To further complicate matters, some of the phosphonates are not easily or accurately measured with some of the test methods, making the choice of which test to use difficult.

The phosphonate titration test most field people have chosen to use is the Palintest PK-158. This is the simplest test to use, as the pH buffer, color indicator and dechlorinating agent are all contained in a single tablet reagent. It is relatively economical, with use cost of about \$0.25 per test using replacement reagents, and it provides the most accurate and repeatable results in analyzing the residuals of “standard” phosphonates like AMP and HEDP. For PBTC determinations, the LaMotte 7625 phosphonate test yields the most accurate results. For help in deciding which phosphonate titration test is best for your application, consult the Chemtex Technical Department.



IMPORTANT NOTE: When using a phosphonate titration test to control product feed rate, do not assume the phosphonate residual you get is an accurate reflection of the phosphonate level in the cooling water, even if you ran a blank in the make-up water. It is highly recommended that you determine the actual phosphonate residual using the phosphonate digestion method initially to establish a correlation, and then repeat this procedure two or three times over the next couple months to assure that the correlation still exists. This is preferably done in the field, but samples can be sent to the lab for verification by phosphonate digestion.



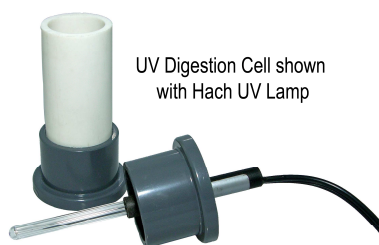
Without question the best method to use to control the feed rate of an all-organic cooling water inhibitor such as C-740 or HS-4030 is phosphonate digestion. This procedure involves converting the phosphonate in the cooling water inhibitor to orthophosphate, in which form it is easily and accurately tested for. Testing equipment and reagents needed to conduct the phosphonate digestion test include a phosphate kit such as the Hach PO-19 Color Disk Kit or colorimeters such as the Hach DR-890 or Pocket Colorimeter II, both of which use Hach PhosVer 3 reagent. Also needed are potassium persulfate reagent and an ultraviolet (UV) lamp and power supply for digestion of the phosphonate. This Hach equipment and the reagents are available through Chemtex and are listed in the Chemtex Test Kit and Reagent Catalog.

A common perception exists that the phosphonate digestion test procedure is complex and difficult to perform. It is actually quite easy—the digestion calls for addition of the potassium persulfate to the sample, followed by immersion of the UV lamp in the

sample for about 10 minutes. The digested sample is then analyzed for orthophosphate using the PhosVer 3 reagent and the Color Disk Kit or colorimeter. Each Chemtex all-organic inhibitor has a recommended cooling water orthophosphate range. The feed rate of the organic inhibitor being tested is adjusted to maintain the proper orthophosphate reading. The entire procedure takes less than 15 minutes to perform.



UV Digestion Cell



UV Digestion Cell shown
with Hach UV Lamp



Hach UV Lamp for
Phosphonate Digestion

IMPORTANT NOTE: It is always important to use clean glassware when performing any type of chemical analysis. In the phosphonate digestion test, it is *critical*. The vessel that is used for the actual digestion of the sample must be cleaned after each digestion using Chemtex D-504 reagent. Simply swirl a few drops of D-504 around the vessel to make certain all the interior surface is contacted by the reagent, then rinse with distilled water. Of course, if you use a colorimeter for the orthophosphate determination (or any other test, for that matter), you should make certain the tubes used in the colorimeter are kept clean as well.

As cooling water discharge regulations become more stringent, the use of all-organic inhibitors will increase. Strongly consider the use of phosphonate digestion as the method for controlling feed rates. The small amount of additional time required to perform this procedure is well worth the assurance that the product will efficiently provide maximum performance.

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