

Understanding orthophosphate

A key parameter in phosphorus control

By Endress+Hauser, USA

Any operator will tell you that a treatment plant is only as good as its equipment. That means employing the devices with the longest lifespans, the lowest operating costs, and the most intuitive designs is critical.

To that end, Endress+Hauser developed its CA80PH Analyzer. With top-of-the-line diagnostic capabilities, an innovative dispensing system, and the durability to ensure performance, the CA80PH promises precision dosing of precipitants to remove phosphorous from wastewater and optimize process control. Water Online spoke with Steve Smith, senior product marketing manager, Tracy Doane-Weidemen, marketing manager and analytics team lead, and Alan Vance, environmental industry manager, to put the product to the test.



What are some of the ways this analyzer can save on operating costs?

There are a number of ways that this new analyzer saves on operating costs, the first of which is ease of installation and the overall capital expense of purchasing and installing equipment. This particular design is an easy system for the operators or users to install in their process. That reduces their capital expense up front.

Over the long term for operating expenses, this device dramatically reduces costs, due to reduced reagent consumption. The cost of analysis, whether it's phosphate or ammonia or other elemental analysis, rises and falls with reagent consumption. By reducing the amount of reagents that are required for each analysis, we can reduce the overall operating costs.

Second, this analyzer incorporates a unique refrigeration system that's used on one of the two versions to cool its primary reagent, which also extends the life of that reagent. That, again, reduces the operating costs.

Third, the overall maintenance on the device is extremely low. The times that you have to maintain the device, do any sort of tubing replacement or reagent replacements, are all extended and can be done without tools, which reduces the user's overall operating cost.

One other thing is that the analyzer has really been designed in a modular fashion, where all the components inside the analyzer are standalone components, which makes them easy to replace, if that issue ever were to arise.

How do the diagnostics associated with the CA80PH make the process safer?

This analyzer was built on our Liquiline transmitter platform. That platform has been applied across all of our sensors, our new colorimetric analyzers, in addition to our composite sampler. We're using one common transmitter platform across all of our instruments. It has sophisticated diagnostics capability built into it, which monitors a range of performance aspects for the device. Those diagnostics can be transmitted over Ethernet communications, which can be accessed through a web server, which is optional in the device. That allows users to access all of those diagnostics remotely and in real-time.

That makes the process much safer, because the operators can make diagnostics decisions and resolution decisions very quickly, with that information at their fingertips. It facilitates much safer operation and faster response to issues when they arise.

Why should customers look for upgradable functionality in an analyzer? What upgrades are they capable of making to the CA80PH Analyzer?

The Liquiline platform allows us to connect up to four sensors into this same colorimetric analyzer. This colorimetric analyzer actually becomes an overall measuring and analysis system that allows you to input other analytical measurements into the device and upgrade its functionality.

For instance, you can bring in one of our combination pH/ORP probes into this analyzer, and through one sensor you can get two separate, independent measurements of pH and ORP in addition to phosphate measurement. You can plug-and-play into that colorimetric analyzer and upgrade its capability to add those measurements.

In many cases, the locations where we're making these types of colorimetric analyses are also locations where the customer is in dire need of other measurement parameters, such as pH, ORP, or dissolved oxygen. We've reduced, again, the operating cost of the device, because now you don't have to buy a separate transmitter to operate your analytical sensors in those locations – you can leverage the electronics in the CA80 colorimetric analyzer.

You can also easily upgrade this transmitter by adding and subtracting I/O (input/output) modules that are used in the Liquiline platform. If today a customer decides they're going to run the analyzer and just use an analog output, but tomorrow they want to add digital communications, it's just a function of adding a module. Plug it into the electronics, and immediately it adds digital communications capability, so you can easily upgrade the I/O in addition to their sensor performance.

Are there certain conditions that make orthophosphate measuring particularly important?

We know that the U.S. has ever-decreasing limits in terms of total phosphorus. However, orthophosphate is the actual portion of the total phosphorus measurement that is referred to as "reactive." We can't really do any type of treatment without looking at how much orthophosphate we have in the process.

Now, that's not to diminish the importance of total phosphorus measurement – we do have an analyzer that measures it. But it's more practical to put that analyzer at a headworks or before primary settling, to make sure that there isn't too much phosphorus building in the system, and maybe do some flex management up front. But once we get past that point, then we're going to want to look at orthophosphate. That's the measurement that makes the most sense.

Orthophosphate is going to be looked at as a control parameter for phosphorus elimination strategies for these treatment plants.

How does orthophosphate measurement inform precise precipitant dosing? How does the CA80PH Analyzer help ensure precise dosing?

The closer we get to the real value, the tighter parameters we can run on our precipitant dosing pumps. We take the information from the flow meter, such as our Promag flow meter, and input that into the CA80PH, combining it with very precise measurements to determine phosphate load.

We don't want to overdose and we don't want to underdose. The tighter the control, the more accurate the measurement required. That's pretty important, because the permit requirements in the U.S. are going lower and lower, and that's only going to continue. A lot of plants are doing not only enhanced phosphorus elimination, but they're also adding chemical dosing as well.

The beauty of the analyzer is that it not only controls the process, it also has two channels so you can do feed forward or feed back—or simultaneously do both—and control the precipitant dosing pump. It's a very smart analyzer.

Are there any features or innovations of the analyzer that you're particularly proud of?

Number one is the fact that this is operating off of our Liquiline transmitter platform. The fact that we're able to leverage that platform in this analyzer, coming across from all of our other products, adds a lot of features, a lot of innovation, a lot of functionality that really benefits the customer and gives them one universal form of electronics that they can manage. Whether they're making a measurement in one location or facility or another, they're using the same electronics.

Second, the dispensing pumps are another major innovation that we use in the system. Most colorimetric analyzers today use peristaltic pumps, which are a maintenance nightmare. They're not very precise, but that's the way analyzers were designed in the past. We're using a more innovative dispensing system, based on syringe pumps. It gives us much more precision and less wear and tear, so we get much better performance over the long run.

Third, this analyzer uses a common photometer platform. All of our colorimetric analyzers coming out now use exactly the same photometer and have the ability to be programmed digitally, to operate at different wavelengths. We don't have to replace photometers when someone wants to change the range of their instrument, for example when moving it to a new location.

Yet another innovation is particular to a sample preparation. When you use a colorimetric analyzer of this type, you typically put in a sample preparation system, which is basically a system that draws a filtered sample from the location where you want to make the measurement and delivers it to the analyzer. We've introduced three new sample preparation systems that offer capability to filter and deliver the sample in an automated fashion to the analyzer.

Two of those filter systems communicate to the analyzer. The operation of the filter system, the backwash of the filter system, is all programmed and communicated from the analyzer to the sample prep system using digital communications. This is different than anything else that's out there, and it's already shown in field tests to run very reliably for extended periods of time, with very little maintenance by the end user.

Releasing a new product like this, is there any particular feedback from the user you're hoping for?

We'd love to hear from people that the device is easy to use, very easy to integrate, and that they haven't had to perform any maintenance on it. We're looking for that ease of use, lower cost of operations from our customers. That's the kind of feedback that we're hoping for, and we've already received it from some of the field test sites where we've had the instrument operating.

How is this analyzer more precise than competing products?

Our chemical and sample dosing system is a completely new design, using linear dispensing pumps that are completely different from the peristaltic pumps that are used today. So, we can provide a more precise sample and chemical delivery, which gives us a more precise analysis than what you're going to get out of other devices.

You don't see a gradual degradation in performance over time, like you see in a system with peristaltic pumps due to the flattening or degradation of the tubing. Our device, from that perspective, is going to be more precise in delivering sample, standards, and reagents.

Also, in our photometer, we use LED technology, which again has very low degradation levels and lowers maintenance. That gives us more precision and better performance from the photometer standpoint over a longer period of time.

What makes this an easy product to install?

Mounting the system in a facility is very simple. It just mounts on a wall or on a stand. The programming is extremely easy, just like our Liquiline transmitter. The setups are all menu-driven, which makes it very easy for the operator to set the system up. Then, it's just a matter of plugging the digital sample preparation system over to the instrument, which is just a few connections, and the system is up and running. We've installed these in a couple of field test sites, and those installations have taken less than a day. As a matter of fact, it takes just a few hours to get the system up and running.

Can users expect an intuitive experience?

As with the products in our Liquiline platform, this instrument is very easy to operate. Anytime we talk to a customer who has used it, that is one of the first things they to say. It's very intuitive. It's very straightforward in terms of setting up the device and programming the sample press system.

How does this product fit into the big picture at Endress+Hauser?

When we look at the big picture of how we promote ourselves in water and wastewater, one of our biggest strengths is the fact that we offer a complete line of products for those customers. Not only do we have analytical on-line sensors and the analyzer we're speaking about today, but a lot of the same diagnostic and communications capabilities are available in our flow meters, in our level devices, in our pressure devices, and more.

When we go visit a plant or we work with an engineering firm on designing automation controls, we can handle all those instrument applications from the front of the plant to the back of the plant. It makes it very nice for customers when they have a common look across all their instruments. They program the same, even though the parameters may be different. We feel that's a big strength for Endress+Hauser, and certainly the analytical line is a big part of that.

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