JCS Industries Inc.

Making Sense Of The Chemical Feed Frenzy

The use of chemicals to treat water supplies can be traced back to the 19th century when English physician John Snow chlorinated a British water supply to stop the spread of cholera. Today, things have gotten remarkably more advanced. Chemicals from sodium hypochlorite to aluminum sulfate are used in municipal and industrial operations to purify water, and they are precisely administered using sophisticated chemical feed systems.

To learn more about these systems and the most recent advances in the field, Water Online spoke with Brian Whitmore, the president and founder of JCS Industries. He told us about the use of certain chemicals and the problems they can pose, how different feed systems can affect operations, and a new product that is taking the next step for chemical treatment.

Image credit: "Sodium Hypochlorite Crystals," Grover Schrayer © 2011, used under an Attribution 2.0 Generic license: https://creativecommons.org/licenses/by/2.0/

How are chemical feed systems utilized in water treatment operations?

There are two types of delivery systems used today. For the most part, they are metering pumps, which are positive displacement delivery devices. The emerging technology, which utilizes a vacuum as a motive source, is the automatic liquid vacuum feeder (ALVF). The ALVF has gained acceptance as an emerging technology that delivers chemicals to the application point under vacuum conditions. This allows for a safer, more reliable way to feed.

JCS liquid feeders are patented vacuum-based devices that feed aqueous chemical solutions that aid in disinfection and process control. The unique design of the ALVF utilizes an electronic flow sensor that accurately measures and controls the chemical being fed. In maintaining the desired feed rate, the feeder helps maintain a stable condition, ensuring that over-feed or under-feed conditions are eliminated.

What are the typical components of a chemical feed system?

The main components of our Model 4100 chemical feeder is the electronic flow sensor that measures the chemical feed rate. The sensor outputs an analog signal

that represents the actual feed rate. This signal is utilized to do two things: to deliver a signal to the operator's supervisory control and data acquisition (SCADA) system for actual feed rate verification and to send a signal to the controller. The controller will adjust the control valve that, in turn, regulates the chemical feed rate. This allows the feeder to maintain the desired feed rate that ensures accurate and reliable chemical feed.

The eductor is the motive source of the system. A vacuum is generated to pull chemical from the storage tank through the feeder and into the eductor. From the eductor, the chemical mixes with the water and is delivered to the process.

What are the most typical chemicals used in water treatment systems? Do any pose particular complications to a chemical feed system?

The first and foremost is sodium hypochlorite (NaOCl). This was the genesis of our Model 4100 chemical feeder. NaOCl has a propensity to off-gas, causing conventional devices to misfeed or vapor lock. Since the 4100 utilizes a flow sensor to actually measure the chemical, the sensor sees the disruption and causes the control valve to open. Once the air pocket has passed, the flow sensor sees that the feed is reestablished, and the system resumes control feeding the chemical.

A limiting factor in feeding NaOCl or anything with high pH levels is the effect of these chemicals reacting with calcium carbonate (CaCO3). Depending on the hardness levels with the eductor motive water, scaling may occur. There are ways to mitigate or minimize this occurrence, but those are site specific.

Other chemicals that have been fed are sodium bisulfite, liquid ammonium sulfate, sulfuric acid, polyaluminum chloride, liquid aluminum sulfate, sodium hydroxide, and copper sulfate. Other chemicals are currently under testing.

How can a specific chemical feed system influence operational efficiency, control, and safety? What qualities should an operator look for in a potential system?

The three areas where the operator can benefit using the 4100 are safety, accuracy, and remote operation.

When it comes to safety, it's important to note that the 4100 is a vacuum-operated device. There is no pressurized chemical in the system. The feed through the system is constant, not pulsed like in metering pumps. Pulsating pressure can mean dangerous leaks.

Using the electronic flow sensor, the accuracy of the 4100 is as high as +/- 1 percent of indicated feed and also a 100:1 full automatic turndown.

Conventional pumping systems rely on pushing chemical in a repetitive action (or pulsing), which makes it hard to accurately monitor the feed rate. The 4100 pulls a continuous stream, allowing for the flow sensor to read accurately. Once you can measure the feed, you can monitor and control it with electronic signals.

Why is the Model 4100's self-regulation capacity a benefit for operations?

Because of the accuracy and control it offers. You can also set internal alarms to notify operators if feed is lost or reduced to below the desired feed rate. If there is a feed disruption as stated earlier, the system can automatically see it and autocorrect the issue before alerting operations.

What control modes are available with the Model 4100? What conditions make each one ideal?

There is "fixed feed" where the feeder is manually set, and that rate is maintained automatically. There is "flow mode," which is sometimes referred to as "remote set point control," where a remote value is set, and the feeder responds. There is "residual control" where the feed rate is controlled by a residual analyzer or pH meter. There is "compound loop" mode where a combination of a remote set point and an analyzer will drive the feed rate. All of these functions are a standard offering with the 4100.

Is there a specific size of operation that the Model 4100 is best suited for?

Feed rates can be anywhere from zero to 50,000 GPD depending on process requirements.

What other unique functions separate the Model 4100 from other chemical feed systems?

The actual retransmission of the chemical feed rate, the fact that alarms can be set to alert personnel of an error or feed disruption the instant it happens, and its battery backup capabilities.

These features are critical requirements when engaging in system optimization. Most of the emphasis is placed on the "macro." Items such as power consumption and major process equipment efficiency are the key focus. Chemical feed is considered a "micro focus." But, if you factor in the capital expenditure and operating expense, and consideration is placed on chemical consumption, major cost savings can be realized by considering vacuum-based feed systems. ■