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WHAT WATER TREATMENT FACILITY MANAGERS ARE SAYING ABOUT ON-LINE ZETA POTENTIAL

A chat with Larry Wilt of American Water/ Tolt Water Treatment Plant in Seattle, WA

Drinking water treatment plants are constantly challenged to manage coagulation chemicals as they strive for the precise dosage to enable a stable floc to form. The chemicals are critical to the filtration process, whether it is a convention floc/sed system or direct filtration, including membrane filtration.

Chemicals are expensive and account for a considerable amount of a plant's operating budget, so their oversight can significantly impact the efficiency, operational bottom line, and overall performance of the plant in response to its local demand.

'After installing Zetasizer WT, we reduced the cost of producing water by $4.65 per one million gallons. When you produce more than 16,900 million gallons annually, that is quite a savings. Our savings were enough to pay for the Zetasizer within the first year of operation'

While traditional methods of coagulant dosage management are falling short of providing operators what they need to control the process and minimize expenses, Industry 4.0 is enabling real-time data at the control center to make better decisions and reduce overall costs.

We spoke with **Larry Wilt** of American Water, who manages the Tolt Water Treatment Plant in Seattle, WA, about using Malvern Panalytical's Zeta Potential (Zp) analyzer. Mr. Wilt started his water treatment career with American Water in 1992 in New Mexico where he worked as a meter reader before being promoted to operations. After obtaining his water treatment certification, he moved to Washington in 2003 and worked as plant operator at the 120 MGD Tolt Water Treatment plant where American Water has a contract with the city of Seattle. In 2011, he was promoted to manager.

Malvern Panalytical has long been promoting the use of Zeta Potential (Zp) to better understand the effect of the coagulant dose used in pre-treatment processes to enable a floc to form and allow filtration to work efficiently.

As a technology, zeta potential (Zp) is a first principle measurement technique of the particle charge, reported in mV. Raw water particles are typically in a Zetasizer range of -15mV to -25mV. A good floc can form in the zeta potential range of -8mV to +3mV. Adding coagulants (which are positively charged) neutralizes the repulsive (negative) charge of the particles in the raw water and enable a strong floc to form.

Coagulation chemicals are added into the raw water to enable a floc to form. How was chemical addition (dosage) managed prior to using Zeta Potential (Zp) at your plant?

We have a big swing in water temperature between summer and winter. During the summer months, the plant would produce high-quality water, but during the winter months when the water can drop down to 4º C, we were having a hard time keeping the turbidities down and the chemical taste was apparent. Without zeta potential, it was guesswork and experience.

How often was testing done throughout the day? Was it seasonally dependent? Did weather play a role in that plan?

Testing was done on a daily basis; the seasons play a big part of chemical dosing and weather also could bring in higher raw turbidities.

A treatment plant uses many types of sensors and meters to manage the daily process of purification. What types of sensors have you used in the pre-treatment process to ensure flocculation is effectively managed?

The only method we used in the past were streaming current meters.

Have these devices been accurate over time? Reliable? What were the limitations of the data when dealing with a raw water changes (could it be used to directly change the coagulant dose)?

The meters were hard to use for us because of the changing of flows, they were reliable only to let us know if there was a pump failure. We were not able to know if the chemical dose was correct and did not have them set up to adjust the chemical dosage.

How has the use of Zp changed the way you manage your coagulant chemistry and dosage?

After hearing about the Zp and going to other plants in the area, we decided to rent one to see how well to would work for us. It was like day and night; we were way over-feeding chemicals during the winter months. It was a no brainer, we had to get one.

How can the dosage be managed based on the particle charge?

Our raw particle count can be very low during the summer and quite high during the late fall rainy season. The lower the particle count the lower the chemical dose.

How does Zp compare to your previous methods?

The Zp works in a much easier way, once we found our sweet number, we just adjust the chemical dose to keep that number in the range we know works best.

How often do you run Zp standards to validate the performance of the Zetasizer Nano Z to ensure it is accurate?

We do a monthly check on the Zp standards and clean the hoses, replace pump on a quarterly basis.

Managing the coagulant dosage is critical to the filtration process. How often is dosage adjusted over normal operating days (no storm, mild seasonality)?

We do not have to adjust our chemical dose very often, normally it is in the late spring and late fall.

Is over-feeding of coagulant a reasonable method of control? Are there negative risks associated to that theory?

In the past over feeding did no good, just wasted product. The cost of over feeding is a big factor in the reason of the Zp.

What are the risks in using Streaming current or Jar Testing (or other means) to monitor the effect of the coagulation addition?

We are unable to do jar testing at this plant. The way it is designed and the addition of ozone at the beginning, addition of lime later in the process makes it difficult to see what is to happen and when.

Can you estimate the reduction in chemical use when optimizing the process with the Zetasizer-WT?

We have dropped our chemical dose during the winter by 1/3.

How has using the Z-WT (On-line Zp) been valuable to you and your plant?

Our chemical dosing has dropped off tremendously since the Zp has been in place. Streamlining chemical doses and cost savings are the biggest value the Zp has done for us. The savings paid for the meter in the first 9 months.

Value is defined in many ways, from time saved, to reduced maintenance or operating costs. Now using the Z-WT, how has your ability to control dosage and manage the pre-treatment process during these events been improved?

There is a 100 percent difference when dealing with 'storm event' issues. We used to fight with trying different doses and now we just adjust the chemical dose until our desired 'Zp' number is correct.

Can you define how ROI was calculated for the justification of the Z-WT purchase?

Big chemical savings and better chemical dosing.

What was the outcome of that calculation? Has it been confirmed with actual plant data over time?

We have convinced corporate that all new facilities need a Zp and it will drop chemical cost and time. We have the data to back this up in chemical cost and SCADA data to back it up.

How would you sum up your experience with Malvern Panalytical and the use of Zeta Potential?

During the rental period, we saved more than $20,000.00 on chemicals. This savings was enough to pay for Zp within the first year of operation. **Last year we reduced the cost of producing water by $4.65 per one million gallons.** When you produce more than 16,900 million gallons annually, that is quite a savings. **Even other water companies like Veolia have asked about our success. It is the best purchase we have made in quite some time!**

Conclusion/Summary

Zeta Potential and the On-line Zetasizer WT supports the challenge of monitoring changes to incoming raw water (storm, seasonal, source) and how to quantitatively determine the chemical dosage needed to ensure a strong floc formation. This optimization process often results is significant chemical cost savings and the ability of the plant to ensure efficiencies are met in near real-time.

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