Post dechlorination via granular activated carbon (GAC)

Comparing Ultra-Low Range CL17sc to Standard CL17sc

The Challenge

One dechlorination process that is used in the beverage industry, and many others, involves the use of granular activated carbon (GAC). Monitoring the health of a GAC system, as well as very low concentrations of residual chlorine, requires a very sensitive, accurate and, ideally, easy-to-use chlorine test. Currently, standard on-line PPM chlorine monitors, commonly used lab or portable grab sample testing methods may struggle to provide meaningful data. Existing technologies are often not satisfactory for efficient dechlorination control due to insufficient accuracy at very low Cl_2 concentrations, potential sample matrix interferences, test complexity or instability.

Background

This site prepares dechlorinated (GAC) water for cleaning of the equipment dedicated for syrup production in a beverage plant. They also prepare water for cleaning of the equipment and target a chlorine residual below 35 ppb to avoid excessive DBP formation. Residual chlorine levels are currently being monitored by a Hach CL17sc. No RO filtration is implemented at this facility.

Challenge

The customer had limited visibility into the performance of their GAC due to the measurement limitations of their current standard on-line chlorine analyzer. This lack of visibility did not allow them to see the true impact of their chlorine levels coming off the GAC after dechlorination. The customer also wanted to keep their disinfection byproducts (DPB) formation under control and therefore imposed a strict limit on the water coming off the GAC that needed close monitoring.

Solution

Accurate testing of the residual chlorine concentrations is essential to monitor the efficiency of the dechlorination process. In response to customer demand, Hach developed and tested the Ultra-Low Range CL17sc (ULR CL17sc) to deliver total chlorine measurements down to 8 parts per billion. The accuracy of the ULR CL17sc unlocks a variety of theoretical benefits to customers dechlorinating their water and monitoring it below 200 ppb.

Results

Direct head-to-head comparisons between the Hach ULR CL17sc and a standard range chlorine analyzer (CL17sc) show:

- ULR CL17sc provided more credible results in this application.
- Higher accuracy at ppb ranges allowed the plant operators to have better visibility into the performance of the GAC.
- Although both analyzers are credible, the ULR CL17sc limit of detection allowed the facility to see movements and efficiency at a level that the standard CL17sc' design would not allow.

Online chlorine measurements were taken after dechlorination via granular activated carbon (GAC), Figure 1.

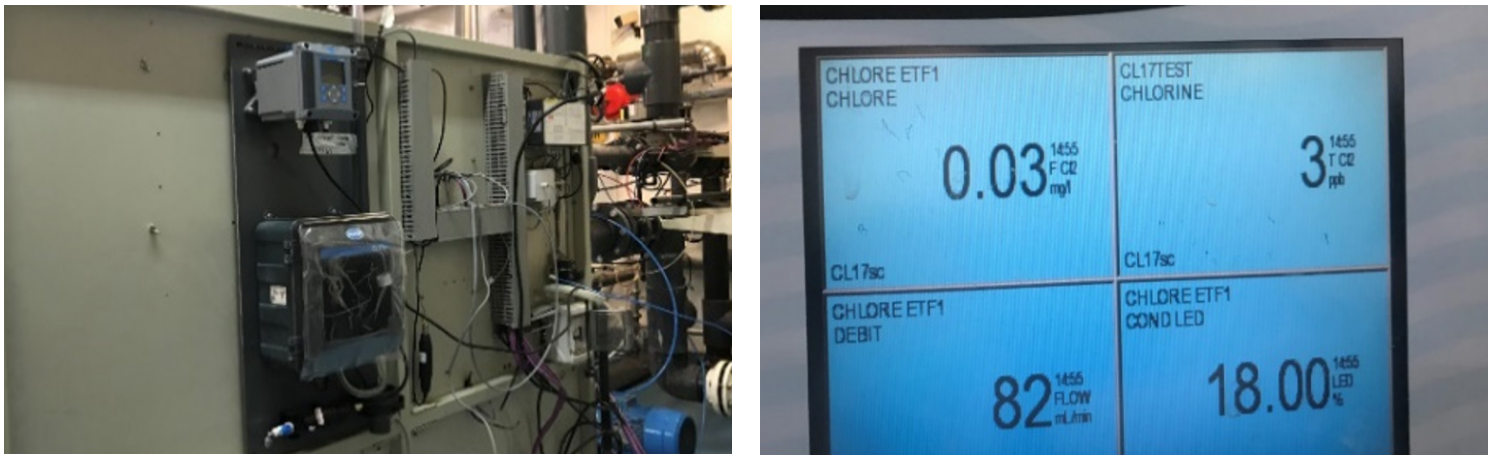

Figure 1. Installation point for Hach ULR CL17sc on a side of the GAC tank (left) and sc1000 controller displaying chlorine concentrations from both CL17 and ULR CL17sc analyzers (right)

Chlorine concentration measurements were taken by both a CL17sc and an ULR CL17sc and compared over a period of roughly two weeks. The graph in Figure 2 provides an overview of the data collected and demonstrates the capabilities of the respective analyzers to measure concentrations of the analyte in the target range (below 35 parts per billion).

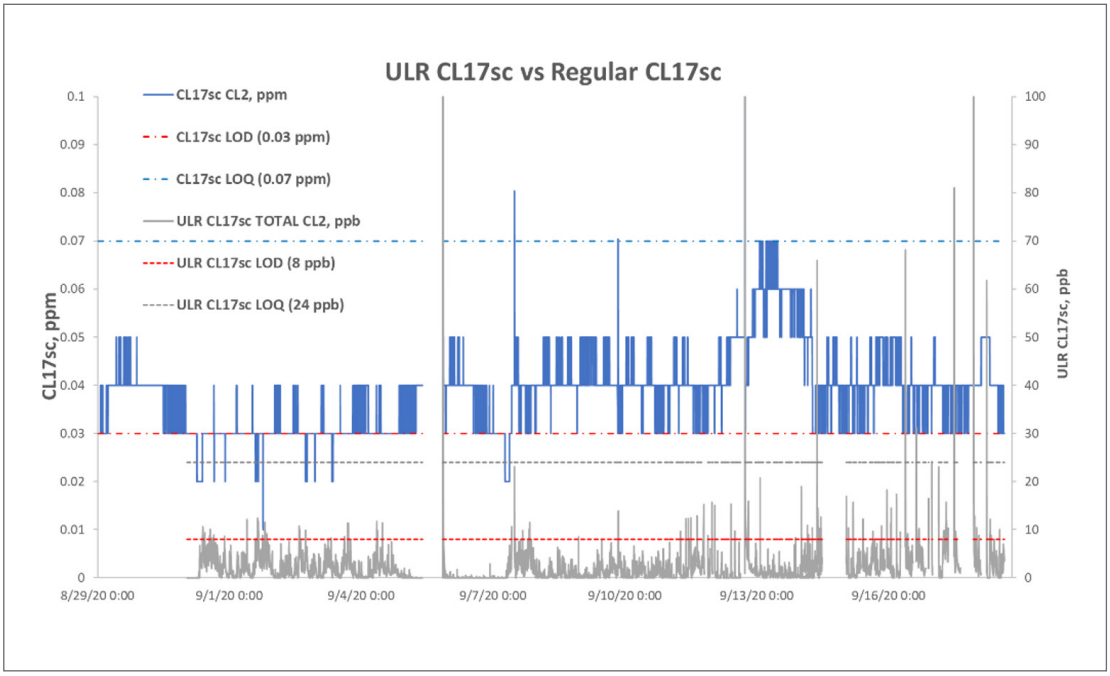

Figure 2. Chlorine readings demonstrating the ULR analyzer's capability of measuring lower concentrations of the analyte. Dotted lines mark the limits of detection (LOD) and quantitation (LOQ) for each analyzer and provide visualization of the results.

The test results summarized in Table 1 demonstrate the ability of each analyzer to measure low chlorine concentrations accurately and display the credibility of each instrument reflecting the readings below and above specified LOD and LOQ, respectively.

Table 1. Summary of the data collected by both CL17sc and ULR CL17sc during the test.

Readings / WWQ Analyzer	Total # of Readings	Min, ppb	Max, ppb	Average, ppb	Readings < LOD (%)	Readings > LOQ (%)	Fully credible data
CL17sc	11517	10	180	38.8	145 (1.26%)	3 (0.03%)	**1.29%**
ULR CL17sc	9216	0	263	2.06	8952 (97.1%)	26 (0.3%)	**97.4%**

The ULR CL17sc has LOD of 8 µg/L (ppb) and accuracy of ±5% or 10 ppb, whichever is greater. The CL17sc has LOD of 30 µg/L (ppb), and accuracy of ±5% or 40 µg/L (ppb), whichever is greater. Depending on your targeted chlorine level, specified LOD or accuracy yields actionable insights and provides confidence that you are below your residual target. Without such confidence tied to the right specifications, you may be breaching your target, putting your system at risk, or incurring additional cost by overfeeding dechlorinating chemicals.

- ULR CL17sc enables measurement of chlorine more accurately at lower range compared to the standard CL17sc. This accuracy allows you to understand the true impact of chlorine exposure.
- The Ultra Low Range CL17sc allows for process control across your water cycle, including visibility into GAC exhaustion or channeling and dechlorinating agent dosage.
- In the RO applications, ULR CL17sc is the only instrument with a cumulative chlorine counter, which helps to forecast your RO membrane efficiency and its useful life.

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