Why the CL17sc and CLT10sc Read Differently and How to Use It to Your Advantage

Introduction

It has been found that two Hach® total chlorine analyzers may provide different results while measuring the same sample. The explanation is most likely in the different analytical methods employed by these instruments – DPD colorimetric and amperometric. Both methods have their specific advantages, and sometimes the knowledge of these differences can be used to your advantage. One technology may provide more accurate results in a specific case than the other and therefore reveal secrets about the application. One such situation was discovered while testing these two instruments side-by-side in a wastewater chlorination/dechlorination application.

CL17sc

The method employed by this analyzer for total chlorine measures all chlorine species present in the sample (i.e. hypochlorous acid, hypochlorite ion, monochloramine, dichloramine, nitrogen trichloride, and organic chloramines). It is well known that the DPD colorimetric method is very accurate in most cases and can be used for calibration of any other instrumentation for chlorine analysis, because it is not influenced by such factors as sample pH, temperature, flow and pressure. On the other hand, there are known positive interferences with this method created by some compounds present in the sample (e.g. iron, manganese, organic chloramines). If these compounds are present in sufficient quantity, the CL17sc could report results that are artificially high.

CL17sc Colorimetric Chlorine Analyzer

In some applications, such as measuring at the end of a chlorine contact chamber in secondary wastewater treatment or after the addition of a dechlorination agent (e.g. SO_2 or sodium bisulfite – SBS), the DPD result can be misleading. The result on the display could be either influenced by or entirely comprised of organic chloramines, which provide no disinfecting power. This may lead to overfeeding of the dechlorination agent, which can cause depleting of dissolved oxygen in the receiving water body, or can potentially violate bacterial levels in the effluent. However, the DPD method is an approved method for reporting chlorine levels in wastewater effluent, so it may be the right instrument for your application as long as there is no violation found.

CLT10sc

The amperometric method employed by this instrument for total chlorine measures only hypochlorous acid (including the internally converted hypochlorite ion) and target chloramines (monochloramine, dichloramine, and nitrogen trichloride). The method is insensitive to other species potentially present in the sample (e.g. organic chloramines, iron, and manganese). The amperometric method is dependent upon sample pH, temperature, flow, and pressure, but these factors are mitigated or compensated for by the CLT10sc design. The amperometric method is also dependent on an accurate reference method for calibration. The sensor's reading can only be as accurate as the reference test used for calibration.

CLT10sc Amperometric Chlorine Analyzer

This total chlorine analyzer was found to be most useful in applications such as drinking or wastewater disinfection where monochloramine is the desired disinfecting agent representing main total chlorine content. Nevertheless, this instrument may also be quite useful in some other applications (e.g. WW chlorination/dechlorination) if there is a concern

with organic chloramines causing positive interference to DPD analysis.

Case Study Highlights

A comparative study of CLT10sc performance in WW dechlorination application was conducted in 2010-11 at Drake Water Reclamation Facility (WRF) in Fort Collins, CO. The study involved a CLT10sc analyzer installed next to two CL17 instruments on the same chlorinated sample at the end of the chlorine contact chamber, approximately 20 feet from entering the dechlorination contact chamber. The facility had the chlorine discharge permit level established at 0.5 ppm total chlorine. Based on historical data from the CL17 analyzers measuring total chlorine residual in this sample (0.35-0.45 ppm), the application was considered to be suitable for a CLT10sc. A CLT10sc was installed indoors, measuring water right before dechlorination.

It was found to be difficult to calibrate the CLT10sc sensor while the CL17 was consistently reading ~0.45 ppm of total chlorine. All necessary maintenance and troubleshooting procedures did not result in any significant improvement and the amperometric

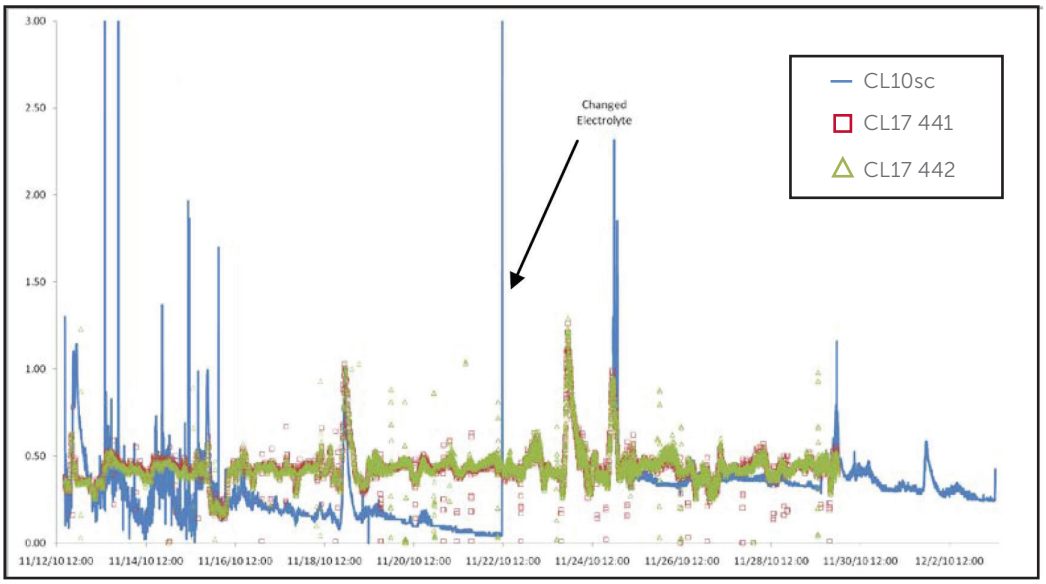

Figure 1 – The CLT10sc readings drift regardless of maintenance (electrolyte replacement)

measurements drifted away of the CL17 readings and became close to zero within a few days (Figure 1).

The observed sensor behavior can be explained by formation of the organic chloramines affecting the content of total chlorine residual. This hypothesis was confirmed by analyses of the sample for monochloramine and free ammonia shown in Table 1.

As seen from Table 1, concentration of monochloramine as a representative of active disinfectants was virtually absent. At the time of analysis (Table 1) the CLT10sc read less than 0.1 ppm total chlorine. Calibration of the sensor to match the CL17 was impossible without changing electrolyte and polishing the cathode tip and did not last long even after that maintenance. However, moving the CLT10sc upstream to the head of the chlorine contact chamber produced significantly more accurate results, proving the presence of

Date	Monochloramine, ppm*	Free Ammonia, ppm**	Total Chlorine, ppm (CL17sc)
4/25/11	0.06	0.04	0.38
4/29/11	0.08	0.04	0.40
5/02/11	0.05	0.03	0.37

Table 1. Results of additional analyses of the WW sample prior to dechlorination
** - Hach Method 10171, LOD = 0.05 ppm (pocket colorimeter)*
*** - Hach Method 10200, LOD = 0.02 ppm (pocket colorimeter), used sample blank instead of reagent blank*

target chloramines in the initial disinfection steps.

Conclusions and Recommendations

- While the CL17sc is the preferred analyzer for most wastewater applications, the CLT10sc has distinct advantages for certain applications such as plants that disinfect with chloramines.
- In particular situations, the CLT10sc may provide benefits of confirming positive interference to DPD total chlorine analysis caused by organic chloramines.
- If it becomes difficult to calibrate CLT10sc against DPD method, conduct analysis of the sample for monochloramine and calibrate the sensor against its results, not the DPD total chlorine test.

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