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Total Organic Carbon Analyzer

Application News

Measurement of TOC in Chloroisocyanuric Acid Used as Disinfectant

Tomomi Higashida

User Benefits

- Samples such as chloroisocyanuric acid, which are difficult to detect using a wet oxidation TOC analyzer, can be measured with high sensitivity using the combustion oxidation TOC-L, which has a strong oxidizing power.
- One sample can be measured quickly, typically within 10-20 minutes.

■ Introduction

In facilities where people have direct contact with water, such as swimming pools, hot springs, and bathhouses, strict water quality management is essential to protect public health and safety. Total organic carbon (TOC) measurement is widely used to detect water quality degradation caused by microbial growth and contamination with foreign substances.

Solid powder chloroisocyanuric acids (including dichloroisocyanuric acid and trichloroisocyanuric acid), which exhibit minimal chlorine deactivation, are commonly used as disinfectants for swimming pool water instead of sodium hypochlorite solutions. However, because chlorinated isocyanuric acid is a recalcitrant substance, it is challenging to detect using wet oxidation TOC analyzers due to its resistance to oxidation and decomposition. In contrast, a combustion oxidation TOC analyzer can measure chloroisocyanuric acids with high sensitivity and recovery rates due to its strong oxidizing power.

In this application, we compared the TOC measurement results for sodium dichloroisocyanurate using a combustion oxidation TOC-L_{CPH} analyzer and a wet oxidation TOC-V_{WP} analyzer.

■ Sample Preparation and Analysis Conditions

Sodium dichloroisocyanurate was dissolved in pure water to prepare aqueous solutions with carbon concentrations of 10 mgC/L and 5 mgC/L.

The TOC measurement employed the non-purgeable organic carbon (NPOC) method. In the NPOC method, the sample is acidified with hydrochloric acid, then sparged to remove inorganic carbon (IC), after which total carbon (TC) is measured as TOC.

■ Analysis of Sodium Dichloroisocyanurate Solution by Combustion Oxidation TOC-L_{CPH}

The equipment was calibrated using a 2-point calibration curve using 0 and 20 mgC/L potassium hydrogen phthalate aqueous solutions. The calibration curve is shown in Fig. 1.

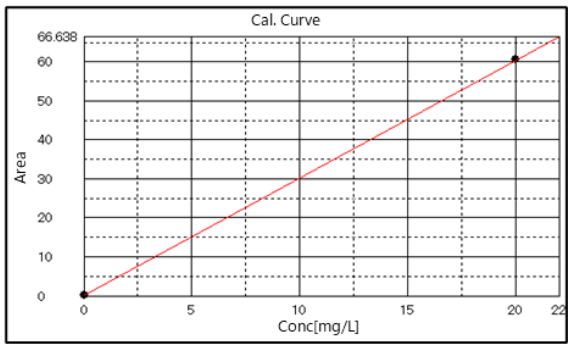
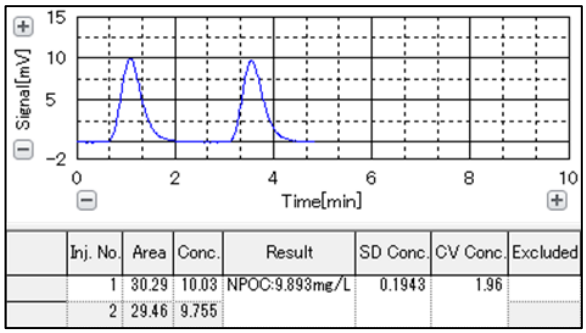


Fig. 1 Calibration Curve Data (Combustion Oxidation)

The prepared sodium dichloroisocyanurate aqueous solution was measured using the combustion oxidation TOC-L_{CPH}. The measurement conditions are detailed in Table 1, and the measurement results are presented in Figs. 2 and 3 and in Table 2. The recoveries for both samples were over 98 %.

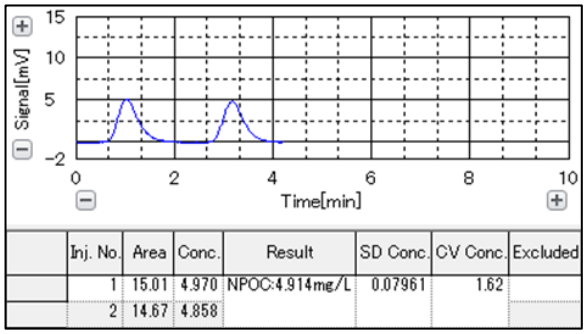
Table 1 Analysis Conditions (Combustion Oxidation)

Instrument:	TOC-L_{CPH}
Oxidation Method:	Combustion Method (680 °C)
Catalyst:	TOC standard catalyst
Measurement Items:	TOC (NPOC method)
Injection Volume:	50 µL
Calibration Curves:	2-point calibration curve using potassium hydrogen phthalate aqueous solutions at 0 and 20 mgC/L



	Inj. No.	Area	Conc.	Result	SD Conc.	CV Conc.	Excluded
	1	30.29	10.03	NPOC:9.893mg/L	0.1943	1.96	
	2	29.46	9.755				

Fig. 2 Measurement Result (10 mgC/L, Combustion Oxidation)



	Inj. No.	Area	Conc.	Result	SD Conc.	CV Conc.	Excluded
	1	15.01	4.970	NPOC:4.914mg/L	0.07961	1.62	
	2	14.67	4.858				

Fig. 3 Measurement Result (5 mgC/L, Combustion Oxidation)

Table 2 Measurement Results (Combustion Oxidation)

Sample	TOC Value (mgC/L)	Recovery (%)
10 mgC/L Sodium dichloroisocyanurate aq.	9.893	98.9
5 mgC/L Sodium dichloroisocyanurate aq.	4.914	98.3

■ Analysis of Sodium Dichloroisocyanurate Solution by Wet Oxidation TOC-V_{WP}

The equipment was calibrated using a 2-point calibration curve using 0 and 10 mgC/L potassium hydrogen phthalate aqueous solutions. The calibration curve is shown in Fig. 4.

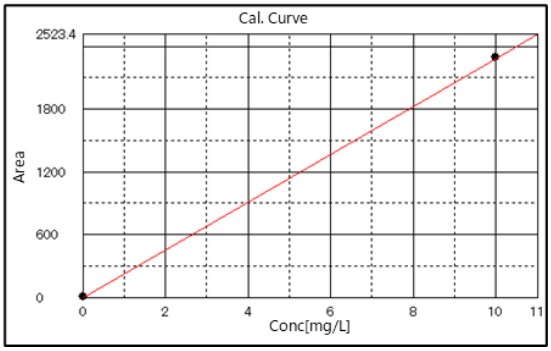
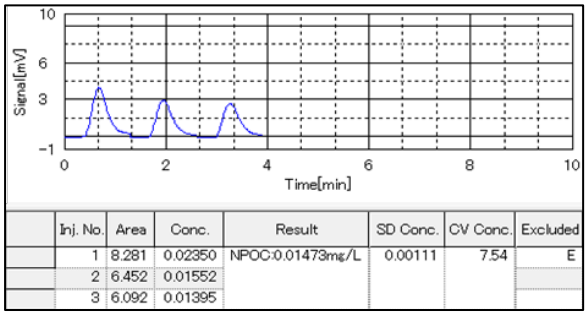


Fig. 4 Calibration Curve Data (Wet Oxidation)

The same samples used for the combustion oxidation analysis were measured with the wet oxidation TOC-V_{WP} analyzer. The measurement conditions are presented in Table 3, and the measurement results are shown in Figs. 5 and 6 and in Table 4. The results indicate that sodium dichloroisocyanurate was almost undetectable using the wet oxidation method. This is because wet oxidation, which utilizes an oxidant, ultraviolet irradiation, and heating, has a lower oxidizing power than combustion oxidation, which uses a high-temperature catalyst.

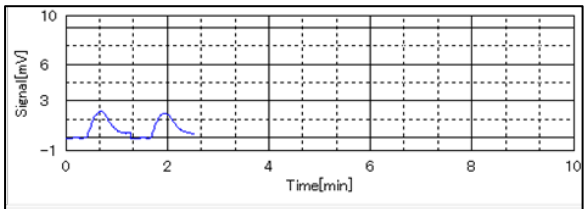
Table 3 Analysis Conditions (Wet Oxidation)

Instrument:	TOC-V_{WP}
Oxidation Method:	Oxidation by oxidizing agents, UV irradiation, and heating
Oxidant:	Sodium peroxodisulfate
Measurement Items:	TOC (NPOC method)
Injection Volume:	2500 µL
Calibration Curves:	2-point calibration curve using potassium hydrogen phthalate aqueous solutions at 0 and 10 mgC/L



	Inj. No.	Area	Conc.	Result	SD Conc.	CV Conc.	Excluded
	1	8.281	0.02350	NPOC:0.01473mg/L	0.00111	7.54	E
	2	6.452	0.01552				
	3	6.092	0.01395				

Fig. 5 Measurement Result (10 mgC/L, Wet Oxidation)



	Inj. No.	Area	Conc.	Result	SD Conc.	CV Conc.	Excluded
	1	4.729	0.00800	NPOC:0.00774mg/L	0.00036	4.62	
	2	4.613	0.00749				

Fig. 6 Measurement Result (5 mgC/L, Wet Oxidation)

Table 4 Measurement Results (Wet Oxidation)

Sample	TOC Value (mgC/L)	Recovery (%)
10 mgC/L Sodium dichloroisocyanurate aq.	0.01473	0.15
5 mgC/L Sodium dichloroisocyanurate aq.	0.00774	0.15

■ Conclusion

Table 5 summarizes the results of TOC measurements of sodium dichloroisocyanurate aqueous solutions using both combustion oxidation and wet oxidation TOC analyzers.

Table 5 Summarized Results

Sample	TOC Value (mgC/L)	
	Combustion Oxidation	Wet Oxidation
10 mgC/L Sodium dichloroisocyanurate aq.	9.893	0.01473
5 mgC/L Sodium dichloroisocyanurate aq.	4.914	0.00774

The combustion oxidation TOC analyzer demonstrated high accuracy in measuring the samples. Due to its strong oxidizing power, the combustion oxidation TOC analyzer is particularly suitable for measuring TOC in samples containing recalcitrant substances such as sodium dichloroisocyanurate.

Fig. 7 TOC-L_{CPH}

Fig. 8 TOC-W_{WP}

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