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Application News

No.048

Total Organic Carbon Analysis

Measurement of TOC in High-Salt Sample with High-Salt Sample Combustion Tube Kit

The quantity of organic matter in seawater is important in the research and monitoring of marine pollution as an indicator of organic pollution. The salt content in sea water is typically about 3.5 %, but using the Shimadzu total organic carbon analyzer, it is possible to measure the TOC directly without dilution or other pretreatment procedures. Further, it is possible to reduce running costs by using the high-salt sample combustion tube kit, which can prolong the life of the catalyst and combustion tube, as well as reduce the frequency of maintenance.
Here, we introduce an example of measurement of organic carbon in aqueous solutions of sodium chloride using the TOC-Lcsh total organic carbon analyzer with the high-salt sample combustion tube kit installed.

High-Salt Sample Combustion Tube Kit

Fig. 1 shows a high-salt sample combustion tube. Compared to the standard combustion tube, it has a larger diameter, and also, because a portion of the catalyst used consists of particles of greater diameter, it serves to alleviate the clogging of salts. Also, sulfuric acid is used for acidification when conducting NPOC measurement, so sulfate salt is accumulated in the combustion tube, which reduces the frequency of combustion tube replacement. Thus, in the case of seawater samples, up to 2500 measurements can be conducted without the need for maintenance (using 40 µL injection volume).

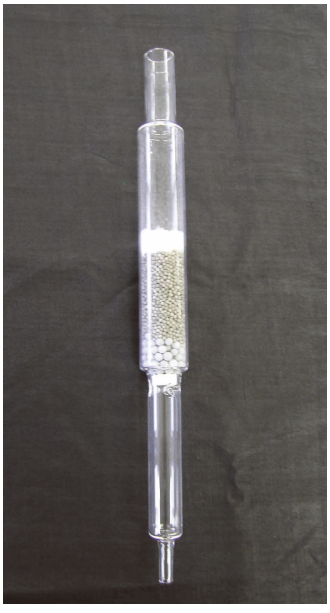


Fig. 1 High-Salt Sample Combustion Tube

Measurement of TOC in High-Salt Sample

We installed the high-salt sample combustion tube kit in the TOC analyzer, and then conducted measurement of sodium chloride aqueous solutions. The salt solution was prepared by dissolving sodium chloride reagent in pure water to obtain a solution concentration of 3.5 %. This solution was then spiked with potassium hydrogen phthalate solution as an organic substance to obtain sample solutions spiked with TOC concentrations of 2.0 – 0.2 mgC/L, and we then conducted TOC measurements. The results are shown in Fig. 3 and Table 1.
The instrument was calibrated using potassium hydrogen phthalate solutions at 0 and 3 mgC/L (mg/L carbon concentration), and a calibration curve was generated (Fig. 2). To eliminate the effect of the carbon portion associated with the pure water used for preparation of the standard solutions, a correction was applied to the calibration curve using the shift-to-origin feature.
Since the TOC concentration of the sodium chloride solution is approximately 0.08 mgC/L, the TOC concentration of each of the solutions became about 0.1 mgC/L higher than the spiked concentration. The measured TOC concentration of the salt solution spiked with 0.2 mgC/L was about 0.3 mgC/L, indicating that accurate quantitation was achieved.

<Measurement Conditions>

Analyzer	: Shimadzu TOC-Lcsh Total Organic Carbon Analyzer + high-salt sample combustion tube kit + B type halogen scrubber
Catalyst	: High-salt sample catalyst
Injection volume	: 150 µL
Measurement item	: TOC (=NPOC: TOC by acidification and sparging)
Calibration curve	: 2-point calibration curve using potassium hydrogen phthalate solutions at 0 – 3.0 mgC/L
Reagent	: Sodium chloride (potassium hydrogen phthalate for water quality testing, Wako Pure Chemical Industries)
TOC Spike substance	: Potassium hydrogen phthalate (potassium hydrogen phthalate, high grade, Wako Pure Chemical Industries)

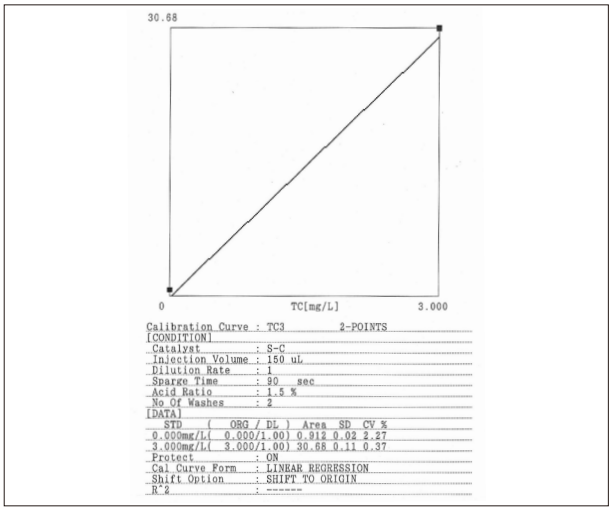
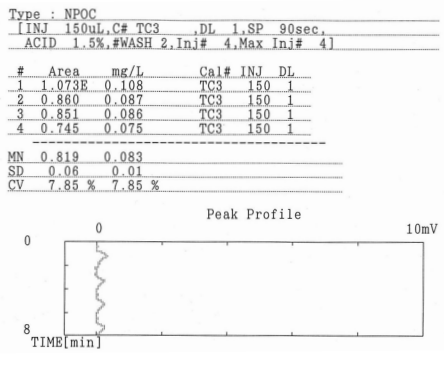


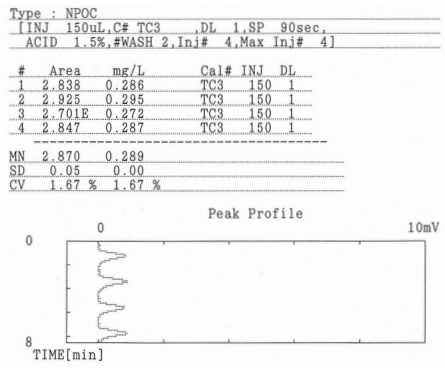
Fig. 2 Calibration Curve

Table 1 TOC Measurement Data of Sodium Chloride Solution

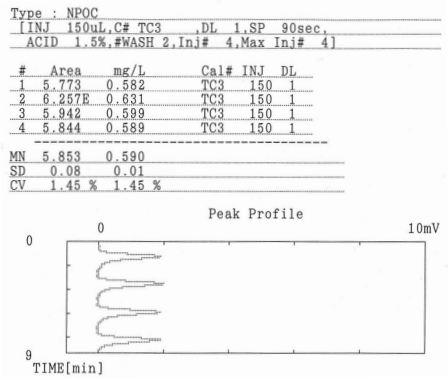
Sample Name	TOC Concentration (mgC/L)
3.5 % sodium chloride solution	0.083
3.5 % sodium chloride solution + TOC 0.2 mgC/L	0.289
3.5 % sodium chloride solution + TOC 0.5 mgC/L	0.590
3.5 % sodium chloride solution + TOC 1.0 mgC/L	1.083
3.5 % sodium chloride solution + TOC 2.0 mgC/L	2.087



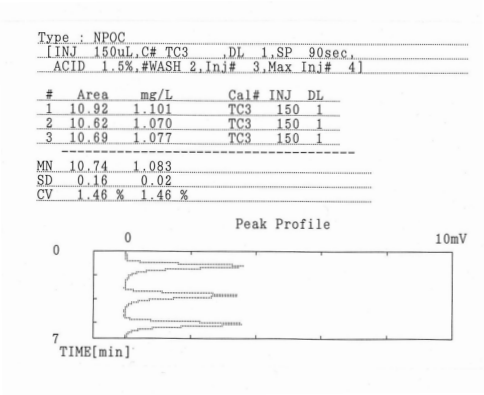
3.5 % sodium chloride solution



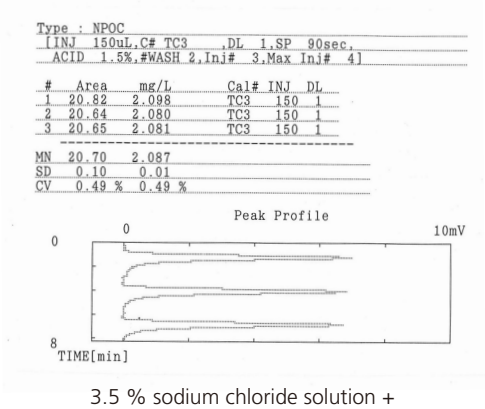
3.5 % sodium chloride solution + TOC 0.2 mgC/L



3.5 % sodium chloride solution + TOC 0.5 mgC/L



3.5 % sodium chloride solution + TOC 1.0 mgC/L



3.5 % sodium chloride solution + TOC 2.0 mgC/L

Fig. 3 TOC Measurement Data Using Sodium Chloride Solutions

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