

Application News

No.056

Total Organic Carbon Analysis

Measurement of a Cement Admixture by a TOC Solid Sample Measurement System

Cement is used for concrete and other construction materials, which have been used for a variety of applications since ancient times. Many varieties are used, with different qualities and properties, depending on their function.

To modify and improve the performance of concrete, water reducing agents, water proofing agents and other admixtures are added to cement. Accordingly, to confirm the strength and properties of existing building structures, it is important to assess the amount of cement admixtures included in the concrete.

As an analysis method for organic admixtures, concrete is pulverized and extracted by boiling, and the filtrate is measured for COD and TOC. However, depending on the type of admixture, the extraction efficiency may be biased, and the concentration may be low, resulting in poor measurement accuracy.

Using the Shimadzu TOC solid sample measurement system, the pulverized concrete can be directly loaded into the instrument to measure the amount of organic carbon. As a result, measurement process and time are reduced, and the impact of variance in the measurement values due to extraction can be reduced. This document introduces an example of the measurement of a cement admixture in pulverized concrete using the TOC solid sample combustion system, which combines the TOC-L total organic carbon analyzer with the SSM-5000A solid sample combustion unit.

■ Analysis Method

The coarsely pulverized concrete sample was finely pulverized using a vibrating mill to create a powder. This was weighed into a special ceramic sample boat, and then analyzed using the TOC solid sample measurement system (Fig. 1).

To measure the TC, a sample boat containing approximately 100 mg of the sample was loaded into the TC combustion furnace, where it was oxidized by combustion. To measure the IC, phosphoric acid was added to a sample boat containing approximately 70 mg of the sample. The sample boat was then loaded into the IC furnace, where it was measured. The TOC value was then found by subtracting the IC value from the TC value obtained.

The following method was used to calibrate the analyzer. The calibration curve for the TC measurement was created by weighing glucose powdered reagent (carbon concentration = 40 %C) into a sample boat, and then measuring the TC.

The calibration curve for the IC measurement was created by weighing sodium carbonate (carbon concentration = 11.3 %C) into a sample boat, adding phosphoric acid, and then measuring the IC.

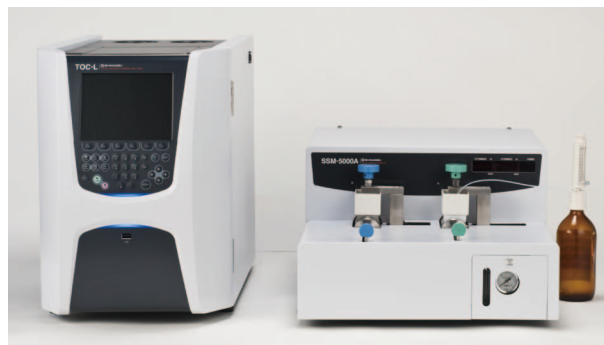


Fig. 1 TOC Solid Sample Measurement System

Measurement Conditions

Analyzer	: TOC Solid Sample Measurement System (TOC-L _{CPH} Total Organic Carbon Analyzer + SSM-5000A Solid Sample Combustion Unit)
Measurement item	: TOC (=TC-IC)
TC oxidation method	: Combustion catalyst oxidation (TC furnace at 980 °C)
IC reaction method	: Extraction of carbon dioxide via acidification with phosphoric acid (IC furnace at 200 °C)
Calibration curve	: TC: 1-point calibration curve from glucose powdered reagent IC : 1-point calibration curve from sodium carbonate powdered reagent
Sample	: Coarsely pulverized concrete A, B

Analysis Results

Samples A and B of coarsely pulverized concrete were measured with the TOC solid sample system. The results are shown in Table 1, and the measurement charts are shown in Fig. 2. Samples A and B were treated under different conditions, so it is evident that the TOC values depend on the treatment conditions.

Table 1 TOC Measurement Results

Sample Name	TC Value (%C)	IC Value (%C)	TOC Value (%C)
Sample A	0.861	0.636	0.225
Sample B	0.859	0.756	0.103

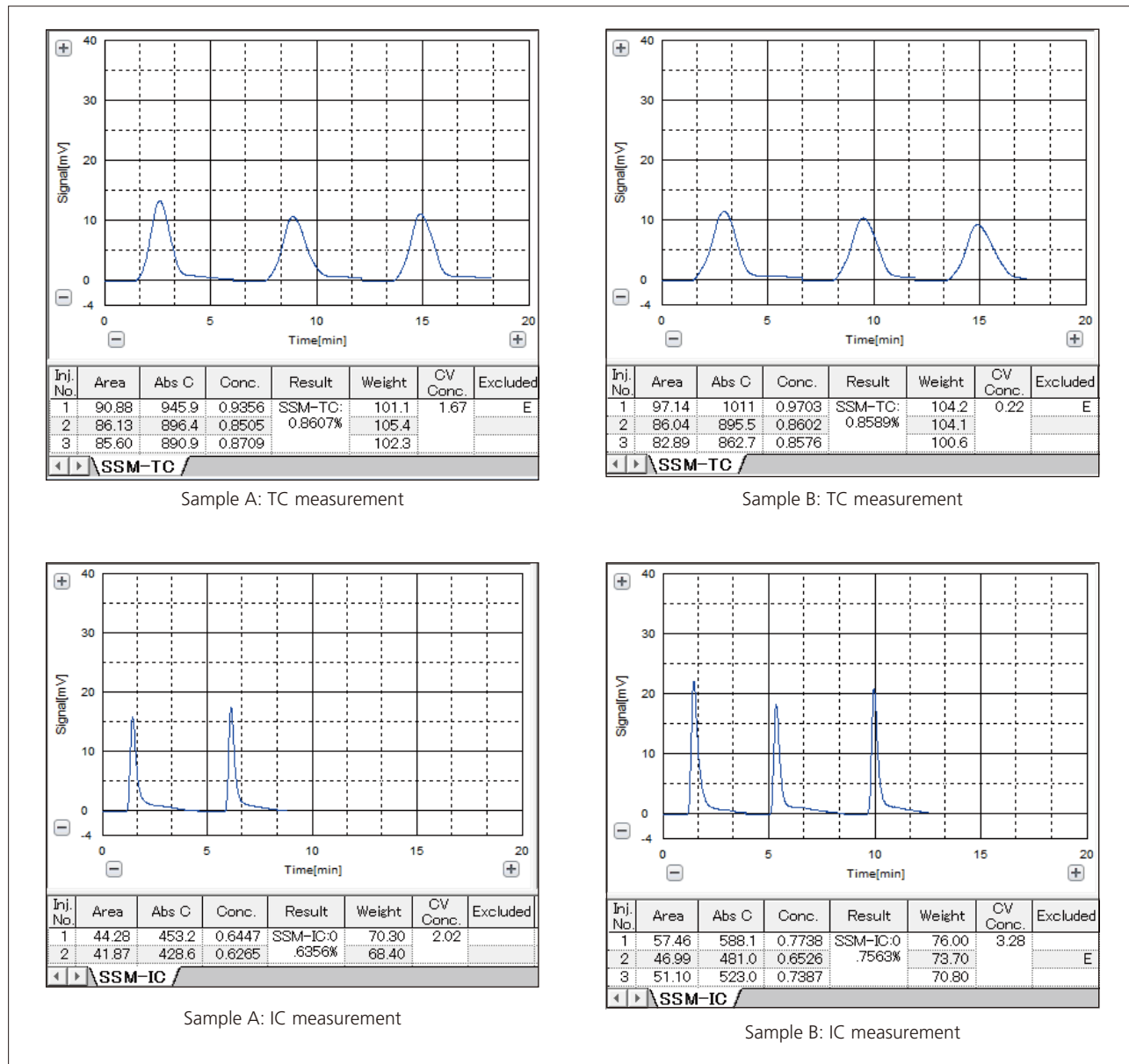


Fig. 2 TOC Measurement Data