

Application News

Total Organic Carbon Analysis

No.O35

Swab / Direct Combustion Analysis of Detergent Residue Using SSM-5000A

Cleaning validation with respect to production equipment at pharmaceutical facilities refers to the scientific verification that residues of previously processed products and detergent used for equipment cleaning, as well as foreign material from the environment in the production equipment, do not exceed specified permissible limits. HPLC (high performance liquid chromatography) is often used to conduct this evaluation; however, detection with HPLC is often difficult due to the large number of constituents in detergents, and further, measurement is not easy when preparation, such as sample enrichment, is required. On the other hand, if a TOC (Total Organic Carbon) analyzer is used, the residual amount of detergent constituents is easily detected because all of the carbon-containing substances are detected.

The rinse method and swab method are two major sampling methods used in cleaning validation; however, the United States FDA and Japanese Ministry of Health, Labour and Welfare evaluate highly and recommend the swab method. In the swab method, a fixed area of the equipment surface is wiped with the swab material, and

the residues adhering to the material are physically collected and analyzed. This allows sampling by just wiping up adhering substances, which are often difficult to sample by the rinse method if any of the adhering substances are insoluble.

Using the "swab / direct combustion carbon analysis method" in conjunction with the combination of Shimadzu's TOC analyzer with the SSM-5000A Solid Sample Combustion Unit allows direct measurement of the carbon in the SSM-5000A. This is contingent on the use of a swab that consists only of inorganic material. Thus, quick, accurate measurement can be conducted even in the case of insoluble residues that are difficult to extract with water, without the need for bothersome pretreatment procedures to extract residues from the swab. (See steps in Fig. 1.)

This Application News introduces an example of measurement of detergent using the Total Organic Carbon Analyzer TOC-Vcsh with the Solid Sample Combustion Unit SSM-5000A.

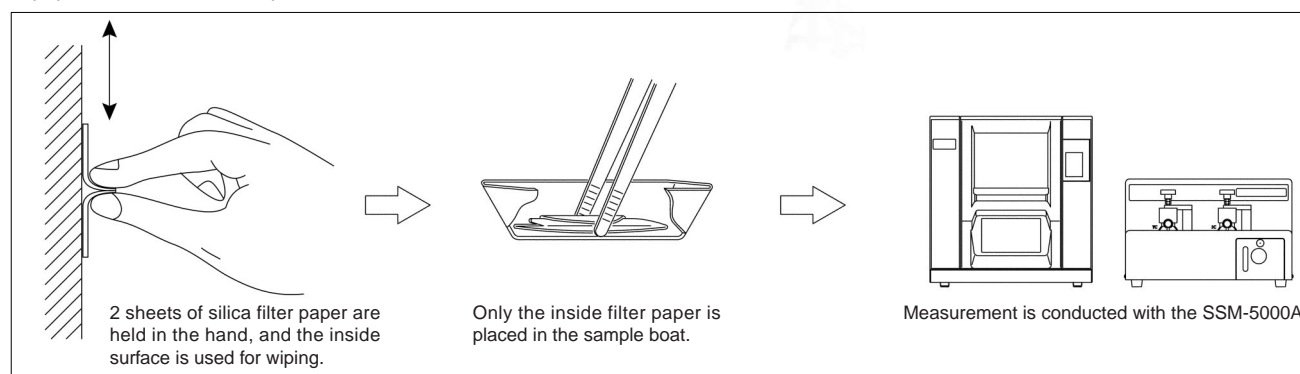


Fig.1 Residue Evaluation Procedure Using Swab / Direct Combustion Method

■ Measurement of Detergent Using SSM-5000A

First, commercial laboratory grade detergent and a solution of sodium dodecylbenzene sulfonate were analyzed for carbon content using the Solid Sample Combustion Unit SSM-5000A. Sodium dodecylbenzene sulfonate is a surfactant, and is specified in the Japanese pharmacopeia organic carbon test method as the test substance for determining the detection rate of organic carbon.

A 1% detergent solution was prepared by adding distilled water to 1 mL of laboratory grade detergent to bring the final volume to 100 mL. A 1000 mgC/L sodium dodecylbenzene sulfonate solution (equivalent to 1000 mg/L carbon concentration) was prepared by dissolving 161.2 mg of the reagent in 100 mL distilled water. These solutions (100 μ L each) were transferred to sample boats and then covered with heat-treated quartz silica fiber filter paper to be impregnated with the solutions. The organic carbon concentrations were then measured using the SSM-5000A. The results are shown in Fig. 2 and Table 1.

The instrument was calibrated by generating a calibration curve using 30 μ L of 1% C glucose solution.

Because both solutions were measured with good repeatability, it was confirmed that the SSM-5000A can be used to accurately measure carbon content in detergent solutions.

Measurement Conditions

Instrument	: Shimadzu Organic Carbon Analyzer TOC-Vcsh + Solid Sample Combustion Unit SSM-5000A
Measurement item	: TC
Calibration curve	: Generated using 30 μ L of 1% C glucose solution
Samples	: 1) 1% laboratory grade detergent solution prepared by diluting 1 mL laboratory grade detergent with distilled water to a volume of 100 mL 2) 1000 mgC/L sodium dodecylbenzene sulfonate solution prepared by dissolving 161.2 mg of reagent (Wako Pure Chemical Industries) in 100 mL distilled water.

Table 1 Detergent Measurement Data Acquired Using SSM-5000A

Sample Name	TC Measurement Value [mgC/L]
(1) 1% laboratory grade detergent solution	1127
(2) 1000 mgC/L sodium dodecylbenzene sulfonate solution	982.9

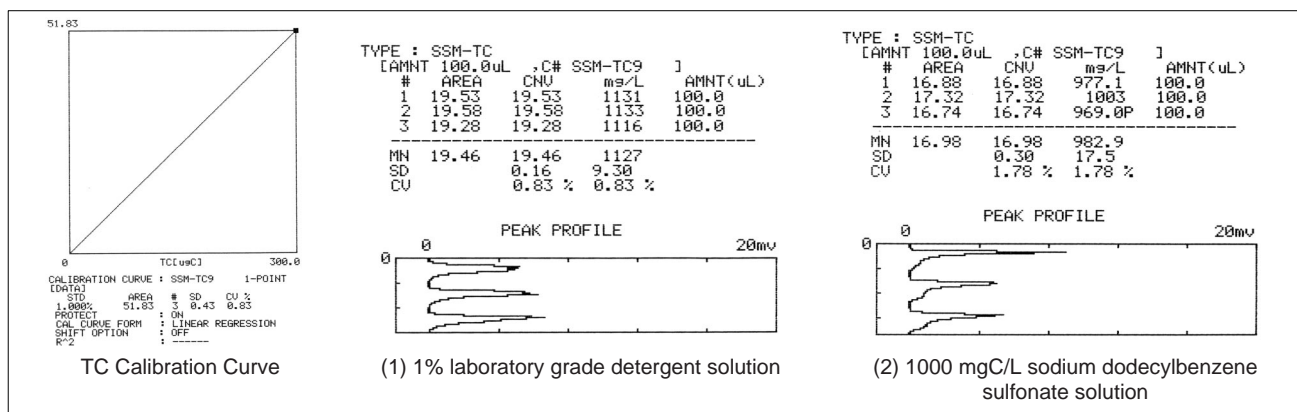


Fig.2 Detergent Measurement Data Acquired Using SSM-5000A

Recovery of Detergent by Swab / Direct Combustion Method Using SSM-5000A

Next, 100 μL each of these detergent solutions were spread on a glass plate, and were wiped dry with sheets of quartz silica fiber filter paper. These were placed in sample boats and their carbon concentrations were measured using the Solid Sample Combustion Unit SSM-5000A to test the rate of recovery. For blank measurement using the swabbing operation, distilled water was similarly spread on a glass plate and wiped dry for measurement and used as the blank.

The results are shown in Fig. 3 and Table 2. Both solutions showed recovery greater than 95%, confirming that detergent solution can be accurately measured using the swab / direct combustion measurement method.

Measurement Conditions

Instrument	: Shimadzu Organic Carbon Analyzer TOC-VCSH + Solid Sample Combustion Unit SSM-5000A
Measurement item	: TC
Swab material	: Advantec QR-100 quartz silica fiber filter paper (size 45 mm) heat-treated at 600°C for 15 min
Measurement method	: 100 μL sample solution was spread out on a 5 cm × 5 cm glass plate, then wiped dry with swab material moistened with 400 μL distilled water. The entire piece of swab material was then subjected to combustion measurement.

Table 2 Recovery of Detergent by Swab / Direct Combustion Method Using SSM-5000A

Sample Name	TC Measurement Value [mgC/L]	Theoretical Value [mgC/L]	Recovery (TC Measurement Value/Theoretical Value)
Blank (distilled water)	0	0	
(1) 1% laboratory grade detergent solution	113.1	112.7	100.4%
(2) 1000 mgC/L sodium dodecylbenzene sulfonate solution	97.3	98.3	98.9%

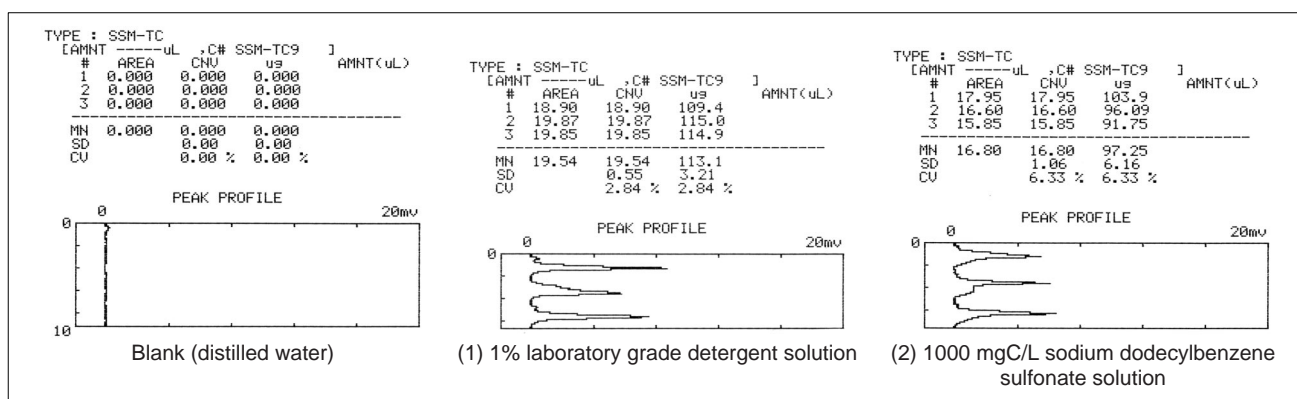


Fig.3 Recovery of Detergent Measured by Swab / Direct Combustion Method Using SSM-5000A

NOTES:

*This Application News has been produced and edited using information that was available when the data was acquired for each article. This Application News is subject to revision without prior notice.



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