

CERTIFICATE FOR

QC DW4

TOTAL ORGANIC CARBON FOR WATER ANALYSIS

BATCH: VKI-29-1-0602

INSTRUCTIONS FOR USE OF THE REFERENCE MATERIAL

Description

This reference material consists of an ampoule with a natural reference sample for quality control. The certificate includes documentation for the analytical parameter Total Organic Carbon (TOC), or Non-Volatile Organic Carbon (NVOC).

Quantity and Preservation

QC DW4 contains ampoules with approximately 14 mL sample, ready for use. The sample has been preserved by autoclaving, but no acid has been added.

Use

The reference material is intended for quality control, i.e. measurement and control of the accuracy and precision of analyses. It is typically intended for analyses of TOC/NVOC in drinking water and groundwater. It may also be used in the quality control of other types of water samples and for the implementation and optimisation of analytical instruments and analytical methods. It is important that the batch numbers of the reference material and on the certificate are identical.

Preparation for Use

Stabilise the ampoule at room temperature (approx. 20°C). Break the ampoule neck open at the mark, withdraw the sample with a pipette. Treat the reference material in the same way as an ordinary sample. If, e.g., acid preservation is normally used, it should be applied to the reference material as well. The certified concentration is given in the table on page 3 of this certificate.

Analysis

For quality control the reference material is analysed at the same time and in the same manner as other samples.

Storage and Durability

Store the ampoules protected from sunlight, e.g. in the ampoule boxes, and at room temperature or in a refrigerator. The certificate is valid until **1st of April 2020** provided the material is stored under the recommended conditions.

After breaking the ampoule, the reference material should be preserved or used on the same day.

PRODUCTION OF THE REFERENCE MATERIAL AND DOCUMENTATION

Production

The production of this reference material is in accordance with the quality management procedures of Eurofins, with the aim to obtain the intended quality of the material.

Documentation of Content

Internal control

The analytical quality of Eurofins has been documented and found satisfactory by regular participation in international proficiency tests.

Homogeneity:

The homogeneity has been investigated by measurements of TOC/NVOC in randomly selected ampoules of QC DW4. Tests for homogeneity have been performed by comparing the standard deviation between the reference material units with the within batch standard deviation obtained from duplicate measurements of the reference material in the same ampoule (F-test, 95%). In addition, homogeneity testings were included in the external control. No indication of inhomogeneity was found.

Stability:

The stability of the reference material is being followed at 5°C, 20°C and 37°C, and no indication of instability was observed at the date of this certificate.

External control

The external laboratory documentation was performed by selected Nordic laboratories. The laboratories were requested to analyse 4 ampoules: two ampoules in the same analytical series, one as a duplicate determination and the other as a single determination, and two ampoules in two different analytical series as single determinations. In addition, the laboratories were requested to analyse a control sample sent together with the reference material. The statistics are in accordance with the international standard: ISO Guide 35 /1/. On the basis of the analytical results submitted by the laboratories the following statistical parameters have been calculated:

\bar{Y} : average, calculated in accordance with ISO Guide 35 (section 10.5.2)

s_L : standard deviation between the laboratories, calculated in accordance with ISO Guide 35 (section 10.5.2):

$$\frac{1}{p-1} \sqrt{\sum (Y_i - \bar{Y})^2}$$

The 95% confidence interval of the true mean value of analytical results is:

$$\bar{Y} \pm t_{0,025}(v) \cdot \frac{s_L}{\sqrt{p}}$$

where

p: number of laboratories included in calculations

v: p-1, degrees of freedom

$t_{0,025}(v)$: t value of 0,025 level at v degrees of freedom.

The criteria for selection of laboratories from Denmark, Finland, Norway and Sweden were that the laboratories perform the analyses on a routine basis. Furthermore, the laboratories were selected on the basis of their results in proficiency tests.

The criteria for selection of laboratories were as follows:

- the laboratory results in the proficiency tests diverged less than 2 standard deviations from the nominal value, and
- the laboratory analyses more than 40 samples each year.

For Finnish laboratories the Finnish Reference Laboratory has identified the laboratory as qualified.

In addition, the criteria are:

- the laboratory result for the control sample in the certification deviated less than 15% from the nominal value, and
- the laboratory results in the certification are not Cochran outliers or Grubbs outliers.

The data included in the external control and names of the participating laboratories are listed in an annex to this certificate. On the basis of the selected results, the following has been calculated:

Certified Values

DETERMINAND	UNIT	AVERAGE	BETWEEN LABORATORY STANDARD DEVIATION	95% CONFIDENCE LIMITS OF THE AVERAGE VALUE		NUMBER OF DATA SETS IN CALCULATIONS/METHOD	EXCLUDED DATA SETS C: Cochran outlier G: Grubbs outlier
				Lower	Upper		
		\bar{Y}	s_L	$\bar{Y} \pm t_{0,025}(v) \cdot \frac{s_L}{\sqrt{p}}$		(p)	
Total Organic Carbon (TOC)	mg/L C	2.57	0.18	2.43	2.71	3/1 6/2	-

Methods

1. The acidified sample is stripped of CO₂. Organic compounds are oxidised to CO₂ with K₂S₂O₈ under UV radiation (SM 5310 A+C, EN 1484:1997)
2. The acidified sample is stripped of CO₂. Organic compounds are oxidised to CO₂ catalytically at ≥680°C (SM 5310 A+B, EN 1484:1997)

Use of the Certified Values

For laboratories with an analytical quality that is comparable with that of the laboratories who have contributed with the external control data of this certificate, the following applies:

- 1) For single determinations, analytical results will with a probability of 95% be in the interval:

$$\bar{Y} \pm t_{0,025}(v) \cdot s_L$$

- 2) Analytical results, calculated as the average of two determinations will with a probability of 95% be in the interval:

$$\bar{Y} \pm t_{0,025}(v) \cdot \frac{s_L}{\sqrt{2}}$$

REFERENCES

- /1/ ISO Guide 35:2006. Certification of reference materials - General and statistical principles for certification.
- /2/ ISO Guide 31:2015. Reference materials - Contents of certificates, labels and accompanying documentation.

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Certificate revision history: April 2017 (expiry date extended); January 2014 (expiry date added); October 2002 (original certificate date)

ANNEX TO CERTIFICATE QC DW4

Laboratory Measurements

Total Organic Carbon (TOC, NVOC)					
m_i mg/L	s_{ri} mg/L	n_{ri}	s_{Li} mg/L	n_{Li}	Method
2.45	0.02	3	0.04	3	2
2.29	0.01	3	0.00	2	1
2.84	0.26	3	0.26	3	2
2.44	0.11	3	0.14	3	1
2.76	0.01	2	0.12	3	1
2.49	0.08	3	0.09	3	2
2.48	0.25	3	0.11	3	2
2.64	0.02	3	0.07	3	2
2.76	0.03	3	0.01	3	2

External Control Values

m_i : average for laboratory i
 s_{ri} : standard deviation for laboratory i within an analytical series
 n_{ri} : number of results for determination of s_{ri}
 s_{Li} : standard deviation for laboratory i between analytical series
 n_{Li} : number of results for determination of s_{Li}

Methods: See explanation on page 3.

ANNEX TO CERTIFICATE QC DW4

Certifying Laboratories

Denmark

Eurofins, Horsens

Miljølaboratoriet, Storkøbenhavn

R. Dons, Nærum

Steins Laboratorium A/S, Brørup

Finland

Keski-Suomen ympäristökeskus ympäristölaboratorio, Jyväskylä

Lahden tutkimuslaboratorio, Lahti

Norway

NIVA, Oslo

Sweden

Svenska Lantbruksuniversitetet, Uppsala

VA-verket Malmö, Malmö