DATA BULLETIN

elementar
EXCELLENCE IN ELEMENTS

Analysis of a 300 ppb TOC standard with the enviro TOC

According to some TOC standards (e.g., the Korean TOC standard: ES 04311.1c), a TOC analyzer used to measure wastewater or surface water must be capable of stably detecting a TOC concentration of 300 ppb in a liquid sample across different vials and sample positions. To show the suitability of the enviro TOC for this application, 7 replicates of a 300 ppb TOC standard (represented by potassium hydrogen phthalate) are analyzed with different methods that are relevant for TOC analysis in wastewater or surface water like NPOC, NPOC particle, TC, and TC particle.

INSTRUMENT:
enviro TOC

DETAILS:
method: TC / NPOC
sample: 300 ppb TOC standard (KHP)

The difference between NPOC and TC methods is that for NPOC analysis the samples are acidified automatically with 10 % HCl to a pH < 2 and then purged which removes TIC as well as dissolved CO_2 from the sample. Therefore, the results of this method are representing the organic carbon compounds only. However, TC analysis considers all carbon compounds in a sample as the sample is combusted without any pre-treatment. However, for this experiment, TIC has not been added to the sample. Consequently, NPOC and TC analysis are expected to give the same result.

The difference of the particle methods compared to the standard methods is that the injection volume of the particle methods is pre-defined and needs to be between 0.1 and 0.25 ml. In addition, with the particle methods the sample in the vial is stirred by default. These two measures avoid sedimentation of the sample before injection. In contrast, for the standard NPOC and TC method the injection volume is flexible up to 2 ml and in this experiment a typical injection volume of 1 ml has been used.

The requirements of the standards are fulfilled if the relative standard deviation of the seven replicates is < 20 % and the standard deviation (SD) multiplied with 10 is < 0.3. The results for the standard methods have been calibrated with a 1 ppm standard and different injection volumes. The results for the Particle methods have been calibrated with a 0.3 ppm standard and different injection volumes.

The results of the 0.3 ppm experiment with the enviro TOC are summarized in the following table:

Table: Statistics of the 300 ppb standard experiment

METHOD	n	AVERAGE [ppm]	TARGET [ppm]	SD x 10	TARGET [SD x 10]	RSD [%]	TARGET [RSD %]
NPOC	7	0.31	0.3	0.14	0.3	4.7	20
NPOC PARTICLE	7	0.29	0.3	0.17	0.3	5.8	20
TC	7	0.29	0.3	0.14	0.3	4.9	20
TC Particle	7	0.28	0.3	0.16	0.3	5.5	20

The 300 ppb TOC standard is also represented by a sharp and clear peak with the particle method (see figure below), supporting the suitability of the enviro TOC to detect such and even lower concentrations in samples containing particles.

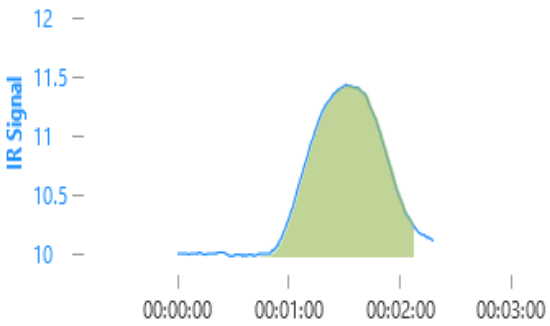

Figure: Typical 300 ppb TOC peak with the NPOC particle method

Summary

With this experiment, it is demonstrated that the enviro TOC fulfills the stated standard requirements for the lower range of wastewater samples as the results are significantly (~factor 2 for the 10 x SD and ~factor 4 for the RSD) below the defined thresholds. Furthermore, the results for the lower injections volumes of the particle methods are also reliable and in the same range compared to the standard methods indicating that instrument conditions like flow or the IR detector signal are very stable. As expected, the TC and NPOC methods are showing also very similar results as sample pre-treatments are negligible in this experiment. Consequently, all tested methods can be used to verify the suitability of the enviro TOC for measuring a 300 ppb TOC standard.

Elementar – your partner for excellent elemental analysis
Elementar is the world leader in high performance analysis of organic and inorganic elements. Continuous innovation, creative solutions and comprehensive support form the foundation of the Elementar brand, ensuring our products continue to advance science across agriculture, chemical, environmental, energy, materials and forensics markets in more than 80 countries.

Elementar Analysensysteme GmbH
Elementar-Straße 1 · 63505 Langenselbold (Germany)
Phone: +49 (0) 6184 9393-0 | info@elementar.com | www.elementar.com

03 / 2022 A