

	LAKEFIELD – INDUSTRIES & ENVIRONMENT	Doc. No.	ME-CA-[ENV]SFA-LAK-AN-009
	DETERMINATION OF TOTAL & DISSOLVED CARBON, ORGANIC CARBON & INORGANIC CARBON IN AQUEOUS SAMPLES BY SKALAR SEGMENTED FLOW AUTOANALYZER	Rev. No	2.4
		Date	28 Mar. 2023
		Page No.	1 of 3
		Authorization	R. Irwin

1. SCOPE

This method is used to determine total and dissolved organic carbon (TOC and DOC), total and dissolved inorganic carbon (TIC and DIC), and total and dissolved carbon (TC and DC) in aqueous samples by Skalar segmented flow autoanalyzer. It is appropriate for natural and treated water sources including drinking water. This method is also used to determine soluble organic carbon in acid leach solutions from solid samples.

2. DERIVATION

This method is derived from Standard Methods for the Examination of Water and Wastewater, method 5310 C.

3. PRINCIPAL OF THE METHOD

Total and dissolved organic carbon (TOC and DOC), total and dissolved carbon (TC and DC), and soluble total organic carbon are determined in this method directly by Skalar segmented flow autoanalyzer. Total and dissolved inorganic carbon (TIC and DIC) are determined by the calculation of TC minus TOC and DC minus DOC respectively. Samples to be analyzed for DC and/or DOC are filtered through a 0.45µm syringe filter or a Flipmate-50 filter (or equivalent) before analysis.

The determination of TOC is based on a pH shift. The sample is acidified, and the inorganic carbon is removed via purging with nitrogen. An aliquot is then resampled for analysis. Buffered persulfate is added, and the sample is irradiated in an UV destructor. The hydroxylamine is added and then the sample enters a dialyzer. The carbon dioxide generated, diffuses through the gas permeable membrane and a weakly buffered phenolphthalein indicator solution is used as the recipient stream. The colour intensity of the solution decreases proportionately to the change in pH caused by the absorbed carbon dioxide gas. The colour intensity is measured at 550nm. TC or DC is measured in the same way as TOC or DOC, the only difference being the sample bypasses acidification and purging with nitrogen gas steps.

4. INTERFERENCES

- Samples that are turbid may need to be diluted. Alternatively, samples may be filtered, the filtrate analyzed as DOC, and the filters analyzed for particulate organic carbon using a carbon analyzer method for TOC analysis.
- High levels of suspended organic carbon and >500mg/L chlorides or other halides may not be oxidized efficiently by persulfate and UV analysis. These types of samples may require dilution to reduce the interference or be reconfigured to the high-combustion method ME-CA-[ENV]EWL-LAK-AN-023.



LAKEFIELD – INDUSTRIES &
ENVIRONMENT

DETERMINATION OF TOTAL &
DISSOLVED CARBON, ORGANIC
CARBON & INORGANIC CARBON
IN AQUEOUS SAMPLES BY
SKALAR SEGMENTED FLOW
AUTOANALYZER

Doc. No.

ME-CA-[ENV]SFA-
LAK-AN-009

Rev. No

2.4

Date

28 Mar. 2023

Page No.

2 of 3

Authorization

R. Irwin

- Solvent extraction samples must be diluted to 5% sulfuric acid to compensate for the high sulfuric acid concentration of the samples. The rinsing solution, calibration, and quality control solutions are also made with a 5% sulfuric acid solution to matrix match the samples.
- High concentrations of chloride (>0.05%) may inhibit the oxidation of organic matter, **therefore HCL must not be used to acidify samples for this method.**
- Samples containing inorganic reducing compounds (e.g. halides, nitrite) may cause incomplete oxidation of organic compounds by consuming some of the oxidizer, which will result in lower TC and TOC measurements. Samples may require dilution or be re-configured to ME-CA-[ENV]EWL-LAK-AN-023.
- A total inorganic carbon standard is added to each organic carbon instrument run to ensure all of the inorganic carbon is sparged from the system and does not appear as a false high TOC result.
- Low level samples may be analyzed using ME-CA-[ENV]EWL-LAK-AN-023.
- Samples that need to be diluted to read within the instrument range may be blank corrected to account for any carbon obtained from the dilution water.

5. SAMPLE REQUIREMENTS

Sampling information and concerns:	Representative sample must be taken.
Containers to be used:	Amber glass or HDPE
Sample size:	Optimum sample volume 60mL; Minimum sample volume 40mL;
Preservation required:	None except soluble TOC is preserved in 10% H2SO4.
Temperature requirements for storage:	5°C +/- 3°C allow samples to warm to room temperature prior to analysis.
pH requirements:	N/A
Pre-treatment:	N/A
Holding time (from time of collection to start of analysis):	14 days for DOC 7 days for TOC
Disposal of samples:	Refer to WI-CA-[ENV]AD-LAK-AD-014



LAKEFIELD – INDUSTRIES &
ENVIRONMENT

DETERMINATION OF TOTAL &
DISSOLVED CARBON, ORGANIC
CARBON & INORGANIC CARBON
IN AQUEOUS SAMPLES BY
SKALAR SEGMENTED FLOW
AUTOANALYZER

Doc. No.

ME-CA-[ENV]SFA-
LAK-AN-009

Rev. No

2.4

Date

28 Mar. 2023

Page No.

3 of 3

Authorization

R. Irwin

6. REFERENCES

American Public Health Association, American Water Works Association, Water Environment Federation Current Edition. Standard Methods for the Examination of Water and Wastewater; Washington, D.C.

Skalar Analytical B. V. 1994. Skalar methods Dissolved Organic Carbon: Cat No. 311-411, Issue 092302/MH/99221759, Skalar Analytical, Breda, Netherlands.

OMOE: Laboratory Services Branch Ministry of the Environment. Practices for the Collection and Handling of Drinking Water Samples. Version 2. 2009. Ontario, Canada

Shimadzu Corporation. Total Organic Carbon Analyzer TOC-LCPH/CPN User's Manual. 2011. Kyoto Japan