

Principle of Total Carbon Measurement by Spectrometer

Article Overview

Total carbon in a sample is measured by converting all carbon to CO₂ and quantifying it using spectroscopic detection, typically infrared spectroscopy.

Overview of Total Carbon Measurement

Total carbon (TC) in a sample includes both organic carbon (TOC) and inorganic carbon (TIC), related by the equation $TC = TOC + TIC$. Accurate measurement requires homogenizing the sample to ensure representativeness and removing interferences such as inorganic carbon when measuring TOC specifically .

Sample Preparation and Oxidation

- o Homogenization: Solid or liquid samples are mixed or ground to ensure uniformity.
- o Inorganic Carbon Removal (for TOC): Acidification converts carbonates and bicarbonates to CO₂, which is then purged from the sample .
- o Oxidation of Organic Carbon: Organic carbon is oxidized to CO₂ using either combustion at high temperatures (650-1200°C) or wet chemical oxidation with oxidants like persulfate under UV or heat .

Spectroscopic Detection

After oxidation, the CO₂ produced is quantified using a spectrometer, most commonly a non-dispersive infrared (NDIR) detector:

- o NDIR Principle: CO₂ absorbs infrared light at specific wavelengths. The spectrometer measures the reduction in IR intensity caused by CO₂ absorption.
- o Calibration: The detector signal (peak area) is correlated with known TC standards to determine the carbon concentration in the sample . Other spectroscopic methods for carbon analysis include UV-Vis, Raman, and X-ray photoelectron spectroscopy (XPS), which can provide additional information about carbon bonding and chemical state, though NDIR remains the standard for total carbon quantification .

Measurement Approaches

- o Direct Method: Measures TC after removing IC ($TOC = NPOC$).
- o Difference Method: Measures TC and IC separately, then calculates TOC as $TOC = TC - IC$.

Applications

This method is widely used in environmental monitoring, water quality analysis, soil and sediment studies,

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and industrial quality control, providing rapid, accurate, and reproducible carbon quantification across diverse sample types . By combining oxidation chemistry with infrared spectroscopic detection, total carbon measurement by spectrometer ensures precise determination of carbon content in both organic and inorganic forms.

This article summarizes the most important and current methods for the determination of total organic carbon (TOC) in

What can measuring total organic carbon levels tell you? Measuring TOC in ultrapure water systems provides critical

Carbon analysis (also called CO₂ analysis or carbonate analysis) is used to determine the total carbon content or the content of

What is TOC and why is it important? Learn about Total Organic Carbon analysis, its applications in

Measurement Principle - Carbon/Sulfur Analysis The oxygen stream combustion-infrared absorption method is utilized for carbon

In this paper, we will introduce a method for determination of sugar concentrations and carbon content of aqueous

Total Organic Carbon (TOC) Measurement (TC-IC): Subtracting the IC concentration from the TC concentration determines the TOC

Liquid Samples Total Carbon (TC) Measurement: Carrier gas (purified air) is passed at a controlled flow rate of 150 mL/min

After measuring the background concentration, spike the sample with a known concentration of TOC. The spike concentration should

Climate change and the rise of CO₂ in the atmosphere has highlighted the possibilities of carbon sequestration in soil. Estimating

Carbon content is one of the most important parameters measured in various types of solutions, from commercial

Total Organic Carbon Analyzer Principle Understanding TOC Measurement Techniques for Accurate Results

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TOC analysis is vital in

Beside the analysis of the total carbon content, it is also possible to determine single fractions of carbon. By changing the

Fourier transform infrared spectroscopy (FTIR) is a technique used to obtain an infrared spectrum of

The Shimadzu TOC-L total organic carbon analyzer is ideal for TOC measurement by Standard Methods 5310B. The TOC-L, with a

How do you measure Total Organic Carbon Analyzer (TOC)? A Total Organic Carbon Analyzer (TOC) measures the organic carbon

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