



Standard Test Method for On-Line Monitoring of Total Carbon, Inorganic Carbon in Water by Ultraviolet, Persulfate Oxidation, and Membrane Conductivity Detection¹

This standard is issued under the fixed designation D5997; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the on-line determination of total carbon (TC), inorganic carbon (IC), and total organic carbon (TOC) in water in the range from 0.5 µg/L to 50 000 µg/L of carbon. Higher carbon levels may be determined by suitable on-line dilution. This test method utilizes ultraviolet-persulfate oxidation of organic carbon coupled with a CO₂ selective membrane to recover the CO₂ into deionized water. The change in conductivity of the deionized water is measured and related to carbon concentration in the oxidized sample using calibration data. Inorganic carbon is determined in a similar manner without the requirement for oxidation. In both cases, the sample is acidified to facilitate CO₂ recovery through the membrane. The relationship between the conductivity measurement and carbon concentration can be described by a set of chemometric equations for the chemical equilibrium of CO₂, HCO₃⁻, H⁺, and OH⁻, and the relationship between the ionic concentrations and the conductivity. The chemometric model includes the temperature dependence of the equilibrium constants and the specific conductances resulting in linear response of the method over the stated range of TOC. See Test Method [D4519](#) for a discussion of the measurement of CO₂ by conductivity.

1.2 This test method has the advantage of a very high sensitivity detector that allows very low detection levels on relatively small volumes of sample. Also, the use of two measurement channels allows determination of IC in the sample independently of organic carbon. Isolation of the conductivity detector from the sample by the CO₂ selective membrane results in a very stable calibration with minimal interferences.

1.3 This test method was used successfully with reagent water spiked with sodium carbonate and various organic

compounds. This test method is effective with both deionized water samples and samples of high ionic strength. It is the user's responsibility to ensure the validity of this test method for waters of untested matrices.

1.4 This test method is applicable only to carbonaceous matter in the sample that can be introduced into the reaction zone. The inlet system generally limits the maximum size of particles that can be introduced. Filtration may also be used to remove particles, however, this may result in removal of organic carbon if the particles contain organic carbon.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

- [D1129 Terminology Relating to Water](#)
- [D1192 Guide for Equipment for Sampling Water and Steam in Closed Conduits \(Withdrawn 2003\)](#)³
- [D1193 Specification for Reagent Water](#)
- [D2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water](#)
- [D3370 Practices for Sampling Water from Closed Conduits](#)
- [D4519 Test Method for On-Line Determination of Anions and Carbon Dioxide in High Purity Water by Cation Exchange and Degassed Cation Conductivity](#)

3. Terminology

3.1 Definitions:

¹ This test method is under the jurisdiction of ASTM Committee [D19](#) on Water and is the direct responsibility of Subcommittee [D19.03](#) on Sampling Water and Water-Formed Deposits, Analysis of Water for Power Generation and Process Use, On-Line Water Analysis, and Surveillance of Water.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.