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Water quality — Guidelines for the determination of total organic carbon (TOC)

Qualité de l'eau — Guide pour le dosage du carbone organique total (COT)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8245 was prepared by Technical Committee ISO/TC 147, *Water quality*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Water quality — Guidelines for the determination of total organic carbon (TOC)

0 Introduction

Total organic carbon (TOC) is a measure of the carbon content of dissolved and undissolved organic matter present in the water. It does not give information about the nature of the organic substance. Inorganic carbon must be eliminated before analysis or determined together with the TOC and subsequently subtracted. The method is instrumental and the selection of the analyser should take into consideration the carbon content of the samples to be analysed. The carbon content of organic substances may vary widely.

1 Scope and field of application

This International Standard gives guidelines for the measurement of TOC concentrations in all kinds of water. It covers definitions, interferences, reagents and pretreatment of water samples containing 0,1 to 1 000 mg/l organic carbon. Higher concentrations may be determined after appropriate dilution. Under certain circumstances it may be necessary to pretreat the sample, for example by the separation of larger particles contained in the water in order to avoid clogging of the apparatus.

This International Standard does not deal with the instrumental side of the determination.

In addition to organic carbon, the sample may contain carbon dioxide or ions from carbonic acid. Prior to the TOC determination, this inorganic carbon must be removed by purging the acidified sample with gas free from CO_2 and organic compounds. Alternatively, both total carbon (TC) and total carbon dioxide may be determined and the organic carbon content (TOC) calculated by subtracting the total carbon dioxide from the TC. This method is most suitable for samples in which the total carbon dioxide is less than the TOC.

Volatile organic substances such as benzene, toluene, cyclohexane, and chloroform may escape during stripping of CO_2. The TOC of these substances must therefore be determined separately or the difference method may be applied.

Particles of elemental carbon (soot), carbide, cyanides, cyanates and isocyanates when present are determined together with the organic carbon.

NOTE — Bibliographic reference 11.2 gives a comparison of the oxidation methods. TOC levels of different types of water are indicated.

2 Reference

ISO 5667-3, *Water quality — Sampling — Part 3: Guidance on the preservation and handling of samples.*

3 Definitions

For the purpose of this International Standard the following definitions apply.

3.1 total carbon (TC): The quantity of carbon present in water in the form of organic, inorganic and elemental carbon.

3.2 total inorganic carbon (TIC): The quantity of carbon present in water in the form of elemental carbon, total carbon dioxide, carbon monoxide, carbides, cyanates, cyanides and thiocyanates.

3.3 total organic carbon (TOC): The quantity of carbon present in water in that organic matter which is dissolved or suspended in the water.

3.4 dissolved organic carbon (DOC): The quantity of carbon present in water in that organic matter which passes a filtration step through a membrane filter of pore size 0,45 µm.

4 Principle

Oxidation by combustion, addition of suitable oxidant, or ultraviolet irradiation, of organic carbon in water to carbon dioxide.

The application of the ultra-violet method with only oxygen as an oxidant is restricted to unpolluted waters free from particulate matter. Inorganic carbon is eliminated through acidification and purging or is determined separately.

The carbon dioxide formed by oxidation may be determined either directly or after reduction to methane (CH_4).

Among others, the following principles for the ultimate determination of CO_2 are applied: infra-red spectrometry, titration (preferably in non-aqueous solution), thermal conductivity (TCD), conductometry, coulometry, CO_2-sensitive electrodes and, after reduction of the CO_2 to CH_4, flame ionization (FID).