



Total Organic Carbon
Analyzer (TOC)

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Brand
Shimadzu

Model
TOC-V_{CSH}

Technical specifications

- Automatic analyzer which enables the measurement of the following parameters: Total Carbon (TC), Inorganic Carbon (IC), Total Organic Carbon (TOC) and Non-Purgable Organic Carbon (NPOC).
- Measurement method: combustion catalytic oxidation (680°C) with Non-Dispersive Infrared Detector (NDIR).
- Quantification range of TOC parameter: from 0.03 to 1000 mg C/L.
- Measurement time: TC ~ 3 min; IC ~ 4 min.
- There are different components which facilitate and extend the TOC-V_{CSH} operation:
 - > **ASI-V autosampler:** autosampler with capacity for 93 vials of 24 mL; agitation system for vials; acidification and purge of samples; possibility of working with closed vials.
 - > **SSM-5000A:** combustion unit for solid samples; two ovens, one for TC (900°C) and another for IC (200°C); ability to measure up to 30 mg of carbon in the case of TC, and 20 mg of carbon for IC.

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Technique description

Organic matter measurement can be directly established through the Total Organic Carbon (TOC) or indirectly from the reduction capacity of the carbon in the sample by determining the Biochemical Oxygen Demand (BOD) and the Chemical Oxygen Demand (COD). However, TOC is a faster, more accurate and direct measurement of the organic content because it does not depend on the initial oxidation state of the matter, nor does it measure other organic bonds such as nitrogen and hydrogen, or inorganic bonds which may contribute to the measured oxygen demand.

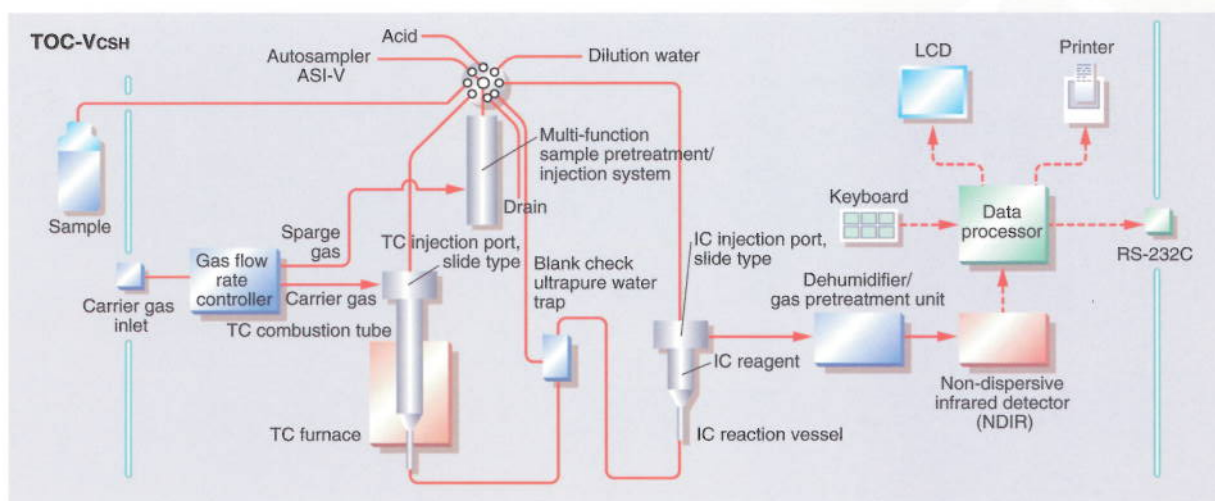
Different substances contribute to the TOC value, from compounds of natural origin, resulting from plants and animal activity (amines, humic and fulvic acids, urea, etc.), to synthetic compounds present as a result of human activities (detergents, pesticides, fertilizers, etc.). Therefore, the organic matter amount is usually correlated with its uses.

The method is based on catalytic oxidation at 680°C. Water is obtained as a combustion product, which is vaporized and eliminated by subsequent condensation. Carbon (organic and inorganic) is another combustion product which is oxidized to CO₂. The carbon dioxide is transported using air flow and measured by a Non-Dispersive Infrared Detector (NDIR). TC is thus obtained. IC, which basically includes dissolved carbon dioxide, carbonates and bicarbonates, is obtained through acidification of the sample using phosphoric acid and the subsequent formation of CO₂ which is analyzed by the NDIR detector. TOC can be obtained by the above difference (TC-IC) or approximating NPOC to TOC (when IC >> TOC). In this case, NPOC is obtained by acidification of the sample to remove all IC and a later agitation to remove all the purgable organic carbon. The acidified and stirred sample is then placed in the combustion chamber where it is oxidized to form CO₂.

With the SSM-5000A module, TC, IC and TOC can also be determined in solid samples. TOC is determined by the TC-IC difference. Solid combustion for TC is carried out at a higher temperature (900°C) than liquid combustion to ensure the complete combustion of the sample. In the case of IC, the sample is acidified with phosphoric acid and also submitted to temperature (200°C) to ensure the complete reaction of the inorganic carbon, but not the organic.

Applications

- > Quality control of ultrapure water.
- > Non-specific indicator for effluent and influent water quality.
- > TOC is used as a common parameter for evaluating the contamination of different types of surface water (rivers, lakes, reservoirs, seas) and groundwater (mine and spring waters).
- > Chlorine, chlorine oxide and ozone are used to disinfect drinking water. If organic matter content in these waters is high, halometans can be formed which are adverse to human health. The determination of TOC in drinking water can be used to estimate the generation of these compounds.
- > Determination of the organic matter present in soils, sewage sludge, leachate, mining waste, etc. by using the solids module. This device can also be employed for processing viscous samples.



Total Organic Carbon (TOC) components diagram