

Simplified TOC Testing for Oil and Gas Waters with High Chloride Concentrations

Introduction

Total Organic Carbon (TOC) has traditionally been measured using benchtop analyzers. In addition to being expensive and complicated, these analyzers are not well adapted to challenging oil and gas applications or to field testing. Samples with insoluble constituents frequently clog analyzer tubing. This necessitates sample filtration, which is time consuming as well as expensive, and can potentially remove organic carbon from the sample, thus biasing the results. Analyzers also measure samples sequentially. Sequential analysis is extremely time-consuming when analyzing a large batch of samples.



Figure 1: Hach DRB200 reactor, TOC-X5 shaker and TNT+ vials

The new Hach TOC vial test overcomes these challenges, making it a simple, rugged, and inexpensive solution for analyzing more challenging matrices. The batch-style analysis also allows for simultaneous measurement of large batches of samples.

Improved TOC Testing with TNTplus

The TNT810 and TNT811 vial tests take the established TOC acid-persulfate chemistry and integrate it into an innovative double-vial analysis unit. Sample is simply pipetted into the reaction vial—no filtration necessary. Total inorganic carbon (TIC) is purged using the automated TOC-X5 shaker unit. After removing the TIC, the sample vial is mated to the indicator vial and the unit is digested in the DRB200 reactor block. As many as 30 samples may be digested concurrently. Finally, the digested sample is analyzed in a DR-series spectrophotometer.

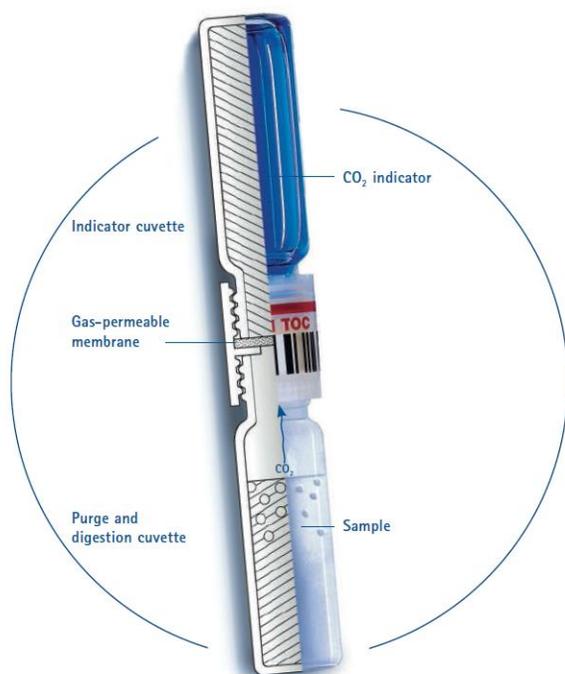


Figure 2: CO₂ gas crosses the gas-permeable membrane into the indicator vial

Membrane Double-Cap

The TNT810/811 kit utilizes an innovative gas-permeable membrane to separate the indicator cuvette from the sample. During digestion, organic carbon is oxidized to carbon dioxide which crosses the membrane into the pH indicator cuvette. Carbon dioxide is converted to carbonic acid which changes the pH and the color of the indicator. The double-vial unit is simply cooled, flipped over, and inserted into the spectrophotometer for determination. Any insoluble matter in the sample is retained in the digestion vial and cannot interfere with the sample measurement.

TOC-X5 Shaker

TIC must be purged from the sample prior to digestion for accurate TOC determination. The new TNT810/811 sample vials contain the correct amount of purging reagent, and the X5 shaker provides mixing and convection. TIC is converted to carbon dioxide and purged from the sample in five minutes. Up to eight samples may be purged simultaneously.

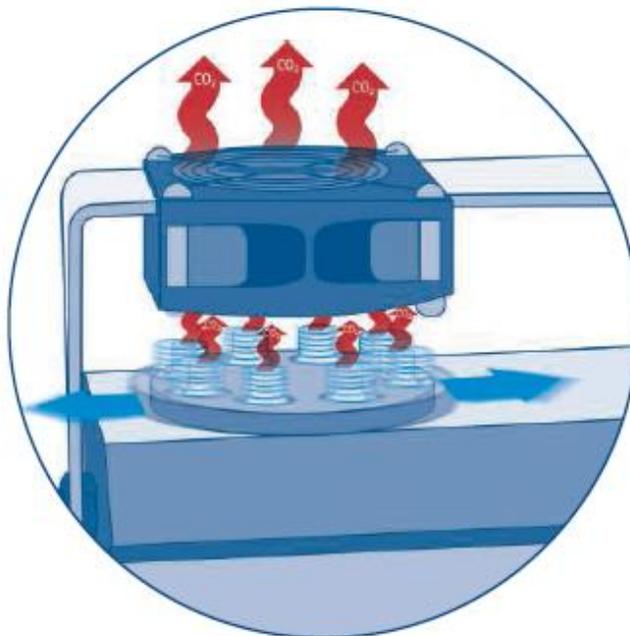


Figure 3: TIC is purged with the TOC-X5 shaker

Chloride Interference

Chloride is an interference for many TOC techniques. Chloride consumes persulfate as it is oxidized to chlorine gas. As persulfate is consumed in the oxidation of chloride, less is available for the oxidation of organic compounds. Further, chlorine gas can cross the membrane double-cap, bleaching the indicator solution and causing a false-positive result. Hach has measured the level of interference caused by chloride and developed sample treatment guidelines to avoid it.

Since the chloride interference is linear it can be eliminated through dilution. TNT810 and TNT811 span a range from 3 – 300 mg/L TOC. Samples high in chloride can be diluted to eliminate the interference while still remaining in range for TOC.

Chloride Interference with TOC

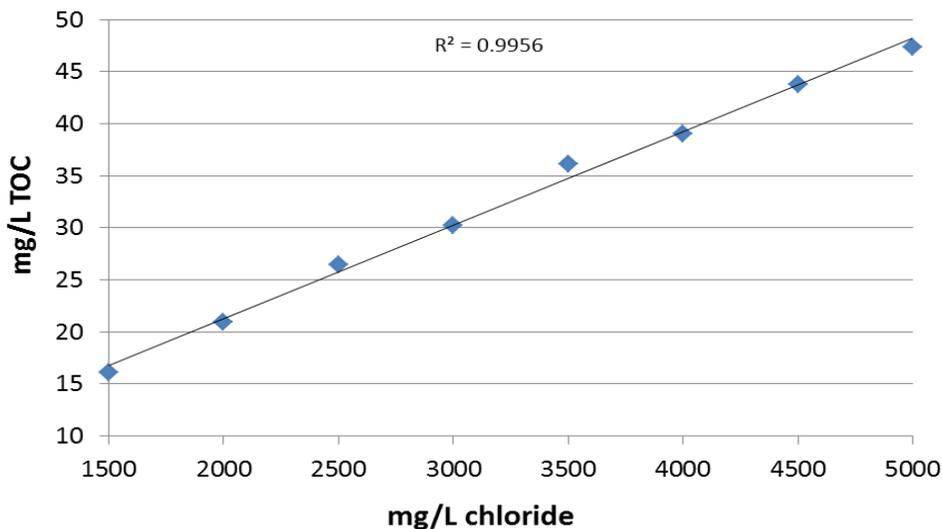


Table 1: Linear chloride interference

Chloride Measurement and Dilution

Chloride can be quickly and easily measured with Quantab test strips. Quantab strips can measure chloride from 30 – 6000 mg/L chloride. After chloride measurement, the appropriate dilution factor can be determined, and the sample diluted to remove the interference. The diluted sample is analyzed for TOC with the TNTplus vial test, and the original concentration is calculated through multiplication of the measured concentration by the dilution factor.

A Complete Solution

The Hach family of lab products makes TOC measurement simple, affordable, and fast. The membrane double-cap vial assembly allows for hassle-free analysis of samples containing solids. The TOC-X5 shaker makes TIC removal a hands-free, reproducible, and automatic process. The batch-style digestion permits timely analysis of large batches of samples. The Quantab test strips provide a quick and simple check for chloride interference. And DR-series spectrophotometers deliver accurate automated concentration measurements.

Hach TNTplus TOC Reagents and Apparatus

- DR6000, DR3900, or DR1900 Spectrophotometer – PN LPV441, LPV440, or DR1900-01H
- DRB200 Digital Reactor Block – PN DRB200
- TNTplus TOC Vials – PN TNT810 and TNT811
- TOC-X5 Shaker – PN LQV148.99.00002
- Quantab Chloride Test Strips – PN 2744940 and 2751340
- Method 10273 - DOC316.53.01505



Figure 4: Quantab chloride test strips

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