

Application News

No. SCA-130-104

Sum parameter – Total Organic Carbon

TOC – Determination in seawater

TOC is an important indicator of the degree of organic contamination. TOC determination is used extensively to detect and study environmental and seawater pollution. In recent years, increased attention is being paid to the measurement of the nitrogen compounds (TN = Total Nitrogen) responsible for eutrophication.



■ Seawater samples

Seawater has an average salinity of 3.5% mass fraction. The total salinity fluctuates depending on each ocean. The Baltic Sea has a salinity of 0.2 to 2%. Some inland seas without outlets have far higher water salinities. The Dead Sea is known for its salinity of 28%. Chloride ions constitute the main component of the anions, followed by sulfate ions. Sodium ions dominate among the cations, which is why the major proportion of crystallized sea salts consists of sodium chloride (common salt). Magnesium, calcium and potassium ions are represented in smaller amounts.

■ Are high salt loads a problem?

During thermal catalytic combustion of the test sample, the dissolved salts crystallize. Depending on the salt concentration, this can affect or clog the system. Maintenance measures (for instance exchanging the catalyst) would then be required in order to render the instrument operational again. Of course, it is desirable to keep the maintenance intervals as long as possible.

■ TOC-L Series

The TOC-L series offers various possibilities to keep the maintenance need for highly polluted samples as low as possible. The analyzers are operated under catalytic combustion at 680 °C. This temperature is lower than the melting point of sodium chloride and therefore prevents deactivation of the active centers of the catalyst by a melt. The use of the platinum catalyst ensures complete conversion of organic carbon compounds to CO₂.

The highly sensitive NDIR detector allows small injection volumes (typically 20 - 50 µL) that reduce absolute sample input onto the catalyst.

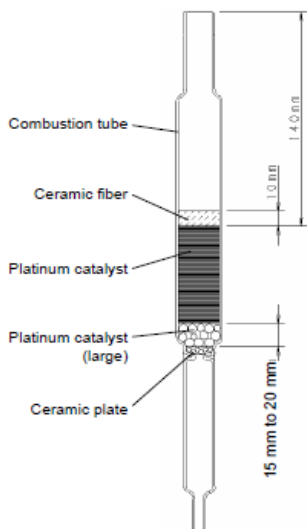


■ Kit for high-salt samples

The TOC-L series features a kit for high-salt samples, which significantly increases instrument availability.

Using this kit in a seawater application, it was possible to carry out 2500 injections without maintenance (injection volume of 40 µL).

The kit consists of a combustion tube with a special geometry and a unique catalyst mixture.



In this application, sample acidification is carried out with sulfuric acid which is used to modify the sample matrix. While NaCl has a melting point of 801 °C, the melting point of NaSO₄ is higher (888 °C). The potassium salts of sulfuric acid also have a significantly higher melting point than those of hydrochloric acid. This has a positive effect on the lifetime of the combustion tube.

Compound	Melting point
NaCl	801°C
KCl	773°C
Na ₂ SO ₄	888°C
MgCl ₂	708°C
CaCl ₂	782°C
K ₂ SO ₄	1.069°C

Tab. Melting point of different salts

■ Simultaneous TN determination using the TNM-L

Based on the similar oxidation process, the TNb determination can be carried out simultaneously with the TOC measurement. For this application, the TNM-L option is installed on the main TOC-L system.

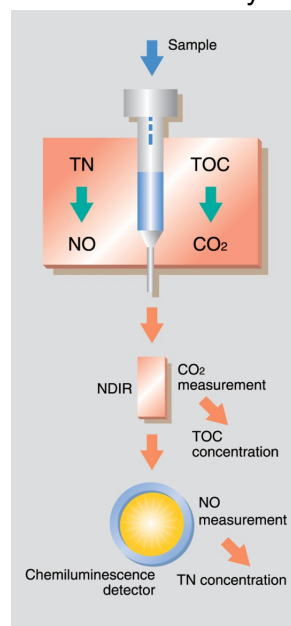


Figure: Simultaneous TOC/TN-Determination

■ Recommended analyzer / Configuration

TOC-L_{CPN}
ASI-L (40ml), External Sparge-Kit.
Kit for high-salt samples
TNM-L