GE
Water & Process Technologies
Analytical Instruments

Fact Sheet

Sievers InnovOx

Laboratory TOC Analyzer

Overview

The new Sievers* InnovOx Laboratory Total Organic Carbon (TOC) Analyzer represents a breakthrough in reliability and sample handling robustness for process and wastewater TOC Analysis. Using a patent-pending Supercritical Water Oxidation (SCWO) technology, the Sievers InnovOx is designed to run thousands of diverse TOC sample matrices — including brine and cellulose — with unprecedented uptime. The InnovOx offers superior analytical performance and calibration stability regardless of sample matrix.

The Sievers InnovOx measures industrial process, environmental and waste water samples. It offers superior versatility, as well as accuracy and precision across a dynamic operating range of 0.5 to 50,000 parts per million (ppm) TOC. The InnovOx can measure Total Carbon (TC), Total Inorganic Carbon (TIC), Total Organic Carbon (TOC), and Non-Purgeable Organic Carbon (NPOC).

The Sievers InnovOx features an Ethernet Web browser interface for easy remote monitoring, an intuitive color touch-screen interface, and three convenient USB ports for data transfer. Like other Sievers TOC Analyzers, the InnovOx is easy to use, operate and maintain.

InnovOx Key Benefits

- **Delivers unprecedented system uptime through an innovative Supercritical Water Oxidation (SCWO) technique**
- **Easily handles consecutive brine, industrial process, environmental and waste water samples**
- **Offers enhanced calibration stability — up to 6 months**
- **Removes oxidation by-products, salts and particulates from the reactor between each measurement**
- **Measures TC, TIC, TOC and NPOC**
- **Has a dynamic detection range (0.5 to 50,000 ppm)**

Applications

The Sievers InnovOx can measure wastewater, environmental samples, or industrial process waters found in a wide range of industries, such as:

- Petrochemical
- Environmental laboratories
- Municipal drinking water and wastewater plants
- Chlor-alkali chemistry
- Food and beverage
- Power
- Pulp and paper
- Manufacturing
- Pharmaceutical
- Research

Key Benefits

Unprecedented Reliability and Uptime

Based on market input, GE Analytical Instruments designed the Sievers InnovOx with two key objectives in mind — to deliver superior reliability and unprecedented uptime. The Sievers InnovOx has met the challenge, and can run thousands of diverse sample matrices without any need for time-consuming reactor cleaning or expensive catalyst replacement. This is due to the innovative Supercritical Water Oxidation (SCWO) technique.

Sample Handling Robustness

With the SCWO technique, the Sievers InnovOx has advanced the standard wet chemical oxidation to achieve unprecedented TOC recoveries regardless of organic compounds and particulate impurities in the

InnovOx Measurements for Brine, Cellulose and Humic Acid Samples			
Replicate	28% Brine Solution	90 µm Cellulose Solution	Humic Acid Solution
1	5.80	95.1	10.2
2	5.69	98.0	10.1
3	5.59	90.9	10.4
4	5.68	104	10.4
5	5.69	93.2	10.2
6	5.53	98.0	10.2
7	5.49	93.3	10.4
8	5.70	101	9.91
9	5.57	103	9.86
Mean	5.66	97.3	10.19
Standard Dev.	0.12	4.50	0.20
RSD	2.13%	4.63%	2.0%

sample. The robust Sievers InnovOx can handle a wide variety of sample matrices, particularly those with brine, cellulose, and other challenging content *(see table above)*.

Versatile Measurement Modes

The versatile Sievers InnovOx can measure Total Carbon (TC), Total Inorganic Carbon (TIC), Total Organic Carbon (TOC), and Non-Purgeable Organic Carbon (NPOC). The InnovOx allows any combination of these modes in a single schedule and multiple runs on the same sample.

Extended Calibration Stability

The Sievers InnovOx TOC Analyzer offers up to six months' calibration stability, unlike competing analyzers that require weekly or even daily calibration. Calibration is easy, using intuitive on-screen prompts. Multi-point calibrations can be performed with a single standard using the the Auto Dilution capability.

Ease of Operation

The Sievers InnovOx is extremely easy to use, with user-friendly features, including:

- Immediate operation — no prior warm-up or stabilization is required
- Automatic sample flow path cleaning after each analysis
- Intuitive touch-screen display
- Compatibility with the Sievers 900 Autosampler

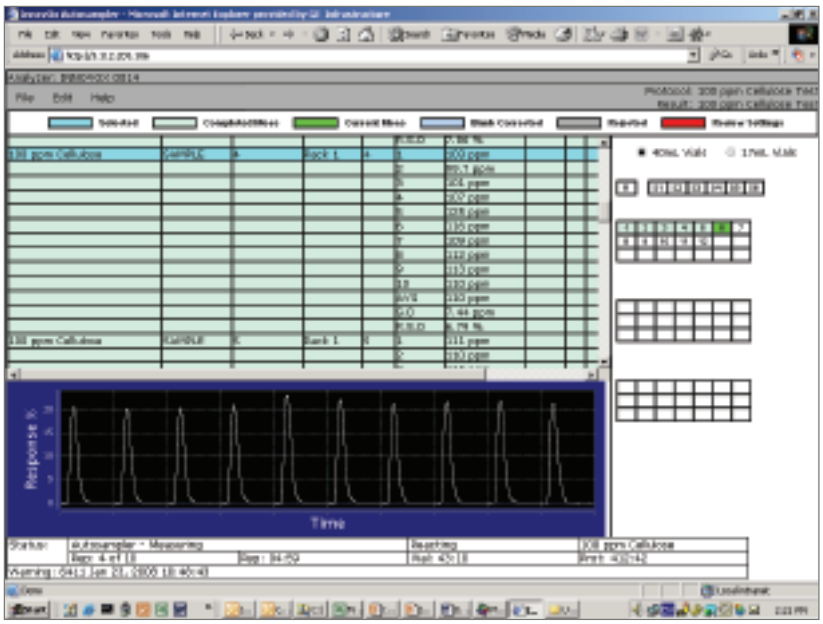
Low Maintenance and Cost of Ownership

The InnovOx requires just a few hours of annual preventive maintenance, facilitated by its modular design and step-by-step videos at www.geinstruments.com. Because the InnovOx is so reliable and requires no catalysts, it has a very low cost of ownership.

Handles diverse samples

Web-based Monitoring

The InnovOx enables users to remotely monitor and control Analyzer operations and results using a secure Web-based interface: just open a Web browser and enter the instrument's IP address. Data can also be downloaded and transferred via a USB port. The InnovOx automatically generates convenient pdf reports.



Web interface screen shot

Regulatory Methods Compliance

The Sievers InnovOx is compliant with ASTM, Standard Methods, ISO, and EPA regulations.

Technology and Operation

The InnovOx features three main steps, each with significant process innovations:

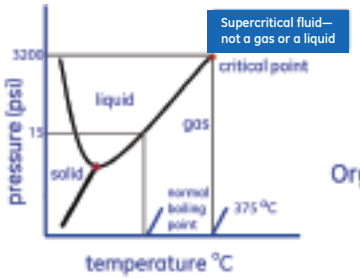
- Sample handling and reagent mixing
- Supercritical Water Oxidation (SCWO) reaction
- NDIR detection

Sample Handling and Reagent Mixing

The InnovOx ensures superior sample representation and accuracy by processing a large sample volume and by thoroughly agitating the sample in the Sample Mixing Chamber. The sample and reagents are added through a unique sample coil delivery system which prevents syringe contamination.

Supercritical Water Oxidation (SCWO)

Supercritical Water Oxidation (SCWO) was originally developed to treat large volumes of aqueous waste streams, sludges and contaminated soils. SCWO destroys organic wastes using an oxidant in water and temperatures and pressures above the critical point of water, 375 °C, and 3,200 psi. These conditions enable rapid and complete oxidation.



Supercritical Water Oxidation (SCWO)

$$\text{Organic} + S_2O_8^{-2} + \text{heat} + \text{pressure} \rightarrow CO_2 + H_2O + SO_4^{-2}$$

Today, SCWO research and development is focused on treating a variety of toxic and hazardous organic wastes. GE Analytical Instruments is the first company to use this technique in a commercial laboratory TOC instrument.

Supercritical Water Oxidation (SCWO) Reaction

Using a patent-pending Supercritical Water Oxidation (SCWO) technique *(see sidebar),* the Sievers InnovOx takes the water sample to a supercritical state by increasing the temperature, and subsequently the pressure, within the reactor. The properties of supercritical water enable the ultra-efficient, rapid oxidation of organic carbon to CO_2, even in the presence of chloride and other inorganic species that negatively interfere with non-SCWO wet chemical oxidation.

NDIR Detection

The Sievers InnovOx uses a highly stable, nondispersive infrared (NDIR) detector with an advanced design for superior response. Unlike other NDIR detectors, the Sievers NDIR has no moving parts and features superior temperature control of the IR source and detector.

Visit www.geinstruments.com and go to *Products —TOC — InnovOx* to see animations of these key components.

Accessories and Options

Air Filter

The Air Filter option offers an alternative to using inconvenient, bulky, external carrier gas cylinders. The Air Filter attaches easily to the back of the instrument. It contains a removable filter that is typically replaced every three months, depending on the number of samples analyzed.

Sievers 900 Autosampler

For high-volume laboratory applications, the InnovOx can be used with the Sievers 900 Autosampler. The 900 Autosampler provides high-throughput sample capacity (63 sample and 6 standard positions for 40-mL vials).

Sievers Certified Standards and TOC Vials

Sievers Certified Reference Materials are available for InnovOx calibration and verification needs, as well as reliable and economical 40-mL TOC vials.

Air Filter

Sievers 900 Autosampler

TOC Vials

Specifications

Operating Specifications[1]

Analysis Modes	TC, TIC, NPOC, TOC
Dynamic TOC Range	0.5 to 50,000 ppm TOC
TOC LOD	0.05 ppm[2]
TOC Accuracy	± 3% of reading at 50 ppm NPOC
TOC Precision	RSD ≤ 5% of reading at 50 ppm NPOC
TOC Linearity	$R^2 \geq 0.995$, measured as NPOC *(see Operation & Maintenance Manual for calibration recommendation)*
Analysis Time	2.2 to 7.3 min, depending on mode
TOC Calibration Stability	Up to 6 months
Particle Diameters in Sample	≤ 800 µm diameter
Ambient Operating Temperature Range	10–40 °C (50–104 °F)
Maximum Relative Humidity	Up to 95%, non-condensing
Sample Temperature Range	10–60 °C (50–140 °F)
Sample Inlet Pressure	Ambient
Drain	Gravity drain

Analyzer Specifications

Outputs	Ethernet and 3 USB ports
Display	Color, touch-sensitive LCD
Power	100–240 ±10% VAC, 400 W, 50/60 Hz
Dimensions	H: 52.05 cm (20.49 in); W: 32.26 cm (12.7 in); D: 58.42 cm (23.0 in)
Weight	22.4 kg (49.4 lb)
Safety Certifications	CE, ETL listed. Conforms to UL Std. 61010-1. Certified to CSA C22.2 No. 61010-1.

Consumables

	Maintenance Frequency	Estimated Maintenance Time
Acid Reagent	As needed, typically for 6 months (285-mL)	5 minutes
Oxidizer Reagent	As needed, typically 30-day stability	5 minutes
Reagent Grade Water	As needed	5 minutes
Air Filter Cartridge	3 months	5 minutes
Pumps	24 months	15 minutes
Sample Flow Path Tubing	12 months	15 minutes
Valve Seals (2)	Frequency depends on sample matrix	15 minutes

[1] Stated analytical performance is achievable under controlled laboratory conditions that minimize operator and standards errors.

[2] Limit of Detection was determined with the following parameters; NPOC mode in the 0-1000 ppm range, blank correction ON, CO_2 free cylinder gas, 0.83 minute sparge time, 1% acid and 0% oxidizer in method, and sampling a continuous stream from ultrapure water system.

The Americas
GE Analytical Instruments
6060 Spine Road
Boulder, CO 80301-3687 USA
T +1 800 255 6964
T +1 303 444 2009
F +1 303 527 1797
geai@ge.com

Europe/Middle East/Africa
GE Analytical Instruments
Unit 3, Mercury Way
Urmston, Manchester
UK M41 7LY
T +44 (0) 161 864 6800
F +44 (0) 161 864 6829
geai.europe@ge.com

Asia Pacific
GE Analytical Instruments
5 United Plaza
1468 Nanjing Rd (W)
Shanghai 200040
China
T +86 021 3222 4555
geai.asia@ge.com

www.geinstruments.com

300 00168 Rev B
MC08-091