

Total Organic Carbon (TOC) in Water Samples by Persulfate Oxidation

- 1. Principle of Method:** This method measures the quantity of total inorganic carbon (TIC) and/or total organic carbon (TOC) in aqueous samples. The instrument mixes an aliquot of liquid sample with phosphoric acid (5 % w/v) and sodium persulfate (10 % w/v) in a heated glass reaction vessel to chemically oxidize carbon into CO₂. The evolved CO₂ gas is then passed through a non-dispersive infrared (NDIR) detector to determine carbon content (TIC or NPOC). Helium is used as the carrier gas for the system, and nitrogen is used as the purge gas for the NDIR. NIST-traceable certified standards are used to calibrate the system. Specific methods include:

- a. Non-Purgeable Organic Carbon (NPOC):**

NPOC is measured by acidifying an aliquot of sample with phosphoric acid and sparging the sample with helium to strip off any purgeable organic and inorganic carbon. After a few minutes of sparging, sodium persulfate is injected into the sample. The remaining carbon in the sample is oxidized into CO₂, which is then detected by the NDIR. The system is calibrated using a range of aqueous solutions of potassium hydrogen phthalate, diluted from a stock NIST-traceable standard solution. Typical calibrations are from 0.8 – 100 mg/L TOC. Calibration accuracy is verified by analyzing a separate QC check solution.

- b. Total Inorganic Carbon (TIC):**

If TIC measurement is required, the sparged CO₂ from the acid reaction step is measured by the NDIR before persulfate addition. The same detector calibration for NPOC analysis is used for TIC determination.

- 2. Instrumentation Used:**

OI Analytical Aurora 1030W TOC Analyzer, manufactured by OI Analytical (a Xylem Inc. brand), received in 2016.

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- 3. References:**

- 3.1** Aurora 1030 Wet Oxidation TOC Analyzer Operator's Manual (rev. 2.1). OI Analytical, College Station, Texas, USA, 2012.

- 4. Standards Used:**

4.1 TOC Calibration Standard: Total Organic Carbon standard, certified reference solution, stock 100 mg/L TOC potassium hydrogen phthalate, purchased from SCP Scientific.

4.2 TOC QC Check Standard: Total Organic Carbon standard, certified reference solution, stock 1000 mg/L TOC potassium hydrogen phthalate, purchased from SCP Scientific.

4.3 TIC QC Check Standard: Total Inorganic Carbon standard, certified reference solution, stock 100 mg/L TIC sodium carbonate/bicarbonate, purchased from SCP Scientific.