Correlation of Hach's Lab and Process TOC Solutions: An Independent Study Comparing QP1680 and BioTector Measurements Across Industries

Overview

An independent study (University of Stuttgart, Germany) evaluated the measurement correlation of Hach®'s QP1680 (laboratory TOC analyzer) and BioTector B7000 (online TOC analyzer) using 24 wastewater discharge samples that were collected from the Chemical, Municipal Wastewater Treatment, Food and Beverage, Dairy, Petrochemical Refining, and Pulp and Paper industries.

Purpose of Study

Lab analysis and process TOC monitoring have different purposes and requirements, and Hach seeks to offer the best fit for both needs. This independent study was performed for the purpose of demonstrating a useful correlation in TOC measurement between the two analyzers, using real samples from a variety of industries.

TOC is becoming an increasingly important reporting parameter in various industries. The QP1680 and BioTector are valuable solutions for laboratory and process TOC monitoring needs, respectively. In addition to their laboratory and process designations, these two analyzers differ in their TOC measurement technology, with the QP1680 employing high-temperature combustion and the BioTector employing two-stage advanced oxidation (TSAO).

In many countries, high-temperature combustion TOC analysis is required for TOC reporting. The QP1680 can serve as an important laboratory complement to the BioTector's process TOC monitoring, especially when high-temperature combustion TOC measurements are required for reporting.

- **Lab TOC requirements:** A standard method is required for reporting and compliance. High-temperature combustion TOC analysis is approved and established for these purposes and doesn't require a change to the standard operating procedure.
- **Process TOC monitoring requirements:** Focus for on-line monitoring is different from lab analysis. Robustness and reliability is critical. Unattended monitoring with low maintenance and minimum breakdowns is essential. The process TOC analyzer must be able to handle particles and high salt loads, maintaining high accuracy and precision with a wide variety of industrial samples.

Figure 1. QP1680 (above) and process TOC analyzer BioTector (left)

Table 1. Specifications for TOC analyzers studied

	BioTector B7000	QP1680
Oxidation Method	Two-stage advanced oxidation (TSAO, hydroxyl radical)	Catalytic combustion at 720 °C
Measurement Principle	TIC and TOC (=NPOC)	NPOC
Standards	EN 1484, ISO 8245, EPA 415.1, ISO 21793	ASTM D7573, EN 1484, EPA 415.1, EPA 9060A, ISO 8245, SM 5310B, EN-ISO 20236
Measuring Range	0 – 20,000 mg/L	0 – 30,000 mg/L
Calibration Range	0 – 100 mg/L	0 – 10 mg/L, 10 – 100 mg/L
Sample Volume	7 mL	200 µl
Particle Tolerance	≤ 2 mm	≤ 0.8 mm

Experimental Design and Execution

24 wastewater discharge samples were collected from direct dischargers representing 6 different industries in Germany: Chemical (3 samples), Municipal Wastewater Treatment (4 samples), Food and Beverage (4 samples), Dairy (4 samples), Petrochemical Refining (5 samples), and Pulp and Paper (4 samples). No sample-specific optimization was employed for either of the two analyzers tested. All samples were measured by an independent partner, who measured all samples on the same day with the same operator and the same sample preparation. In addition to industrial samples, each instrument was tested with TOC standards in the range of 10 – 80 mg/L nominal TOC.

The specifications of the two tested TOC analyzers are listed in Table 1, above.

Results

The QP1680 and BioTector demonstrated very good TOC correlation across all industrial samples, with an instrument-to-instrument coefficient of determination (R^2) value of 0.9959. Results from the independent study can be observed in Figures 2, 3, and 4, shown below and on the next page.

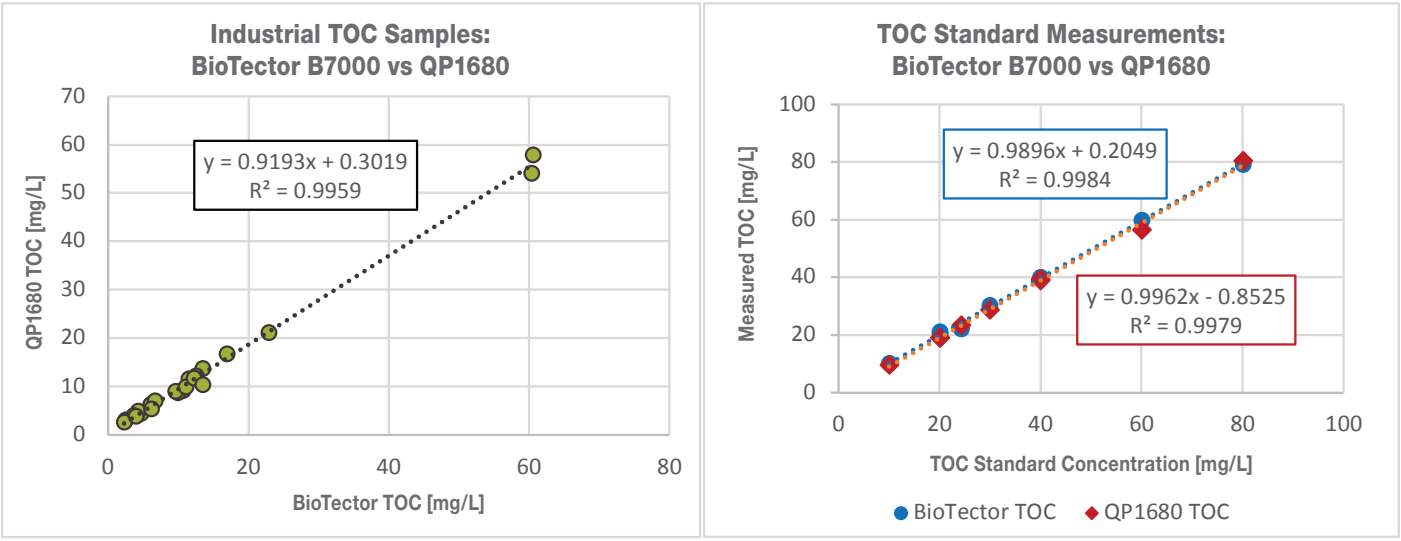

Figure 2. BioTector and QP1680 correlation (left) and TOC standard measurements for each instrument (right)

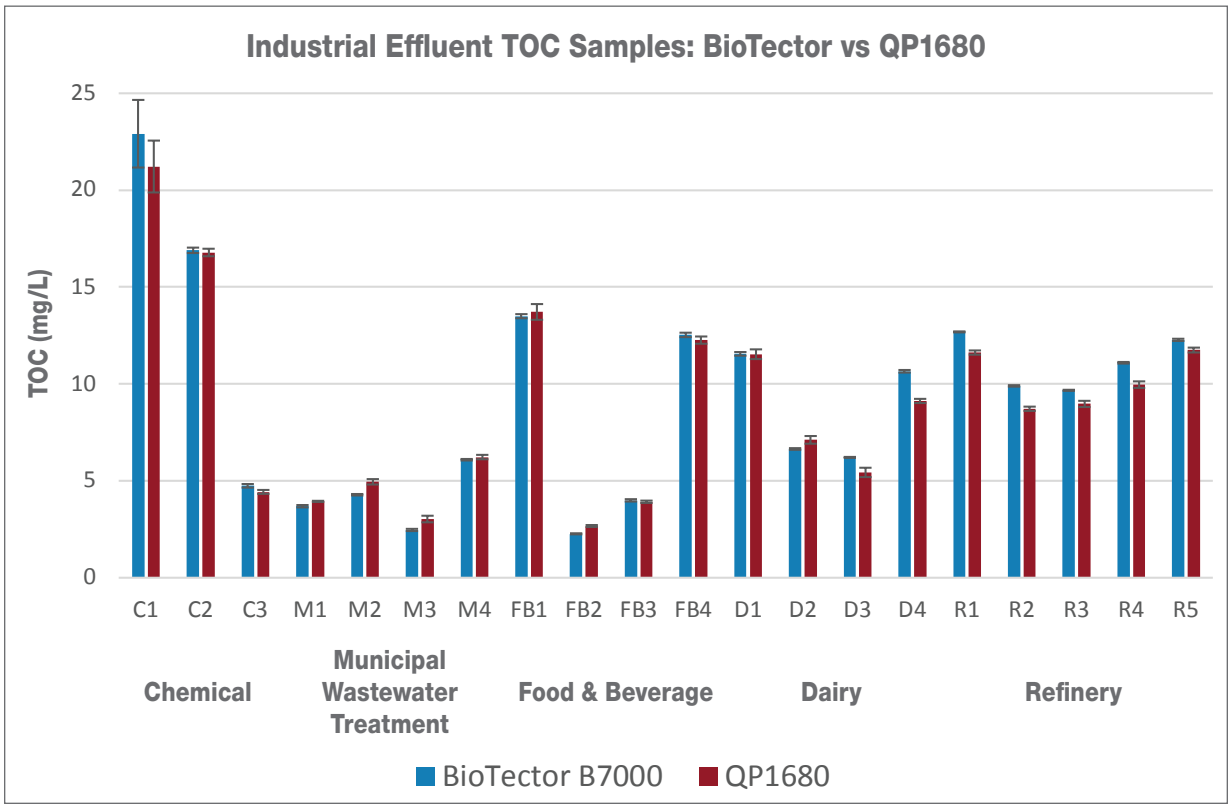

Figure 3. TOC results for Chemical, Municipal WW Treatment, Food and Beverage, Dairy and Petrochemical Refining samples

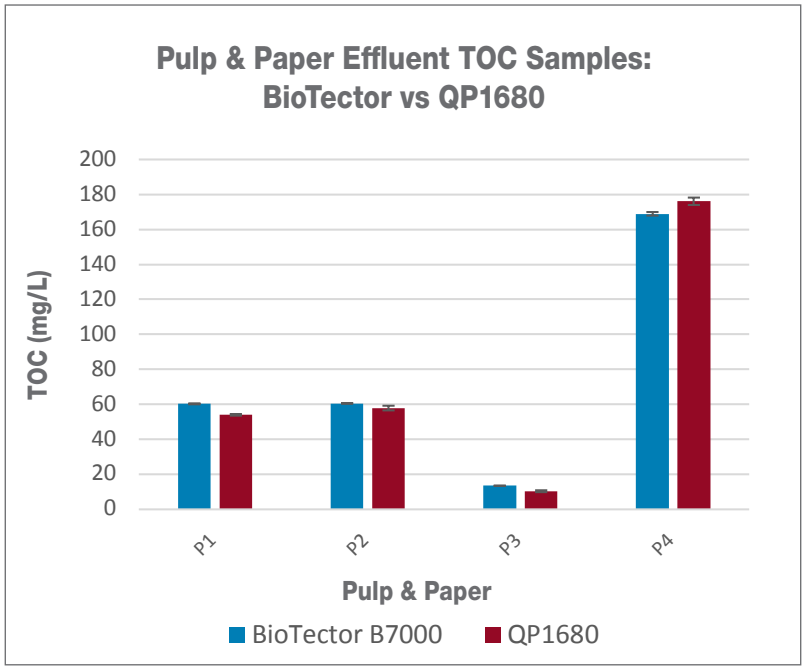

Figure 4. TOC results for Pulp & Paper samples

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