

## Application Note

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### Abstract

The analysis of Total Organic Carbon (TOC) in samples can be difficult due to the variety of sample matrices. Specifically, liquid samples with large particulates can negatively affect TOC instrumentation by blocking liquid-handling system valves and tubing and can lead to significant consumable costs and maintenance downtime. Considering these challenges, Teledyne Tekmar has developed the Lotix Solid Sampler (LSS) Boat to work in conjunction with the Lotix Automated High Temperature Combustion TOC Analyzer for aqueous matrices. The LSS Boat can easily analyze a variety of difficult liquid and solid samples over a wide carbon concentration range with exceptional accuracy and precision.

### Introduction

This study evaluates the LSS Boat's ability to analyze liquid waste samples with suspended particulate matter for the presence of Total Carbon (TC). Instrument accuracy was evaluated as a measure of the LSS Boat's performance. Precision was based on Percent Relative Standard Deviation (%RSD) and evaluated by running samples in triplicate.



### Analytical Procedures

#### Instrumentation Methodology

The LSS Boat uses a quartz combustion tube packed with pre-conditioned cobalt oxide catalyst for oxidation. The default "Solids" method in the TOC TekLink software was used for this analysis.

#### Standard Preparation

##### 10,000 ppmC Stock Standard

1. "Indirect weighing" (weighing by difference) was used to measure 10.625 g of Potassium Hydrogen Phthalate (KHP) into a tared weigh boat. The KHP was then added to a 500 mL volumetric flask filled half way with deionized (DI) water. The flask was then brought to volume.
2. The solution was mixed thoroughly by the addition of a stir bar.

##### Working Calibration Standards

Working calibration standards for a 5-point concentration range of 0.0 – 10,000.0 ppmC were created from the 10,000.0 ppmC stock standard using serial dilutions.

A volume of 20 uL from each standard was injected with a syringe into the quartz boat lined with quartz wool. The volume of standard was then entered into the TOC TekLink software when prompted.

**Note:** Allow time for the quartz boat to cool between injections so the liquid sample does not boil off. This can be done manually by waiting 1-2 minutes or changing the setting for the "boat cool down time" located in the default solids method.

### Sample Preparation

For this study, the samples were analyzed for Total Carbon (TC) content, thus no sample preparation was needed. When measuring for Total Organic Carbon (TOC), simply add a few drops of 1:1 Nitric Acid and deionized water solution to each sample to remove any Inorganic Carbon (IC) that may be present.

### Sample Analysis

1. A sample schedule was created in the TOC TekLink software using the default "Solids" method.
2. A mid-range calibration standard was added to the beginning and end of the schedule to ensure the accuracy of the results.
3. The quartz boat with liquid sample was placed on the LSS Boat sample injector.
4. When prompted by TOC TekLink, the volume/weight of the sample was entered. Once entered, the software automatically moved the sample into the combustion furnace for analysis and the concentration was calculated against the calibration curve.

### Standard Results

The 5-point calibration curve yielded an  $r^2$  value of 0.99991 and low %RSD which can be observed in Figure 1 and Table I.

**Figure 1** TOC TekLink Software Showing Calibration Curve Results

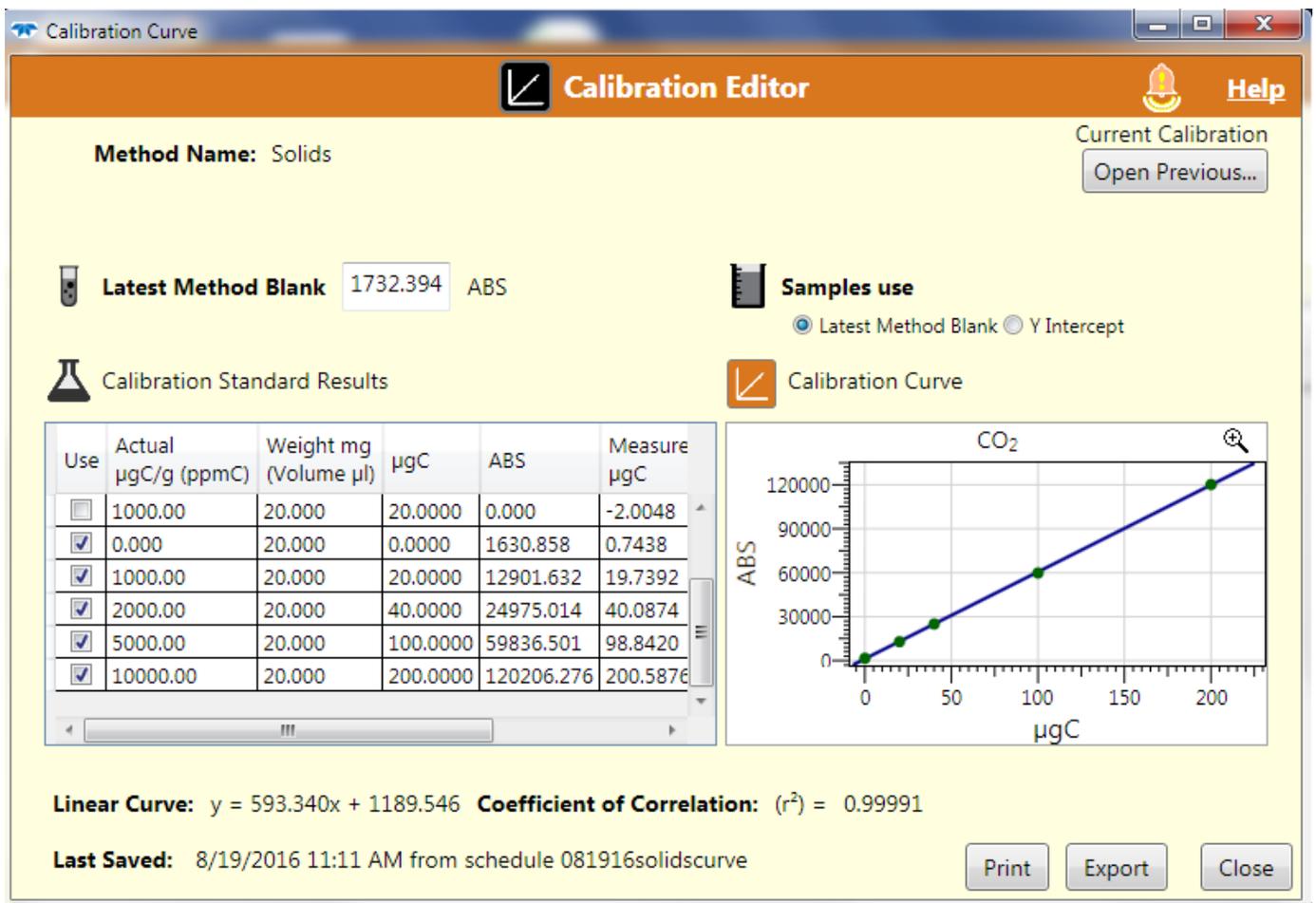


Table I Calibration %RSD in the TOC TekLink Report				
Sample Type	ID	ABS	Std Dev	% RSD
Cal Std	0.0 ppmC	1630.858	1225.686	7.707
Cal Std	1000.0 ppmC	12901.632	115.183	0.893
Cal Std	2000.0 ppmC	24975.014	118.032	0.473
Cal Std	5000.0 ppmC	59836.501	327.119	0.547
Cal Std	10000.0 ppmC	120206.276	1587.992	1.321

### Sample Results

Three liquid samples from an agricultural processing waste water stream were run in triplicate. The results demonstrated <5% RSD. The Check Standard passed with an RSD of 0.7% and was within  $\pm 10.0\%$  of the true value indicating the calibration curve was valid throughout the analysis (Table II). The LLS Boat was able to accommodate an extensive analytical range using a single calibration curve.

Table II Sample and Check Sample Results				
Sample Type	ID	$\mu\text{gC/g}$ (ppmC)	Std Dev	%RSD
Clean	Clean			
Blank	Blank	1729.808 (ABS)	0.000	0.000
Sample	Agr_Sample1	3626.094	87.072	2.401
Sample	Agr_Sample2	8720.752	199.680	2.290
Sample	Agr_Sample3	175.965	8.565	4.867
Chk Std	2000.0 ppmC	1955.659 (Passed)	14.201	0.726

### Conclusion

The Lotix Solids Sampler (LSS) Boat demonstrated accurate and precise results when analyzing difficult liquid sample matrices. Combining the LSS with the Lotix Combustion TOC Analyzer provides a comprehensive analytical solution for TC and TOC analysis in a wide range of liquid and solid sample matrices. Additionally, the LSS mitigates the maintenance and consumable costs associated with analyzing samples with large particulates on traditional aqueous TOC instrumentation. For laboratories who routinely analyze samples containing particulates greater than 0.8 mm in diameter, the LSS boat is a cost-effective and reliable solution.