

Total Organic Carbon (TOC) in Soil Samples

Introduction

Soil carbon which includes both inorganic carbon and organic carbon, plays important role in the carbon cycle so it is significant for environmental issues. Decomposition of animal and plant residues, microorganisms is the main source of the organic carbon in soil [1]. Total organic carbon (TOC) content of the soil is one of the most important constituents of soil because of the capacity to affect agricultural products growth. Therefore, determination of total organic carbon (TOC) in soil is important with regard to agricultural concerns. TOC content of soils can be measured by directly or by difference method ($TOC=TC-IC$) after inorganic and total carbon contents are measured. In this study, total organic carbon (TOC) of six different soil samples were determined by difference method with [Trl-TOC-S analyzer](#).

Principle of operation

Total carbon (TC) and inorganic carbon (IC) measurements were made by [Trl-TOC-S analyzer](#) under the following conditions for six soil samples without any pretreatment.

Table 1: TC and IC Analysis Parameters

Parameters	Total Carbon (TC)	Inorganic Carbon (IC)
Method Mode	TC High Mode	IC Low Mode
Decomposition furnace temperature	850 °C	-
Catalytic furnace temperature	500 °C	-
Acid volume	-	10 mL
Air pressure	2 bar	2 bar
Carrier gas flow rate	3 L/min	100 mL/min
NDIR gas flow rate	100 mL/min	100 mL/min
Detector	NDIR	NDIR

TC Analysis: Samples were carefully weighed in to quartz sample boat without any pretreatment and weights of the samples were input to the Trl-TOC-S software. Quartz sample boats with soil samples were placed in the sample loading car. The sample was automatically moved into the decomposition reactor with the starting of the analysis. The total carbon of the sample was then calculated against the calibration curves created before.

IC Analysis: Pre-weighed sample was put in to standard 40 mL screw cap vials and insert into IC chamber of the instrument then, each sample were acidified with 20 % volume H_3PO_4 to analyze inorganic carbon by Trl-TOC-S.

Results

IC Results: IC results showed that there is no IC in neither of the samples, therefore TC results are equivalent to TOC.

TC Results: TC results and RSD values of soil samples shown in table 2.

Table 2: TC Results of six soil samples

Sample Name	Sample Size	TC Results	Rsd (%)
Sample 1	8000 mg	745 ppm	1.34
	8000 mg	731 ppm	
Sample 2	750 mg	1.283 %	0.16
	750 mg	1.285 %	
Sample 3	500 mg	1.866 %	1.8
	500 mg	1.820 %	
Sample 4	100 mg	13.074 %	0.42
	100 mg	13.152 %	
Sample 5	50 mg	23.277 %	0.20
	50 mg	23.210 %	
Sample 6	30 mg	38.696 %	1.24
	30 mg	38.021 %	

Conclusions

In this study, six different solid soil samples were analyzed in duplicate with [Trl-TOC-S](#) without any pretreatment. According to IC analysis results, there is no IC in the samples so TC is equivalent to TOC in the samples. RSD values of the results are less than %3 in all, even less than % 1 in some showed repeatable analysis. The results shows that Trl-TOC-S provides wide measurement ranges from low ppm high percentage carbon contents.

On the other hand, sample 6 were analyzed by loading 30 miligrams while sample 1 analyzed by loadindg 8 grams that is; Trl-TOC-S can either analyze large size of sample or small amount of sample with high accuracy and reproducibility .

References

[1]: Total Organic Carbon. (n.d). Retrieved May 18, 2016, from http://soilquality.org/indicators/total_organic_carbon.html