

APPLICATION NOTE

AGRICULTURAL CHARACTERIZATION

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 measure by directly or can be determined 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 with Trl-TOC-S 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	-
Air pressure	2 bar	2 bar
Carrier gas flow rate	3 L/min	100 mL/min
Sampling gas flow rate	100 mL/min	100 mL/min

TC Analysis: Pre-weighed samples were put into quartz sample boat without any pretreatment which is inserted in to TC decomposition furnace with sample loading car when analysis start. Each sample were analyzed in dublicate.

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 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 ,calculated by TrI-TOC-S software, of soil samples shown in table 2.

Table 2: TC Results of six soil samples

Sample Name	Sample Size	Raw Data	TC Results	Rsd (%)
Sample 1	8000 mg	27.166	745 ppm	1.341
	8000 mg	26.755	731 ppm	
Sample 2	750 mg	40.635	1.283 %	0.164
	750 mg	40.717	1.285 %	
Sample 3	500 mg	39.573	1.866 %	1.78
	500 mg	38.719	1.820 %	
Sample 4	100 mg	53.337	13.074 %	0.422
	100 mg	53.625	13.152 %	
Sample 5	50 mg	48.054	23.277 %	0.203
	50 mg	47.931	23.210 %	
Sample 6	30 mg	47.945	38.696 %	1.244
	30 mg	47.200	38.021 %	

Conclusions

In this study six different solid soil samples were analyzed in duplicate with TrI-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. All of the analyzes finished in three minutes, RSD values of the results are less than %3 in all, even less than %1 in some showed repeatable analysis. The results shows that TrI-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 loading 8 grams that is; TrI-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