

## APPLICATION NOTE

### AGRICULTURAL CHARACTERIZATION

#### Total Carbon and Nitrogen in Compost

##### Introduction

Compost, which is made from organic matter (leaves, food scraps, etc.), is a popular soil amendment with farmers, growers, landscapers and in residential gardening.<sup>[1]</sup> The compost is very beneficial for the land on several counts, including as a soil conditioner, fertilizer and as a natural pesticide.<sup>[2]</sup> Carbon to nitrogen ratio is a ratio of the mass of carbon to the mass of nitrogen in a substance.<sup>[3]</sup> Organisms which decompose organic matter use carbon as a energy source and nitrogen to build cell structure.<sup>[4]</sup> In the presence of too much carbon, decompositon slows when the nitrogen is used up and some of the organisms die. That is, decomposition takes longer if there is too much carbon. If the energy source, carbon, is less than required amount, this leads to release of ammonia to the atmosphere which should be kept minimum for the compost pile and environment.<sup>[4]</sup> Therefore, this C/N ratio can be very essential in the analysis of and compost and total carbon (TC) and total nitrogen (TN) content of the compost should be firstly known to determine this ratio. High temperature catalytic oxidation method is very common technique for the determination of total carbon and nitrogen in the solid samples. In this study, total carbon (TC) and total nitrogen (TN) analysis of a compost sample ,which comes from a customer, were done by Trl-CN analyzer and in this application report the results of the work are presented.

##### Principle of operation

Total carbon (TC) and total nitrogen (TN) measurements were made with Trl-CN analyzer under experimental parameters in table 1.

**Table 1:** Analysis Parameters

Parameters	Total Carbon (TC)	Total Nitrogen
Method Mode	TC High Mode	TC High Mode
Decomposition furnace temperature	900 °C	900 °C
Catalytic furnace temperature	720 °C	720 °C
Air pressure	2 bar	2 bar
Carrier gas flow rate	3 L/min	3 L/min
Sampling gas flow rate	100 mL/min	100 mL/min
Oxygen flow rate	-	300 mL/min

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

## Results

**TC Results:** TC, TN results and RSD values ,calculated by TrI-CN software, of soil samples shown in table 2 and table 3, respectively.

**Table 2:** TC Results of six soil samples

Repeat Number	Sample Size (mg)	Raw Data	TC Results (%)	Rsd (%)
1	50.0	66.769	40.32	2.79
2	51.0	72.958	42.53	
3	50.5	68.260	40.88	

**Table 3:** TN Results of six soil samples

Repeat Number	Sample Size (mg)	Raw Data	TN Results (%)	Rsd (%)
1	50.0	75.613	1.78	0.64
2	51.0	77.673	1.80	
3	50.0	76.485	1.80	

## Conclusions

In this study, total carbon (TC) and total nitrogen (TN) content of a compost sample was determined with TrI CN analyzer to calculate C:N ratio. According to results C/N ratio was calculated as 23:1. As seen in the results part of the report, result showed high repeability with acceptable RSD values. In the experimental part, in spite of the high carbon content of the samples, high sample loading was achieved with 50 mg sample. Total nitrogen of the compost samples were analyzed with same analyzer by installation of nitrogen analyzer unit module (TN) to TrI-CN analyzer. To conclude, TrI-CN analyzer provides high repeability and accuracy in total carbon and nitrogen anaysis of the solid samples on the same instrument with high solid sample loading.

## References:

- [1]: Compost Quality: Performance Requirements. (n.d.). Retrieved February 4, 2015, from <http://www.calrecycle.ca.gov/organics/products/quality/Needs.htm>
- [2]: Compost. (n.d.). Retrieved May 17, 2016, from <https://en.wikipedia.org/wiki/Compost>
- [3]: Carbon-to-nitrogen ratio. (n.d.). Retrieved May 17, 2016, from [https://en.wikipedia.org/wiki/Carbon-to-nitrogen\\_ratio](https://en.wikipedia.org/wiki/Carbon-to-nitrogen_ratio)
- [4]: Compost Fundamentals: Compost Needs - Carbon Nitrogen Relationships. (n.d.). Retrieved May 17, 2016, from [http://whatcom.wsu.edu/ag/compost/fundamentals/needs\\_carbon\\_nitrogen.htm](http://whatcom.wsu.edu/ag/compost/fundamentals/needs_carbon_nitrogen.htm)