Application Note

Instrument: TruMac® CN

Carbon/Nitrogen in Soil and Plant Tissue

LECO Corporation; Saint Joseph, Michigan USA

Sample Preparation

Samples must be of uniform consistency to produce suitable results. Typically samples should be ground to a fineness of <0.5 mm.

Carbon and nitrogen results for soil and plant tissue materials are generally reported on a dry basis. The materials can either be dried prior to analysis or the moisture content determined and the values corrected. Please see the note addendum at the end of this document for details on drying these materials.

Accessories

528-203 Crucibles

Calibration Samples

502-092 EDTA, 502-642 Phenylalanine, 501-050 Nicotinic Acid

*Analysis Parameters**

Furnace Temperature	1350°C
TE Cooler Temperature	5°C
Dehydration Time	0 seconds
Purge Cycles	3 seconds

**Refer to TruMac Operator's Instruction Manual for Method Parameter definitions.*

Element Parameters

	Carbon	*Nitrogen*
Baseline Delay Time	0 seconds	6 seconds
Minimum Analysis Time seconds	15 seconds	35
Comparator Level**	100.00	100.00
Endline Time	2 seconds	2 seconds
Conversion Factor	1.00	1.00
Significant Digits	5	5
TC Baseline Time seconds	—	10
IR Analysis Stabilize Comparator	0	—
IR Baseline Time	1 second	—

***Comparator Level indicator has been removed from methods as of software version 1.20.*

Burn Profile

Burn Cycle	*Lance Flow*	*Purge Flow*	*Time (seconds)*
1	Off	On	5 seconds
2	On	On	5 seconds
3	On	Off	END

Ballast Parameters

Equilibrate Time	30 seconds
Not Filled Timeout	300 seconds

Aliquot Loop

Equilibrate Pressure Time	4 seconds
High Precision	Yes
High Speed	No

Procedure

1. Prepare instrument for operation as outlined in the operator's instruction manual.
2. Condition the system by analyzing 3 to 5 blanks (crucible is not required).
3. Determine blank.
   a. Enter 1.0000 g mass into Sample Login (F3) using Blank as the sample name.
   b. Place a 528-203 Crucible to the appropriate position of the autoloader.
   c. Repeat steps 3a and 3b a minimum of three times.
   d. Initiate the analysis sequence (F5).
   e. Set the blank following the procedure outlined in the operator's instruction manual.
4. Calibrate.
   a. Weigh ~0.50 g of EDTA calibration sample into a 528-203 Crucible, enter mass and sample identification into Sample Login (F3).
   b. Transfer crucible to the appropriate position of the autoloader.
   c. Repeat steps 4a and 4b a minimum of three times.
   d. Initiate the analysis sequence (F5).
   e. Calibrate the instrument following the procedure outlined in the operator's instruction manual.

   Note: Multi-point (fractional weight or multiple calibration samples) may be used to calibrate if desired. A TruMac can be calibrated using several replicates of a single mass range (nominal 0.50 g) of EDTA utilizing a single standard calibration. The calibration can be verified by analyzing different compounds such as phenylalanine (0.25 g), nicotinic acid (0.15 g) or other reference materials with a similar matrix to the samples being analyzed.
5. Analyze Samples.
   a. Weigh ~0.50 g sample into a 528-203 Crucible; enter mass and sample identification into Sample Login (F3).
   b. Transfer crucible to the appropriate position of the autoloader.
   c. Repeat steps 5a and 5b for each sample to be analyzed.
   d. Initiate the analysis sequence (F5).

Notes

Sample Drying Instructions:

- Soils—Samples should be dried at 105°C for one hour prior to analysis.
- Plant Tissues—Samples should be dried between 80°C and 85°C for two hours prior to analysis.
- If soot (carbon black) is noticed in the primary filter (steel wool filter), reduce the sample mass to prevent soot build-up in this filter. Soot can be produced when larger masses of some sample types are analyzed.

Typical Results

(Based on a single standard calibration with 0.5 g of 502-092 EDTA)

Sample	*Mass g*	*% Carbon*	*% Nitrogen*
Soil 502-308*	0.5155	2.80	0.234
Lot: 1010	0.5052	2.81	0.234
2.77 ±0.06% C	0.5142	2.79	0.233
0.233 ±0.013% N	0.5160	2.81	0.235
	0.5005	2.82	0.236
	0.5008	2.80	0.234
	0.4998	2.82	0.235
	0.5039	2.80	0.233
	0.5006	2.82	0.235
	0.5011	2.80	0.233
	X =	***2.81***	***0.234***
	s =	***0.01***	***0.001***

Sample	*Mass g*	*% Carbon*	*% Nitrogen*
Tobacco 502-082**	0.5021	46.55	2.54
Lot: 1015	0.5055	46.51	2.54
46.3 ±0.40% C	0.5001	46.56	2.54
2.56 ±0.04% N	0.5065	46.71	2.54
	0.5084	46.67	2.54
	0.5020	46.59	2.54
	0.5007	46.53	2.53
	0.5007	46.49	2.53
	0.5010	46.53	2.53
	0.5025	46.47	2.52
	X =	***46.56***	***2.53***
	s =	***0.07***	***0.01***

Soil 502-309*	0.4989	13.34	1.15
Lot: 1010	0.5010	13.35	1.14
13.23 ±0.35% C	0.5051	13.21	1.13
1.13 ±0.03% N	0.5003	13.39	1.14
	0.4978	13.41	1.15
	0.5007	13.28	1.14
	0.5002	13.32	1.14
	0.4996	13.31	1.14
	0.5006	13.26	1.14
	0.5034	13.35	1.15
	X =	***13.32***	***1.14***
	s =	***0.06***	***0.01***

Alfalfa 502-273**	0.5076	45.03	3.70
Lot: 1021	0.5011	44.95	3.69
45.0 ±0.3% C	0.5021	44.98	3.69
3.74 ±0.03% N	0.5074	45.04	3.69
	0.5055	44.90	3.68
	0.5152	44.92	3.68
	0.5345	44.86	3.68
	0.5031	44.85	3.68
	0.5063	44.87	3.68
	0.5040	44.83	3.67
	X =	***44.92***	***3.68***
	s =	***0.07***	***0.01***

Orchard Leaves	0.5025	50.99	2.39
502-055**	0.5011	50.89	2.38
Lot: 1031	0.5032	50.78	2.36
50.7 ±0.3% C	0.5048	51.00	2.37
2.39 ±0.06% N	0.5013	50.83	2.36
	0.5037	51.02	2.37
	0.5018	50.88	2.36
	0.5110	50.84	2.36
	0.5019	50.83	2.36
	0.5047	50.91	2.36
	X =	***50.90***	***2.37***
	s =	***0.08***	***0.01***

**Samples were dried at 105°C for one hour prior to analysis.*
***Samples were dried at 85°C for two hours prior to analysis.*

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