



Application Note 51

Determining the CHN content of soil samples

The determination of the Carbon, Hydrogen and Nitrogen (CHN) content of soil samples is of major interest to environmental and agrochemical laboratories throughout the world. The primary interest is to determine carbon and nitrogen content. Carbon can be determined in both its inorganic and organic forms via acid pre-treatment or temperature differential measurement e.g. at 500 degrees centigrade and 1050 degrees centigrade. It is widely accepted that the organic matter has significant beneficial effects on soils biological, chemical and physical properties. Organic matter directly influences the productive capacity of different soils.. being a major contributor of C as well as N,P and S plus other nutrients. The determination of the N content of soils using a CE440 elemental analyser saves considerable time and cost with no data quality loss as compared with the traditional Kjeldahl nitrogen determination method.



SAMPLE REQUIREMENTS

- Test sample (1- 50milligrams)
- Solid / Sludges
- Test sample should be representative of soil
- Detection limits down to 100ppm

EQUIPMENT

- Exeter Analytical CE440 Elemental analyser
- 6 -7 figure Micro balance

OVERVIEW OF PROCESS

- Samples are combusted via horizontal sample introduction with exothermic flash combustion taking combustion temperature to 1800 degrees centigrade
- Total control of all combustion parameters
- Multiple calibration standards
- Samples run via automated sample introduction along with calibration standards and blanks.
- Instrument software manages acquisition of sample data and calibration
- Steady state detection means no chromatography involved and hence no peak area calculations required
- Linear calibration

Results and discussion

The data reported below was produced from 3 soil samples run in duplicate. All 3 samples were taken from same location at a depth of approximately 15 centimetres within a one metre square area.



Analytical conditions

Combustion temperature 975 °C, exothermic 1800 °C

Reduction temperature 620 °C

Combustion time 60 seconds

Purge time 60 seconds

Samples combusted in high purity tin capsules

Sample	Weight	%C	%H	%N
Ref:1456.5	10-20 mg	2.55 / 2.57	1.05 / 1.07	0.21 / 0.21
Ref:1456.6	10-20 mg	2.52 / 2.54	1.03 / 1.06	0.20 / 0.22
Ref:1456.7	10-20 mg	2.55 / 2.57	1.05 / 1.06	0.22 / 0.23

The results fall within expected values for soil type and the data demonstrates good overall precision and accuracy. The Carbon to Nitrogen (C/N) ratio falls within expected values.

In this application the unique horizontal furnace configuration of the CE440 elemental analyser enabled automated removal of combusted soil residues resulting in enhanced data accuracy and precision. The CE 440 provided complete control over combustion parameters, enabling the often challenging soil samples to be handled with ease. Employing steady state detection, meant with the CE440 there were no complex peak areas to evaluate. Proprietary software algorithms enabled the CE440 to provide the most accurate and precise N data irrespective of soil sample type.

Conclusion

The CE440 elemental analyser has been demonstrated to provide accurate, precise and reliable determination of the Carbon and Nitrogen content of soil samples. The system enables routine analysis of soil samples free of the worry about the issues of residue build up and potential problem of cross contamination from one sample to the next.

EAI

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