Application Note

Instrument: TGM800/TGA801

Determination of Moisture in Soil

LECO Corporation; Saint Joseph, Michigan USA

Introduction

In soil science, hydrology and agricultural sciences, soil water content plays an important role in groundwater recharge and soil chemistry. The amount of moisture or soil water is important as it serves as a solvent and carrier of food nutrients for plant growth. The yield of a crop is more often determined by the amount of water available rather than the deficiency of other soil nutrients. Soil moisture also regulates soil temperature and aids in the chemical and biological activities within the soil. Microorganisms require water for their metabolic activities that are important in releasing nutrients within the soil. Water is also essential for the process of photosynthesis in plants. Monitoring soil moisture on an ongoing basis allows growers to make better informed irrigation decisions. Additionally, the determination of a variety of analytically important constituents within soil (carbon, nitrogen, sulfur, etc.) requires moisture correction utilizing an accurate moisture value.

Thermogravimetric analysis (TGA) is an analytical technique in which changes in sample mass due to changes in physical and chemical properties of materials is measured as a function of temperature and/or time. TGA is commonly used to determine selected characteristics of materials that exhibit either mass loss or gain, due to decomposition, oxidation, or loss of volatile materials such as moisture.

The LECO TGM800 and LECO TGA801 are macro thermogravimetric analyzers designed to determine moisture content of materials using a loss-on-drying technique. Mass loss of the sample is measured as a function of the oven temperature by controlling the atmosphere and ventilation rate. The TGA801 allows up to 19 samples to be analyzed simultaneously and the TGM800 allows for up to 16 samples to be analyzed simultaneously.

Sample Preparation

Samples must be of a uniform consistency to produce suitable results.

Accessories

621-010-236 Small Aluminum Foil Crucibles (1.51 inch Crucible), 621-010-642 Carousel (16 place, TGM800 only), 621-331 Ceramic Crucibles (TGA801 only), 621-011-507 Double Sided Spoon.

Sample Mass ~1.0 g

Method Reference

ASTM D2974-13 Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other organic Soils.

Analysis Time ~1.5 h

General Method Parameters

	TGM800	*TGA801*
Crucible Type	Small Aluminum Foil	Ceramic
Minimum Crucible Weight	0.80000	20.0000
Maximum Crucible Weight	1.20000	30.0000
Crucible Density	0.50	3.0
Lid Density	-	3.0
Sample Type	Other	Other
Sample Density	1.0	1.0
Minimum Sample Weight	0.8000	0.8000
Maximum Sample Weight	1.2000	1.2000

Method Step Parameters

	TGM800	*TGA801*
Step Type	Preset	Preset
Preset Method Step	Moisture	Moisture
Cooling Option	-	Active
Crucible Lids	-	No
Start Temperature	25.0 °C	25.0 °C
End Temperature	110.0 °C	110.0 °C
Ramp Rate	20 °C/min	10.0 °C/min
Hold Time	60 min	60 min
Maximum Time	240 min	240 min
Atmosphere	Air	Air
Flow Rate	5.0 LPM	10.0 LPM
Final Weight	At Constancy	At Constancy
Constancy Window	9 min	9 min
Constancy Level	0.0010 g	0.0010 g

Method Step Calculations

Calculation Type	Custom
Measurement Type	Mass Ratio
Calculation Name	Moisture
Enable Calibration	Disabled (TGA801)
Moisture Calculation*	(((Initial Mass - Moisture Mass)) ÷ Moisture Mass)

**As specified in ASTM D2974-13*

Procedure

1. Create and/or select a method, using the Method Step Parameters listed above, following the procedure outlined in the appropriate Instruction Manual (LECO TGM800 or TGA801).
2. Log in and load samples following the procedure outlined in the appropriate Instruction Manual (LECO TGM800 or TGA801).

Typical Results

	TGM800		*TGA801*	
	Initial Mass (g)	*% Moisture*	*Initial Mass (g)*	*% Moisture*
Soil	1.0290	6.07	1.0105	5.86
502-694 LCRM®	1.0074	6.05	1.0715	5.84
Lot: 1000	1.0210	6.02	1.0152	5.88
	1.0045	5.96	1.0086	5.92
	1.0173	6.05	1.0256	5.90
	Avg =	***6.03***	***Avg =***	***5.88***
	s =	***0.05***	***s =***	***0.03***
Soil	1.0059	9.62	1.0188	9.44
502-814 CRM	1.0064	9.62	1.0108	9.45
Lot: 1002	1.0179	9.63	1.0341	9.45
	1.0146	9.65	1.0311	9.45
	1.0029	9.62	1.0199	9.45
	Avg =	***9.63***	***Avg =***	***9.45***
	s =	***0.01***	***s =***	***<0.01***
Soil	1.0059	2.58	1.0383	2.64
502-962 LCRM	1.0063	2.55	1.0013	2.61
Lot: 1000	1.0093	2.51	1.0027	2.62
	1.0032	2.58	1.0045	2.61
	1.0152	2.55	1.0047	2.59
	Avg =	***2.55***	***Avg =***	***2.61***
	s =	***0.03***	***s =***	***0.02***

TGM800

TGA801

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