Application Note

Instrument: TGA801

Determination of Moisture and Ash in Plant Tissue

LECO Corporation; Saint Joseph, Michigan USA

Introduction

The moisture content of plant tissue is often used to monitor the drying and curing process for commercial plant materials. Monitoring moisture values in plant tissue allows producers to ensure that the drying process meets the required moisture content criteria for a particular plant product. By monitoring moisture content, it is possible to prevent mold and fungal growth from high moisture levels, as was over-drying of plant materials. Both high moisture levels and over-drying lead to plant material deterioration and a reduction in product quality. The ash concentration in plant tissues can be used to evaluate the quality and effectiveness of cleaning and/or separation processing of the plant material. Additionally, the determination of a variety of analytically important constituents within Plant Tissue (Carbon, Nitrogen, Sulfur, etc.) require 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 TGA801 is a macro thermogravimetric analyzer designed to determine moisture and ash content of materials by measuring the change in mass of the sample as a function of the oven temperature while controlling the atmosphere and ventilation rate. The TGA801 allows up to 19 samples to be analyzed simultaneously.

Sample Preparation

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

Accessories

621-331 Ceramic Crucibles, 621-011-507 Double Sided Spoon.

Sample Mass ~1.0 g

Analysis Time ~4.5 h

General Method Parameters

Crucible Type	Ceramic
Minimum Crucible Weight	19.0000
Maximum Crucible Weight	30.0000
Crucible Density	3.0
Lid Density	3.0
Sample Type	Leaf
Sample Density	1.5
Minimum Sample Weight	0.8000
Maximum Sample Weight	1.2000

Method Step Parameters - Moisture

Step Type	Preset
Preset Method Step	Moisture
Cooling Option	Active
Crucible Lids	No
Start Temperature	25.0 °C
End Temperature	80.0 °C
Ramp Rate	6.0 °C/min
Hold Time	120 min
Maximum Time	240 min
Atmosphere	Air
Flow Rate	10.0 LPM
Final Weight	At Constancy
Constancy Window	9 min
Constancy Level	0.0005 g

Method Step Parameters - Ash

Step Type	Preset
Preset Method Step	Ash
Cooling Option	Active
Crucible Lids	No
Start Temperature	80.0 °C
End Temperature	500.0 °C
Ramp Rate	6.0 °C/min
Hold Time	60 min
Maximum Time	240 min
Atmosphere	Oxygen
Flow Rate	10.0 LPM
Final Weight	Constancy
Constancy Window	9 min
Constancy Level	0.0005 g

Method Step Calculations - Moisture

Calculation Type	Preset
Preset Method Step	Moisture
Measurement Type	Mass Ratio
Enable Calibration	Disabled
Moisture Calculation	(((Initial Mass – Moisture Mass)) ÷ Initial Mass)

Method Step Calculations - Ash

Calculation Type	Preset
Preset Method Step	Ash
Measurement Type	Mass Ratio
Enable Calibration	Disabled
Moisture Calculation	(Ash Mass ÷ Initial Mass)

Method Step Calculations - Ash Dry

Calculation Type	Preset
Preset Method Step	Ash Dry
Measurement Type	Mass Ratio
Enable Calibration	Disabled
Moisture Calculation	(Ash*((1 ÷ Moisture)))))

Procedure

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

Typical Results

	Initial Mass (g)	*% Moisture*	*% Ash*	*% Ash Dry*
Alfalfa	1.0347	6.45	9.95	10.63
502-273 LRM®	1.0039	6.46	9.99	10.68
Lot: 1026	1.0209	6.46	9.98	10.66
	1.0110	6.46	9.97	10.66
	1.0167	6.46	10.01	10.70
	Avg =	***6.46***	***9.98***	***10.67***
	s =	***0.01***	***0.02***	***0.03***
Tobacco	1.0242	2.93	9.38	9.67
502-082 LRM	1.0090	2.93	9.43	9.72
Lot: 1018	1.0109	2.91	9.47	9.76
	1.0389	2.91	9.43	9.72
	1.0108	2.93	9.43	9.71
	Avg =	***2.92***	***9.43***	***9.71***
	s =	***0.01***	***0.03***	***0.03***
Orchard Leaves	1.0038	4.13	5.67	5.91
502-931 LCRM®	1.0524	4.20	5.65	5.90
Lot: 1000	1.0092	4.20	5.64	5.89
	1.0040	4.14	5.68	5.92
	1.0776	4.17	5.67	5.92
	Avg =	***4.17***	***5.66***	***5.91***
	s =	***0.03***	***0.02***	***0.01***

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