

Instrument: TGM800/TGA801

Determination of Moisture 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. 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 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

621-010-956 Large Aluminum Foil Crucibles (2.4 inch diameter, TGM800 only) used with the 621-011-237 Carousel (11 place, TGM800 only), 621-010-236 Small Aluminum Foil Crucibles (1.5 inch diameter) used with the 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 to 5.0 g

Analysis Time ~2.5 h

General Method Parameters

| | TGM800 | TGM800 | TGA801 |
|-------------------------|---------------------|---------------------|---------|
| Crucible Type | Small Aluminum Foil | Large Aluminum Foil | Ceramic |
| Minimum Crucible Weight | 0.8000 | 1.1200 | 19.0000 |
| Maximum Crucible Weight | 1.2000 | 1.6800 | 30.0000 |
| Crucible Density | 0.50 | 0.50 | 3.0 |
| Sample Type | Leaf | Leaf | Leaf |
| Sample Density | 1.5 | 1.5 | 1.5 |
| Minimum Sample Weight | 0.8000 | 0.8000 | 0.8000 |
| Maximum Sample Weight | 1.2000 | 5.2000 | 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 | 80.0 °C | 80.0 °C |
| Ramp Rate* | 6.0 °C/min | 6.0 °C/min |
| Hold Time | 120 min | 120 min |
| Maximum Time | 240 min | 240 min |
| Atmosphere | Air | Air |
| Flow Rate | 4.0 LPM | 10.0 LPM |
| Final Weight | At Constancy | At Constancy |
| Constancy Window | 9 min | 9 min |
| Constancy Level | 0.0005 g | 0.0005 g |

Method Step Calculations

| | |
|----------------------|---|
| Calculation Type | Preset |
| Preset Method Step | Moisture |
| Measurement Type | Mass Ratio |
| Enable Calibration | Disabled (TGA801 only) |
| Moisture Calculation | $((\text{Initial Mass} - \text{Moisture Mass}) \div \text{Initial Mass})$ |

**A ramp rate of 20 °C/min can be used, and may speed up the analysis and improve the temperature overshoot without any detrimental effects.*

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. Login and load samples following the procedure outlined in the appropriate Instruction Manual (LECO TGM800 or TGA801).

Typical Results

| | TGM800 (Small Al Foil) | | TGM800 (Large Al Foil) | | TGA801 (Ceramic) | |
|----------------|------------------------|-------------|------------------------|-------------|------------------|-------------|
| | Initial Mass (g) | % Moisture | Initial Mass (g) | % Moisture | Initial Mass (g) | % Moisture |
| Alfalfa | 1.0199 | 6.42 | 5.0104 | 6.45 | 1.0156 | 6.42 |
| 502-273 LRM® | 1.0033 | 6.43 | 5.0387 | 6.44 | 1.0736 | 6.45 |
| Lot: 1026 | 1.0036 | 6.52 | 5.0057 | 6.43 | 1.0371 | 6.46 |
| | 1.0052 | 6.45 | 5.0161 | 6.43 | 1.0801 | 6.44 |
| | 1.0046 | 6.41 | 5.0398 | 6.42 | 1.0738 | 6.42 |
| | Avg = | 6.45 | Avg = | 6.43 | Avg = | 6.44 |
| | s = | 0.04 | s = | 0.01 | s = | 0.02 |
| Tobacco | 1.0460 | 2.78 | 5.0158 | 2.77 | 1.0235 | 2.70 |
| 502-082 LRM | 1.0372 | 2.84 | 5.0173 | 2.73 | 1.0173 | 2.73 |
| Lot: 1018 | 1.0196 | 2.80 | 5.0185 | 2.75 | 1.0036 | 2.71 |
| | 1.0113 | 2.80 | 5.0235 | 2.78 | 1.0656 | 2.68 |
| | 1.0253 | 2.80 | 5.0168 | 2.76 | 1.0206 | 2.69 |
| | Avg = | 2.80 | Avg = | 2.76 | Avg = | 2.70 |
| | s = | 0.02 | s = | 0.02 | s = | 0.02 |
| Orchard Leaves | 1.0603 | 4.18 | 5.0467 | 4.16 | 1.0080 | 4.21 |
| 502-931 LCRM® | 1.0478 | 4.22 | 5.0309 | 4.16 | 1.0223 | 4.29 |
| Lot: 1000 | 1.0373 | 4.24 | 5.0427 | 4.18 | 1.0081 | 4.17 |
| | 1.0315 | 4.24 | 5.0172 | 4.15 | 1.0297 | 4.19 |
| | 1.0301 | 4.28 | 5.0555 | 4.14 | 1.0570 | 4.19 |
| | Avg = | 4.23 | Avg = | 4.16 | Avg = | 4.21 |
| | s = | 0.03 | s = | 0.02 | s = | 0.05 |



TGM800



TGA801

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