Application Note

Instrument: TGM800

Determination of Moisture in Cannabis

LECO Corporation; Saint Joseph, Michigan USA

Introduction

Moisture content can play a vital role in several aspects of the growth and distribution of industrial hemp and recreational cannabis. Moisture content of cured cannabis is an indicator of potential microbial contamination and is a key variable used to calculate other constituent results on a dry basis. Additionally, determination of moisture content is required for the pressing process of extracting CBD oil from cannabis. Improper drying of the cannabis plant during the drug extraction process can lead to mold or fungal infestations, which in turn may pose a risk to the health of the user. Moisture content testing in cannabis is beginning to become a mandatory part of the routine testing process in some areas of the country. Therefore, producers need to have the ability to accurately and precisely determine the moisture content of cannabis throughout the drying and curing process.

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 is a thermogravimetric analyzer designed to indirectly determine moisture content of materials using a mass 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 instrument consists of a computer, an integrated four-place balance, and a multiple sample oven that allows up to 16 samples to be analyzed simultaneously, with a maximum oven temperature of 175 °C.

Method Reference

Modified* USP Monograph 731: Loss on Drying Method
Modified* USP Monograph 921: Water Determination Method

**USP Monograph 731 and 921 indicate that a drying temperature of 105 °C should be utilized. In order to avoid loss of volatile organic compounds during the drying process, an oven temperature of 80 °C was chosen for the analysis of cannabis. Refer to LECO's Pittcon Poster, "Determination of Moisture/Loss on Drying in Cannabis by Various Analytical Techniques", for additional information regarding the choice to utilize an oven temperature of 80 °C.*

Sample Preparation

Samples must be of a uniform consistency to produce suitable results. All cannabis samples were ground using a hand tobacco grinder (cured samples) or a knife mill (uncured/fresh samples). The uncured samples were prepared immediately prior to analysis in order to minimize moisture loss during sample preparation. After preparation, any noticeable seeds were removed prior to analysis in order to improve accuracy and precision.

Accessories

621-010-956 Large Aluminum Foil Crucibles (2.4 inch diameter) used with the 621-011-237 Carousel (11-place Carousel), 621-010-236 Small Aluminum Foil Crucibles (1.5 inch diameter) used with the 621-010-642 Carousel (16- place Carousel), 621-011-507 Double Ended Scoop.

Sample Mass

~1.0 g

Analysis Time (Cured and Uncured)

~2.0 hours

General Method Parameters

Crucible Type	Small Al Foil	Large Al Foil
Minimum Crucible Weight	0.8000	1.1200
Maximum Crucible Weight	1.2000	1.6800
Crucible Density	0.5	0.5
Sample Type	Leaf	Leaf
Sample Density	1.5	1.5
Minimum Sample Weight	0.8000	0.8000
Maximum Sample Weight	3.5000	3.5000

Method Step Parameters

Step Type	Preset
Preset Method Step	Moisture
Cooling Option	Active
Start Temperature	25.0 °C
End Temperature	80.0 °C
Ramp Rate	20.0 °C/min
Hold Time	30 min
Maximum Time	240 min
Atmosphere	Nitrogen
Flow Rate	4.0 L/min
Final Weight	At Constancy
Constancy Window	9 min
Constancy Level	0.0005 g

Method Step Calculations

Calculation Type	Preset
Calculation Name	Moisture
Measurement Type	Mass Ratio

Calculation Equation

(((Initial Mass – Moisture Mass)) ÷ Initial Mass)

Procedure

1. Create and/or select a method using the parameters described above following the procedure in the TGM800 Instruction Manual.
2. Log in and load samples following the procedure outlined in the TGM800 Instruction Manual.

Typical Results

	Initial Mass (g)	*Moisture (%)*
Cured Recreational Cannabis	1.0141	8.11
	1.0251	7.68
	1.0631	8.12
	1.0079	8.27
	1.0303	8.15
	Avg =	***8.07***
	s =	***0.22***
Cured Hemp Cannabis #1	1.0056	7.29
	1.0584	7.53
	1.0357	7.14
	1.0224	7.25
	1.0142	7.27
	Avg =	***7.30***
	s =	***0.14***
Cured Hemp Cannabis #2	1.0925	7.60
	1.0109	7.44
	1.0675	7.68
	1.0459	7.21
	1.0935	7.12
	Avg =	***7.41***
	s =	***0.24***
Fresh Hemp Cannabis #1	1.0312	74.02
	1.0802	74.18
	1.0073	74.16
	1.0026	73.76
	1.1079	73.82
	Avg =	***73.99***
	s =	***0.19***
Fresh Hemp Cannabis #2	1.0252	74.33
	1.2081	73.82
	1.1355	73.84
	1.1024	73.92
	1.0195	73.80
	Avg =	***73.94***
	s =	***0.22***

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