Application Note

Instrument: TGM800

Determination of Moisture in Cheese

LECO Corporation; Saint Joseph, Michigan USA

Introduction

The TGM800 is a thermogravimetric analyzer 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.

An accurate determination of moisture content in cheese provides important information related to the food quality and safety (texture, taste, microbial stability) as well as a key variable used to calculate a products purity, yield, and/or resulting constituent analysis on a dry basis.

Sample Preparation

Sample should be passed through a shredder and of uniform consistency to produce suitable results.

Method Reference

AOAC Official Method 948.12 Moisture in Cheese

Fixed Drying Time Method

With 2.4 in crucible using ~3 g sample mass.

Accessories

621-010-956 Aluminum Foil Crucible (2.4 in Crucible),
621-011-237 Carousel (11 place)

Sample Mass ~3.0 g

Analysis Time ~75 min

Method General Parameters

Crucible Type	Large Foil
Minimum Crucible Weight	1.1200
Maximum Crucible Weight	1.6800
Crucible Density	0.5
Sample Type	Other
Sample Density	1.0
Minimum Sample Weight	2.0000
Maximum Sample Weight	3.5000

Method Step Parameters

Step Type	Preset
Preset Method Step	Moisture
Start Temperature	25.0 °C
End Temperature	130.0 °C
Ramp Rate*	10.0 °C/min
Hold Time	75 min
Maximum Time	180 min
Flow Rate**	5.0 L/min
Final Weight	At End of Step

Method Step Calculations

Calculation Type	Preset
Calculation Name	Moisture
Measurement Type	Mass Ratio

Calculation Equation

(((Initial Mass – Moisture Mass)) ÷ 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 parameters described above following the procedure in the TGM800 Instruction Manual.
2. Login and load samples following the procedure outlined in the TGM800 Instruction Manual.

Typical Results—Fixed Drying Time, 2.4 in Crucible

Sample	*Mass (g)*	*% Moisture*
Colby-Jack	*3.0270*	*39.78*
	3.0135	*39.95*
	3.0438	*39.80*
	3.0572	*39.68*
	3.0616	*39.63*
	3.0376	*39.46*
	3.0220	*39.55*
	Avg =	***39.69***
	s =	***0.17***
Mozzarella	*3.0469*	*48.38*
	3.0318	*49.07*
	3.0364	*48.82*
	3.0232	*48.84*
	3.0406	*48.58*
	3.0361	*48.28*
	3.0695	*48.95*
	Avg =	***48.70***
	s =	***0.30***
Mild Cheddar	*3.0079*	*37.80*
	3.0637	*37.89*
	3.0329	*38.20*
	3.0408	*38.26*
	3.0026	*37.95*
	3.0657	*37.78*
	3.0294	*38.26*
	Avg =	***38.02***
	s =	***0.22***
Parmesan	*3.0037*	*29.67*
	3.0192	*30.02*
	3.0069	*29.47*
	3.0082	*30.09*
	3.0225	*30.25*
	3.0281	*29.85*
	3.0299	*30.00*
	Avg =	***29.91***
	s =	***0.27***

***The TGM800 analyzer was connected to Compressed Air (oil and water free) for the reported moisture analyses.*

Fixed Drying Time Method

With 1.5 in crucible using ~1 g sample mass.

Accessories

621-010-236 Aluminum Foil Crucible (1.5 in Crucible),
621-010-642 Carousel (17 place)

Sample Mass ~1.0 g

Analysis Time ~75 min

Method General Parameters

Crucible Type	Small Foil
Minimum Crucible Weight	0.8000
Maximum Crucible Weight	1.2000
Crucible Density	0.5
Sample Type	Other
Sample Density	1.0
Minimum Sample Weight	0.8000
Maximum Sample Weight	1.2000

Method Step Parameters

Step Type	Preset
Preset Method Step	Moisture
Start Temperature	25.0 °C
End Temperature	130.0 °C
Ramp Rate*	10.0 °C/min
Hold Time	75 min
Maximum Time	180 min
Flow Rate**	5.0 L/min
Final Weight	At End of Step

Method Step Calculations

Calculation Type	Preset
Calculation Name	Moisture
Measurement Type	Mass Ratio

Calculation Equation

(((Initial Mass – Moisture Mass)) ÷ 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 parameters described above following the procedure in the TGM800 Instruction Manual.
2. Login and load samples following the procedure outlined in the TGM800 Instruction Manual.

Typical Results—Fixed Drying Time, 1.5 in Crucible

Sample	*Mass (g)*	*% Moisture*
Colby-Jack	1.0342	40.32
	1.0259	40.09
	1.0145	39.93
	1.0206	39.98
	1.0355	40.03
	1.0426	40.14
	1.0296	40.16
	Avg =	***40.09***
	s =	***0.13***
Mozzarella	1.0244	48.55
	1.0726	49.62
	1.0522	49.09
	1.0273	48.21
	1.0384	49.21
	1.0328	49.29
	1.0317	48.99
	Avg =	***48.99***
	s =	***0.47***
Mild Cheddar	1.0185	38.59
	1.0547	38.33
	1.0675	37.63
	1.0377	38.79
	1.0309	38.70
	1.0172	38.66
	1.0261	38.36
	Avg =	***38.44***
	s =	***0.39***
Parmesan	1.0381	30.57
	1.0081	30.23
	1.0022	30.27
	1.0241	29.98
	1.0220	30.52
	1.0081	30.66
	1.0498	30.50
	Avg =	***30.39***
	s =	***0.24***

***The TGM800 analyzer was connected to Compressed Air (oil and water free) for the reported moisture analyses.*

Mass Constancy Drying Time Method

With 2.4 in crucible using ~1 g sample mass.

Accessories

621-010-956 Aluminum Foil Crucible (2.4 in Crucible),
621-011-237 Carousel (11 place)

Sample Mass ~1.0 g

Analysis Time ~60 min

Method General Parameters

Crucible Type	Large Foil
Minimum Crucible Weight	1.1200
Maximum Crucible Weight	1.6800
Crucible Density	0.5
Sample Type	Other
Sample Density	1.0
Minimum Sample Weight	0.8000
Maximum Sample Weight	1.2000

Method Step Parameters

Step Type	Preset
Preset Method Step	Moisture
Start Temperature	25.0 °C
End Temperature	130.0 °C
Ramp Rate*	10.0 °C/min
Hold Time	0 min
Maximum Time	180 min
Flow Rate**	5.0 L/min
Final Weight	At Constancy
Constancy Window	9 min
Constancy Level	0.0010 g

Method Step Calculations

Calculation Type	Preset
Calculation Name	Moisture
Measurement Type	Mass Ratio

Calculation Equation

(((Initial Mass – Moisture Mass)) ÷ 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 parameters described above following the procedure in the TGM800 Instruction Manual.
2. Login and load samples following the procedure outlined in the TGM800 Instruction Manual.

Typical Results—Mass Constancy Drying Time, 2.4 in Crucible

Sample	*Mass (g)*	*% Moisture*
Colby-Jack	1.0529	40.03
	1.0536	39.89
	1.0557	39.89
	1.0489	39.80
	1.0523	40.02
	1.0609	39.85
	1.0532	39.96
	Avg =	***39.92***
	s =	***0.09***
Mozzarella	1.0383	49.07
	1.0583	48.67
	1.0443	49.24
	1.0587	47.82
	1.0440	49.00
	1.0484	48.43
	1.0221	48.81
	Avg =	***48.72***
	s =	***0.48***
Mild Cheddar	1.0241	38.27
	1.0228	38.12
	1.0583	38.33
	1.0159	38.85
	1.0464	38.99
	1.0822	37.86
	1.0027	38.02
	Avg =	***38.35***
	s =	***0.42***
Parmesan	1.0539	31.54
	1.0225	30.80
	1.0184	30.59
	1.0085	30.36
	1.0565	31.13
	1.0107	30.69
	1.0085	30.89
	Avg =	***30.86***
	s =	***0.39***

***The TGM800 analyzer was connected to Compressed Air (oil and water free) for the reported moisture analyses.*

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