Application Note

Instrument: TGA801

Determination of Moisture and Ash in Pet Food

LECO Corporation; St. Joseph, Michigan USA

Introduction

Determining moisture and ash in pet food is fundamental for quality control, regulatory compliance, and nutritional evaluation. Pet food nutrient guarantees (protein, fat, fiber, etc.) are expressed on an as-fed basis and moisture content affects how these nutrients are calculated. High moisture content often reflects a lower nutrient concentration. To compare different pet food products fairly, nutrients are often converted to a dry matter basis, requiring accurate moisture data. High moisture content in non-canned pet food products can also lead to mold growth, toxin production, and yeast proliferation, which can be detrimental to an animal's health. This is especially important in semi-moist products, fresh/frozen diets, and treats.

The Association of American Feed Control Officials (AAFCO) provides scientific, evidence-based standards and guidelines for pet food definitions, labeling, and nutritional requirements. The FDA and state agencies develop regulations based on the standards and recommendations developed by the AAFCO. These regulations require declared moisture levels not to exceed the guaranteed amount. Moisture overages can trigger label noncompliance, product recalls, and customer complaints, so it is vital that accurate moisture values are obtained.

Ash is the inorganic residue left after combustion of all organic matter and represents the total mineral content, such as calcium, magnesium, potassium, phosphorus, and sodium. These minerals are critical for bone development, metabolism, and electrolyte balances in growing pets. A very high ash content in pet food may indicate soil or sand contamination, poor raw material quality, or excess bone content. Ash content also affects calorie calculations and guaranteed analysis label claims. Determining ash content allows nutritionists to adjust pet food formulations to meet target mineral levels and ensure that regulations are followed. Therefore, ash determination is useful for supplier verification and raw ingredient quality assurance.

Instrument Model and Configuration

Thermogravimetric analysis (TGA) is an analytical technique in which changes in sample mass due to changes in the physical and chemical properties of materials is measured as a function of temperature and 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. Macro TGA systems typically use a nominal one gram sample mass to allow more accurate mass change measurements in heterogeneous materials.

The LECO TGA801 is a macro thermogravimetric analyzer designed to determine moisture, volatile, 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.

*Method Reference**

AOAC 950.46: Moisture in Meat*
AOAC 923.03: Ash of Flour Direct Method*
AOAC 983.18: Meat and Meat Products - Preparation of Test Sample

**A modified version of these AOAC Methods were utilized for the generation of data included in this application note. A reduced sample mass was used to achieve a decreased sample analysis time.*

Sample Preparation

Samples must be of a uniform consistency to produce suitable results. Samples should be prepared in accordance with AOAC 983.18.

Accessories

621-331 Ceramic Crucibles, 621-011-507 Double Ended Scoop.

Sample Mass ~1.0 g

Analysis Time ~3.5 to 6.0 hours

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	Feeds
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	125.0 °C
Ramp Rate	20.0 °C/min
Hold Time	00:30:00
Maximum Time	04:00:00
Atmosphere	Air
Flow Rate	10.0 LPM
Final Weight	At Constancy
Constancy Window	00:09:00
Constancy Level	0.0005 g

Ash

Step Type	Preset
Preset Method Step/Step	Ash
Cooling Option	Active
Crucible Lids	No
Start Temperature	125.0 °C
End Temperature	550.0 °C
Ramp Rate	20.0 °C/min
Hold Time	00:30:00
Maximum Time	04:00:00
Atmosphere	Air
Flow Rate	10.0 LPM
Final Weight	At Constancy
Constancy Window	00:09:00
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)

Ash

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

Ash Dry

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

Procedure

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

Typical Results

Sample	*Initial Mass (g)*	*% Moisture*	*% Ash*	*% Ash Dry*
Pet Food #1	1.0155	2.52	6.36	6.52
Dry Pet Food	1.0148	2.57	6.08	6.24
Select Formula	1.0064	2.57	6.06	6.22
	1.0299	2.54	6.39	6.55
	1.0278	2.56	6.34	6.50
	$\bar{x}$ =	***2.55***	***6.25***	***6.41***
	s =	***0.02***	***0.16***	***0.16***
Pet Food #2	1.0184	3.70	7.37	7.65
Dry Pet Food	1.0046	3.69	7.56	7.84
Ferret Food	1.0507	3.68	7.32	7.59
	1.0084	3.64	7.24	7.51
	1.0740	3.73	7.19	7.47
	$\bar{x}$ =	***3.69***	***7.33***	***7.61***
	s =	***0.03***	***0.14***	***0.15***
Pet Treat	1.0308	25.12	7.66	10.23
Lean Dog Treat	1.0236	25.20	7.29	9.75
	1.0685	25.07	7.57	10.10
	1.0618	25.18	7.22	9.65
	1.0147	25.20	7.82	10.45
	$\bar{x}$ =	***25.15***	***7.51***	***10.04***
	s =	***0.06***	***0.25***	***0.34***
Pet Food #3	1.0213	3.35	13.70	14.17
Chicken Meal	1.0156	3.40	14.81	15.33
	1.0137	3.36	13.71	14.19
	1.1016	3.39	14.03	14.52
	1.0273	3.37	13.60	14.07
	$\bar{x}$ =	***3.37***	***13.97***	***14.46***
	s =	***0.02***	***0.50***	***0.52***
Pet Food #4	1.0733	73.12	2.72	10.13
Canned Dog Food	1.0537	72.72	2.49	9.13
Healthy Blend	1.0657	73.16	2.47	9.20
Chicken and Apple Pâté	1.0806	73.17	2.56	9.54
Label Claim = 78 % Moisture Maximum	1.0400	73.29	2.36	8.85
	$\bar{x}$ =	***73.09***	***2.52***	***9.37***
	s =	***0.22***	***0.13***	***0.49***
Pet Food #5	1.0590	81.94	1.53	8.49
Canned Cat Food	1.0651	81.37	1.57	8.43
Tuna, Salmon, and Sweet Potato in Broth	1.1496	81.68	1.52	8.31
Label Claim = 84 % Moisture Maximum	1.1528	81.77	1.57	8.59
	1.1075	81.75	1.62	8.87
	$\bar{x}$ =	***81.70***	***1.56***	***8.54***
	s =	***0.21***	***0.04***	***0.21***

$\bar{x}$ = Sample Mean; s = Sample Standard Deviation

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