Compositional Analysis
Foodstuff

Dairy

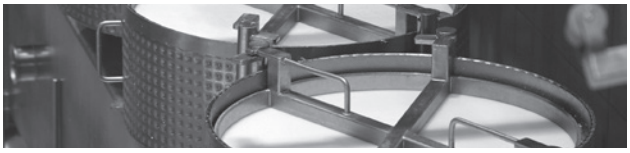
Meat & Poultry

Animal Feeds

Processed Foods

Compositional Analysis
Foodstuff

Industries



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Instruments

SMART 6
Moisture/Solids Analyzer
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Universal Fat Analyzer
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ProFat
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Ash/Bone Content Analyzer
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Who we are

At our core, we are **C**hemists, **E**ngineers, and **M**anufacturers, all under one big roof. Together, we passionately design and develop laboratory instruments that are used by major companies, prestigious research institutes, and universities around the world. We are proud of what we do, and we hope it shows. With over 100,000 instruments sold, you've probably used a product that has been tested with a CEM instrument. That fact motivates us to push harder to create better instruments, to help solve more problems for the scientific community of tomorrow.

Founding Fathers (circa 1980)

Chemist: Dr. Michael J. Collins (**Middle**)
Electrical Engineer: Ron Goetchius (**Right**)
Mechanical Engineer: Bill Cruse Jr. (**Left**)

1978

CEM was founded and launched the world's first microwave drying system as the company's first product

1984

Introduced a rapid microwave muffle furnace which is > 90% faster than traditional muffle furnaces

1985

Introduced ProFat™, a 5 minute fat analyzer for raw meat samples, without the use of chemicals

1989

Introduced ultra-fast cooling quartz-fiber crucible technology for ashing

Greetings.

I feel very fortunate to be living the American Dream. CEM started 40 years ago, in a garage with two other people, and has grown into a major global scientific instrumentation company, now employing over 300 people worldwide. We have shipped more than 100,000 systems, which are being used in laboratories throughout the world. Our success is based on introducing new "disruptive" technologies, which have created significant value for the customers we serve.

We pioneered the field of microwave chemistry, which has been transformational in a number of key markets. Important applications include food testing, microwave digestion for elemental analysis, chemical synthesis for drug development, academic research, and solid phase peptide synthesis. In all cases, our systems have provided speed (hours to minutes), simplicity, and improved performance.

More recently, CEM introduced a new technology that is transforming food compositional testing. Our goal is to provide simple, rapid and direct methods that eliminate extensive calibration and can replace the classical, outdated wet chemistry techniques. Food testing, in particular, will continue to be a major focus of our new product development. CEM remains an entrepreneurial company that is nimble, flexible, innovative, and committed to serving the needs of our customers. We have a passion to be the very best at what we do. I am excited about the future and look forward to working with all of you as we continue to bring major new innovation to the food industry and the various other markets we serve.

Sincerely,

Michael J. Collins PhD
President and CEO

2001

Developed the world's first combined microwave and NMR system for rapid fat analysis

1998

Introduced infrared temperature control with microwave drying

2007

Developed the world's first automated protein analyzer based on a non-toxic dye binding technique

2016

Introduced a second generation NMR technology for fat analysis that eliminated method development

2015

Introduced iPower® technology that reduced microwave drying times up to 40%

2013

Developed a rapid temperature conditioning process for fat analysis by NMR. This reduced preparation time from 20 – 60 minutes, down to only 30 seconds

Dairy Industry

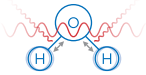
Analysis Solutions

- Moisture/Solids
- Fat
- Protein

The CEM Approach

Our approach is focused on developing the absolute best technique possible for the compositional analysis of dairy products. When using our products, you can have confidence that you will obtain extremely accurate and repeatable results. Compared to reference techniques, our technology is much easier and safer to use. Compared to other rapid techniques, our technology is more accurate and robust, while maintaining very rapid test times. For these reasons, we've sold thousands of compositional analysis systems, used in most of the top global dairy companies.

Key Technologies



iPower

- Dual-frequency drying (the absolute fastest direct method)
- Works on any type of sample (liquid, powder, slurry)
- Eliminates sample burning issues
- Recognized as an AOAC approved method

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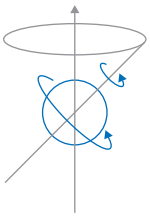

ORACLE NMR

- Rapid and direct fat analysis
- No method calibrations
- Superior to NIR/FT-NIR
- More repeatable than wet chemistry reference methods

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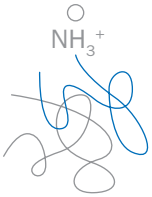


iTag

- Easy 3 minute protein test
- Green chemistry replacement for Kjeldahl
- Not affected by non-protein nitrogen

Learn More: Page 38

Analyze Fluid and Viscous Dairy Products Without Homogenization

- **Avoid complications and recalibrations from clogging and cuvette damage**
- **Match or improve accuracy and precision of FT-IR on any dairy product**

Milk, cream, whey, flavored milk, ice cream, yogurt, quark, sour cream, cream cheese, finished products, and more

Analysis of liquid milk samples has traditionally been performed by FT-IR based methods. This process is based on a transmissive infrared measurement that requires uniform particle sizes to avoid light scattering. For this reason, FT-IR systems utilize an initial sample homogenization to obtain uniform fat globule sizes, while also eliminating entrapment of protein. However, many types of non-standard milk samples now exist, which contain added ingredients that are problematic for the complete homogenization that is essential for FT-IR analysis. This includes milk products containing DHA, chocolate milk, and sweetened or condensed milk. These additives can cause significant wear on the instrument from the need to forcibly pump the sample through an extremely small opening (≤ 50 µm) for measurement.

Incomplete homogenization results in significant costly risks to the instrumentation, as well as affecting sample calibrations from the wearing of the flow cell wall. In fact, complete homogenization is so critical that monitoring by routine light-scattering particle size analysis of homogenized milk samples is recommended when using FT-IR systems[1].

Analysis of these samples by our technology is simple and easy, without the need for any homogenization. Regardless of the type of added ingredients to a dairy sample, the analysis is accurate and repeatable without risk of damage to the instrumentation. Accuracy can match the results of FT-IR, while exceeding less accurate NIR/FT-NIR methods.

[1]Marzo, L.D.; Barbano, D.M.; *J. Dairy Sci.* 99, 9471-9482 **2016**

"We use CEM's SMART 6 with NMR instrument 24/7 for milk based liquid products as well as almond products. The testing is very simple and new hires catch on pretty quickly. It is low maintenance and we rarely see issues with it that cause production to slow down."

Maria Yepez / Assistant QA Manager
HP Hood LLC

"Our CEM SMART 6 and NMR systems have provided consistent and repeatable moisture/solids and fat results for our fluid milks, ice creams, buttermilks, half & half, and heavy cream. It was easier to calibrate and yielded more consistent results than the FT-IR systems I have used in the past. Additionally, the system is simple to use and train new employees."

Timothy Melin / Assistant QA Manager
Upstate Niagara Coop Inc.

"Our infrared (IR) system had difficulties obtaining good calibrations with cultured products, and we also struggled with any flavorings or inclusions (ex. fruit pieces) in our yogurt and other cultured products. Additionally, sample prep of cultured products, needed for infrared (IR) systems, was labor and time intensive, resulting in an overall test time, doubled that of the Gerber method. CEM's NMR technology is easier to calibrate, provides directly measured solids results (as well as fat contents), and does not require dilutions or other significant sample prep. The system gives extremely rapid results, more accurate than our standard method (Gerber) we used for flavorings and inclusions, while also having better precision when used by plant operators."

William E Ellison II / Quality Assurance & Compliance Manager
Kemps Farmington Cultured Products

The Most Accurate Analysis of Semi-Solid and Solid Dairy Products

- **Superior technology compared to NIR/FT-NIR systems**
- **Eliminates recalibrations and results drifting over time**

Cheese, yogurt, butter, cream cheese, dairy powder, whey powder, cheese powder, and more

With mid-infrared (FT-IR) based methods being unable to analyze more viscous dairy products, NIR/FT-NIR has been used as an alternative technology with its fast analysis time. However, a major weakness of NIR is that its signal is based on overtones of the fundamental bands, which reside within the mid-infrared wavelength. Therefore, its signals are weak and difficult to separate, requiring the use of complex method development and calibration. Maintaining accurate results is also difficult as the analysis is susceptible to even small changes in sample composition, which makes NIR use often unreliable.

Our technology overcomes the limitations of NIR technology for compositional analysis of any dairy product, while still being based on simple, safe, and rapid approaches. Moisture/solids results are obtained in minutes by iPower, a dual-frequency drying process that removes moisture and provides a direct measurement. Fat analysis is performed by a revolutionary NMR based process, developed in 2016, that directly and unambiguously detects fat molecules in dairy products. This 30 second method is completely free of calibrations. Additionally, the entire sample is analyzed instead of a small area, which protects against inhomogeneity issues.

"CEM's rapid analysis platforms and excellent customer service have had a positive impact on nearly every aspect of our business, from accounting and quality, to research and development. No other technology has allowed us to achieve these benefits across all our products, from milk and cheese, to concentrated milk powders."

Chalmer Wren IV / Instrumentation Specialist:
Analytical Services
Leprino Foods

"The CEM ORACLE Fat Analyzer has demonstrated the ability to eliminate daily calibrations used with previous technology for a broad range of samples while maintaining high sample accuracy and precision. As one of the global leaders in food testing this is very beneficial for our testing needs."

Timothy Lumb / Chemistry Manager, Food & Pharmaceuticals
ALS

"While using the CEM NMR based system, we have accurate fat and moisture analysis. The CEM NMR based system is convenient and easy to use with repeatability also better compared to other systems. This allowed us to optimize our process by having consistent results from raw to finished product."

Nathan G. Labante / Quality Assurance Supervisor
Saputo Dairy Foods USA, LLC

"We use the CEM SMART with NMR technology for fat and moisture determination in all our ice cream mix produced; raw material and semi-finished materials as well. A considerable time saving and excellent reliability are major advantages of this instrument."

Piero Scotto / Quality Analyst
Unilever Ice-cream Plant (Algida)

"The SMART NMR instrument helps our company because it is very easy and simple for our operators to operate, it requires very little maintenance and the results are precise which saves us time and labor. We use this instrument to test our ice cream mix samples and I would recommend this instrument for other companies."

Bodram Khemraj / Production Manager
Fieldbrook Foods Inc.

Safe and Easy Alternative to Kjeldahl for Protein Analysis

- **No harsh chemicals**
- **Rapid test with minimal training required**
- **Not fooled by adulterants**

The Kjeldahl method has been used for determination of protein content in dairy products since it's development in 1883. This method is undesirable because it requires the use of heated sulphuric acid and sodium hydroxide in a multi-step process. However, it is currently a standard method for reference analysis of dairy products.

Our Sprint® system is a breakthrough for protein analysis of dairy samples. It is an AOAC approved method and has demonstrated great success in replacing Kjeldahl for routine analysis. The system is extremely simple to use, binds only to protein, and doesn't use any harsh or dangerous chemicals.

	CEM Sprint System	Kjeldahl	Dumas Combustion
Sample Types	Any dairy product	Any dairy product	Dry products (powders)
Harsh Chemicals	X	✓	X
Rapid	✓	X	✓
Analyze Entire Sample	✓	✓	✓
Repeatability	High	Lower	Lower
Susceptible to Adulteration	X	✓	✓

"We use the Sprint for protein analysis of a variety of dairy products. The Sprint system is a MUCH safer and simpler way to test protein contents than the method we previously used."

Cynthia Kallstrom / Quality and Technical Manager
Kerry Inc.

"The Sprint has provided accurate and consistent protein determination for our milk products used for cheese production. We love the system and have found it user friendly, efficient, and reliable."

Tracy Kruger / Assistant Laboratory Manager
Lactalis American Group

"The Sprint instrument is very easy to use. Because of this the operator can check the recipe to adjust the production. The final product is always in the specifications since we use the Sprint."

Marie-Eve Gauthier / Quality Supervisor
Parmalat Canada Inc.

"...The plant uses the instrument running over 100 samples on a daily basis to screen & test raw milk, pre-pasteurized standardized milk, whey permeate and finished products such as yogurt & ice cream. The Sprint unit has excellent repeatability and is invaluable in terms of maximizing profitability & obtaining consistency in terms of maintaining the standard specifications of finished products & raw materials."

Roland Klimm / Director of Cultured Products
Fairlife, LLC

"The Sprint is used to determine the protein content of incoming ingredients, intermediate products/work in progress, as well as finished products. It has been a very helpful instrument in providing process control for our products."

Laura Sinclair / Corporate QA Manager
Gay Lea Foods Co-operative Ltd.

Meat & Poultry Industry

Analysis Solutions

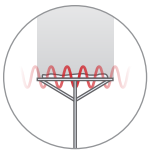
- Moisture
- Fat
- Protein
- Bone/Ash Content

Simple Solutions for Rapid Moisture, Fat, and Protein Determination.

We pride ourselves in our offerings of uniquely beneficial solutions for rapid and accurate testing of meat products. We provide simple analyses for rapid moisture, fat, and protein determination, and we avoid the challenges that meat-based compositions present for near infrared-based techniques.

For fat or chemical lean (CL) analysis, our ORACLE™ system can completely eliminate the need for reference chemistry, as no method development or reference samples are needed. The ORACLE system eliminates the challenges and costs associated with continuous validation of near infrared-based techniques. Those inferior techniques are calibrated with complex chemometrix (PLS, ANN) with large numbers of reference calibration samples.

Key Technologies



ProFat Fat Analysis

- Rapid and accurate fat analysis for raw/pre-blended meat
- Analyzes the entire sample
- Ready to use methods without calibrations
- More accurate than in-line processes (X-ray/NIR)

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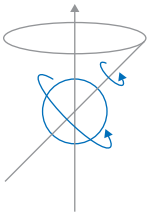

ORACLE NMR

- Rapid and direct fat analysis
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  More repeatable than wet chemistry reference methods

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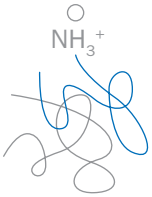


iTag

- Easy 3 minute protein test
- Green chemistry replacement for Kjeldahl
- Not affected by non-protein nitrogen

Learn More: Page 38

Microwave Muffle Furnace

- Rapid and easy bone/ash content determination
- Results in only 15 minutes
- Direct bone determination

Learn More: Page 40

Maximize Profit with Raw Beef & Poultry

- **Direct method that analyzes the entire sample**
  - *Minimize lean meat giveaway/optimize chemical Lean value*
  - *Confidence in raw material specification*
- **Compact at-line solution with results in 2 minutes**

Obtaining an accurate and fast fat determination in raw meat and poultry products is of critical importance for maximizing profitability. This allows manufacturers to more precisely control their raw material and blending costs by minimizing use of more expensive lean meat.

Our ProFat system provides an extremely powerful method for fat determination. In contrast to NIR based methods, the ProFat analyzes an entire sample up to 5 grams. The system features a rapid 2 minute test, and can be easily placed at-line.

Its use of an extremely accurate AOAC based drying process, and its ability to analyze an entire sample, allows it to produce results with significantly better accuracy than any NIR based process. The testing process is as simple as spreading the sample on a pad and pressing “START”.

"We are a large ground beef processor in Wisconsin. We like the ProFat because it is easy to use & more accurate on fat results."

Sue Stuckart / QA Manager ER
American Foods Group

"We are a ground beef processor and use the CEM ProFat system to measure fat contents. We find the ProFat to give us quick and accurate fat results and we no longer have to use hazardous chemicals to determine our fat contents."

Kerry Pozulp / Plant Manager
Cherry Meat Packers (Chicago, IL)

"Currently we use the CEM ProFat machine to check fat on ground turkey products. The quality of accuracy and speed of the machine works very well with our production demand. We would highly recommend this machine."

Sandy Tauer / QC Manager
Turkey Valley Farms (Marshall, MN)

"DG Foods, LLC has used the ProFat system for over 5 years. The machine has accurately provided quick results, allowing us to produce a quality poultry product and maintain production efficiency. We have been pleased with the machine and CEM customer service."

Shantay Thompson / Quality Manager
DG Foods, LLC

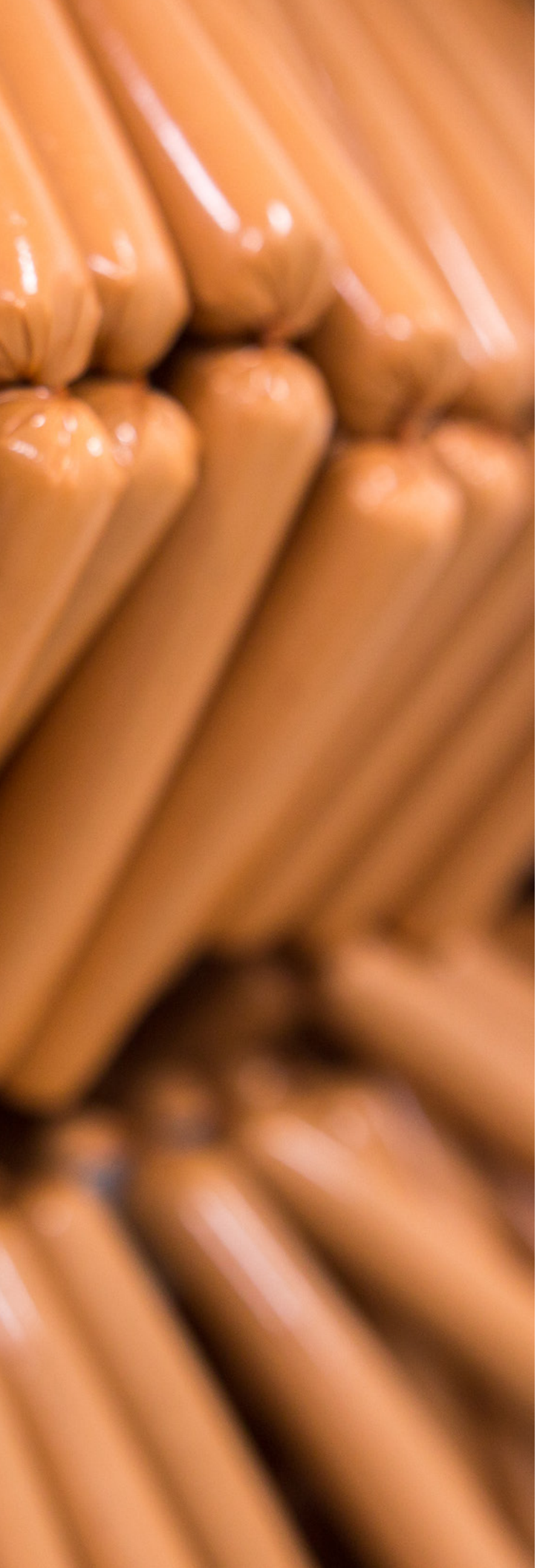
The Gold Standard for Least Cost Formulation

- **Best in class technologies available for moisture, fat, and protein**
- **Push fat to the maximum allowable limit**
- **Optimize moisture/protein ratio**

Meat processors are faced with significant economic pressures to maximize narrow margins in an environment with fluctuating prices and availability of raw materials. Least Cost Formulation (LCF) is an important tool for optimizing low cost materials in products that allow the least cost, which still meets required ingredient constraints. Using LCF means that ingredient composition can be fluctuating to achieve the most cost effective production route.

Our technology is ideal in LCF processes, as it maintains rapid and accurate results for product testing as ingredients change. The ORACLE NMR system requires no methods or calibrations for fat analysis of any processed or raw meat sample. No matter how your ingredients or composition changes, you can be confident you are getting an accurate fat result in less than 5 minutes. This is ideal for products such as hot dogs, and sausages, where the compositions can constantly change. The ORACLE provides the unparalleled ability to push fat levels to the limit under any formulation. This is a significant benefit for profitability.

As a separate advantage, our technologies allow unmatched confidence in maximizing added water. Our iPower technology, used in the SMART 6™ system, provides a direct and rapid (< 3 min) moisture analysis for processed and raw meat samples. Complementary to this, our Sprint system allows for rapid (< 3 min) protein detection in processed meat samples. These tools used individually or together, provide profitability by improving moisture/protein ratio and maximizing allowable added water.



"When the time came to replace an NIR based system, I opted for a CEM system. The main reason was the calibration process required for the NIR system being very labor extensive (~ 100 samples per product type) and we have several product types with various fat ranges. The economical aspect was also a factor in our purchase decision because of the added cost of calibration process with the NIR." (Rose Packing manufacturers sausage, hams, bacon, and cured meat products)

Maria Maris / QC Manager
Rose Packing

"The Sprint unit is both easy to use and an efficient, clean use of our time in the lab. Successful operation of the unit, by new team members can be learned quickly. The unit itself is able to keep up with the high volume of meat samples (including hot dogs, sausage, hams) we need to analyze every day, without producing any hazardous fumes or waste into the environment."

Ryan Krenke, Sr Supervisor / Food Safety & Quality Assurance, Prepared Foods Division
Tyson Foods

"The CEM NMR fat analyzer runs all our samples quickly and efficiently. It is easy to use even for new technicians in training. Klement's uses this instrument every day for all meat samples to assure customers and auditors we accurately monitor the fat percentage in all products. The CEM Sprint system has also allowed us to quickly and easily measure protein in our products." (Klement Sausage Co. produces a variety of meat products including fresh, cooked, summer, and bologna sausages).

Sarah Goran/ Quality Assurance Supervisor
Klement Sausage Co., Inc.

"Tip Top Poultry uses CEM's systems for moisture, fat, and protein testing in a variety of raw and cooked chicken products. We prefer CEM's NMR technology over NIR for fat analysis and have found the technology effective, reliable, and rapid. Additionally, the Sprint system has saved us considerable money by allowing us to test protein in house. We conduct comparison sample testing using other method(s) or an outside laboratory and CEM's results are consistent."

Jana Weidemann / Technical Service Director
Tip Top Poultry

The Most Accurate Analysis of Animal Feeds.

- **Eliminates calibrations and methods for fat analysis of wet pet food and kibble**
- **Rapid 10 minute ash determination**
- **Rapid, simple, and green process for protein determination of wet pet food**

Animal Feeds Industry

Analysis Solutions

- Moisture
- Fat
- Protein
- Ash Content

The animal feeds industry is being subjected to increased regulation every year, and is becoming one of the most competitive markets in the food industry. Every manufacturer needs to ensure their product not only meets required regulations, but is economically viable so it can be offered at a competitive price.

Our technology provides the best in class determination of moisture, fat, protein, and ash content in animal feeds.

"This new equipment (SMART 6 with CEM's NMR for Moisture and Fat in wet pet food) give us full satisfaction both in terms of its speed and reliability of the results. It fully meets our needs for the production management and for the requirement level of our product's quality."

Cyril GINHOUX / Quality Coordinator
Nestlé Purina Plant (France)

"The CEM NMR and SMART microwave drying technology is invaluable to us in producing our fish products. We can test our product rapidly during production for moisture and fat, to ensure our product is in specification for our customers. Compared to other rapid techniques such as infrared (NIR), NMR provides a precise rapid moisture and fat results. We would highly recommend using CEM's technologies for moisture and fat analysis."

John Emerson / Quality Supervisor
Channel Fish Co. Inc.

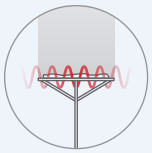
"Our fat results have been much more accurate with CEM's NMR technology than by NIR for our wet pet food. The Phoenix allows us to rapidly and accurately determine ash levels of cat food to meet required minimum levels much faster than a traditional muffle furnace. Similarly, the Sprint system has provided us rapid protein testing while also being a green replacement for Kjeldahl."

Betty Prouty / QA Lab Tech Lead
Performance Pet

"In the last two years, we have implemented CEM's SMART and NMR technology at various stages in processing orders and have realized an 85% reduction in rejections. CEM's technology provides benefits not possible with other technologies such as near infrared (NIR). This has increased our sales and productivity as well as strengthened our reputation in the pet food industry."

John Pittman / Operations Manager
Cannon Holdings LLC

Key Technologies



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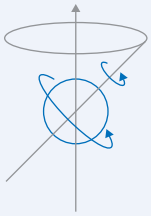

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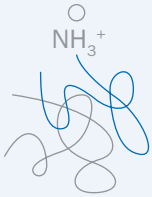

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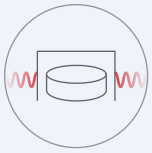

Microwave Muffle Furnace

- Rapid and easy ash content determination
- Results in only 15 minutes
- Extremely accurate

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Processed Foods Industry

Analysis Solutions

- Moisture
- Fat
- Protein

Extremely Accurate and Repeatable Results.

Processed Food encompasses a wide variety of products. Analysis can be complex, and the products can contain a wide variety of changing ingredients. Our systems are uniquely positioned to provide the most accurate and repeatable results, regardless of product reformulations or ingredient changes.

Compared to reference techniques, our technology is much easier and safer to use. Compared to other rapid techniques, our technology is more accurate and robust, while maintaining very rapid test times. For these reasons, thousands of CEM instruments are used around the world.

Key Technologies

iPower

- Dual-frequency drying (the absolute fastest method)
- Works on any type of sample (liquid, powder, slurry)
- Eliminates sample burning issues
- Recognized as an official method

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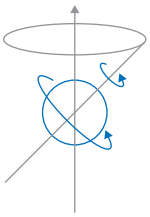

ORACLE NMR

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Processed Foods Industry | Sample Types

- Alfredo Sauce
- Almond Milk
- Bar Layers
- Batter
- Bean Flakes
- Beef Boullion Powder
- Beef Tallow
- Beer Stillage
- Beer Syrup
- Bologna
- Butter
- Butter Beans
- Caramel, Soft
- Cheese Loaf
- Cheese Sauce
- Cheese Slices
- Cheese Slices, Imitation
- Cheese Sticks
- Chicken, Breaded
- Chicken Paste
- Chickpeas
- Chili
- Chocolate
- Chocolate Pudding
- Chocolate Whey Powder
- Cinnamon Powder
- CMP Slurry
- Coffee Creamer
- Coffee Extract
- Coleslaw
- Cookies
- Corn Feed
- Corn Mash
- Corn Slurry
- Corn Syrup
- Corn, Raw
- Cornbread
- Cottage Cheese
- Cottage Cheese Dressing
- Cranberries
- Cream Cheese
- Creamer Mix
- Creamer, Non-dairy
- Croutons
- Custard
- DDGS, Corn
- DDGS, Rice
- Dietary Foods and Supplements
- Donuts
- Dough
- Dry Potatoes
- Egg Whites
- Eggnog
- Eggs
- Emulsifier, Powdered
- Farmers Cheese
- Fish Meal, Cod and Pollock
- Fish, Breaded
- Flavored Yogurt
- Flour
- Fondant
- Frappuccino®
- French Onion Dip
- French Toast
- Fructose
- Fruit Peel
- Glaze
- Graham Cracker
- Greek Yogurt
- Guacamole
- Honey
- Infant Formula
- Jerky
- Ketchup
- Lactose Powder
- Lactose Liquid
- Lard
- Licorice
- Macaroni and Cheese
- Maltodextrin
- Margarine
- Mayonnaise
- Mink Feed
- Mousse
- Mushroom Sauce
- Nutrition Bar
- Nutrition Drink
- Onion Rings
- Orange, Solids and Peel
- Parmesan Cheese
- Peanut Butter
- Pectin
- Pepper
- Pet Food, Dry
- Pie Dough
- Pie Filling
- Pizza Dough
- Pork Broth
- Potassium Carbonate
- Potato Chips
- Potatoes, Dehydrated
- Potatoes, Frozen
- Potted Meat
- Poultry Meal
- Pretzel
- Pudding
- Pumpkin
- Ravioli
- Raw Meat
- Raw Meats, Calculated Protein
- Refried Beans
- Rice
- Rice Flour
- Ricotta Cheese
- Roux
- Salad Dressing
- Sorbet
- Sour Cream
- Soy Curd
- Soy Milk
- Soy, Flour
- Soy Products
- Soybean Oil
- Soybeans
- Starch
- Stillage, Whole
- Sunflower Seeds
- Sweet Whey Powder
- Sweetened Condensed Milk
- Tofu
- Tomatoes
- Tomato Paste
- Tortilla Chips
- Turkey, Mechanically Separated
- Vegetable Powder
- Whey
- Whey Cream
- Whey Powder
- Whey, Crystallized
- WPC Powder
- WPC/WPI
- Yogurt
- Yogurt with Fruit
- Yogurt, Flavored

"We use the CEM SMART and NMR technology to test moisture and fat on our mayonnaise and salad dressings. These systems have allowed us to accurately control the oil in our products which has saved us money. We would highly recommend CEM's technology for moisture and fat analysis."

Kathy Crean / QA Supervisor
Ventura Foods LLC

"CEM's SMART 6 and ORACLE have given us the flexibility and the accuracy we have been looking for in a rapid test. Comparative studies show CEM's SMART and NMR technology are both accurate and precise for moisture and fat determination. We would highly recommend CEM's technology for providing reliable and quick results we can trust." (FITCO manufactures high quality poultry-based ingredients)

Dannielle Price / Lab Manager
FITCO: Food Ingredients Technology Co.

"We prefer CEM's SMART and NMR for fast, accurate and easy to use solids and fat testing. CEM's technology consistently provides accurate results and we would highly recommend its use for food testing." (KanPak tests soft serve ice cream, nutritional drinks, iced cappuccinos)

Zach Lancaster / QA Lab Manager
KanPak LLC

"The CEM SMART/NMR moisture/solids and fat testing system is a wonderful instrument. It allows us to analyze our products accurately, quickly and consistently even with the variety of products we test. Using no chemicals is a benefit, maintenance of the equipment is very low, and CEM provides excellent support. We would highly recommend this instrument for fat and moisture analysis. (Mullins Food Group manufactures high quality sauces, ketchup, dressings, and spreads)

Charlie Wind / Harold Gause

Quality Assurance Director/Lab Manager
Mullins Food Products Quality Systems

"CEM's SMART 6 and NMR technology are accurate, fast, reliable, and easy to use. CEM provides top notch customer service and installation. I would recommend this product to anyone needing moisture, solids, and fat capabilities." (C.F. Sauer Company is a top producer of spices, flavoring extracts, and other food products)

Skyler Walling / Asst. Quality Manager
C.F. Sauer Company

SMART 6 Moisture/Solids Analyzer

Dual-frequency drying is the gold standard in moisture/ solids analysis.

Overview

The SMART 6 is the most technologically advanced system in the world for rapid moisture/solids analysis. The system is based on the revolutionary new breakthrough called iPower for sample drying. This patented dual-frequency heating energy source provides the most rapid and complete drying available, for the widest range of sample types.

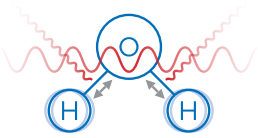
Features

- Up to 40% faster than CEM's SMART 5
- Analyze both dry and wet products on 1 system
- Pre-programmed methods for all sample types
- Compact and lightweight for easy at-line placement

Validation

- 985.14 (AOAC)
- AOAC 2008.06
- AOAC PVM 1.2004

Over 11,000 moisture analyzers sold worldwide

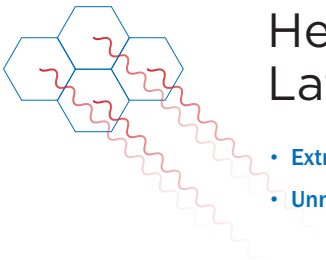


iPower

- **Analyze wet and dry samples**
- **Eliminates surface burning**
- **Reduce testing time**

Dual-Frequency Drying

iPower is an innovative drying process based on the use of a dual-frequency energy source controlled by an intelligent processing system. This prevents burning and incomplete drying, which can arise from other heating technologies. The result is a direct method for virtually any type of sample, with faster drying than traditional microwave and infrared based systems.



Hexagonal Lattice

- **Extremely uniform drying**
- **Unmatched reproducability**

Collimated Energy

Stray infrared irradiation can negatively impact sample temperature readings with the use of infrared temperature sensors.
SMART 6 has a unique honeycomb lattice, providing collimated infrared irradiation for sample heating, thereby avoiding stray light. This provides highly accurate temperature control.

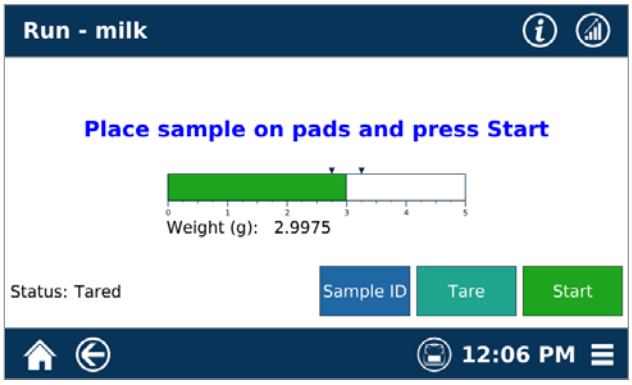
Time Comparison

		SMART 6			SMART 5 Turbo	
Food	**Reference**	**SMART 6 Time Savings**	**Results**	**Time**	**Results**	**Time**
Beef (Raw)	67.82% (M)	43%	67.82% (M)	1:57	67.93% (M)	3:26
Cheese (Powder)	2.94% (M)	NEW	2.86% (M)	2:29	iPower required	N/A
Cheese (Slices)	46.78% (M)	39%	46.51% (M)	1:29	46.49% (M)	2:25
Cream	41.93% (S)	23%	41.91% (S)	1:46	41.75% (S)	2:18
Chicken (Raw)	73.05% (M)	43%	72.88% (M)	2:02	72.96% (M)	3:35
Ham (Deli)	73.85% (M)	39%	74.10% (M)	2:08	74.12% (M)	3:29
Hotdog, Beef	53.53% (M)	42%	53.27% (M)	1:47	53.34% (M)	3:05
Ice Cream	41.38% (S)	24%	41.35% (S)	1:43	41.22% (S)	2:16
Pectin	4.32% (M)	NEW	4.31% (M)	5:32	iPower required	N/A
Sour Cream	26.31% (S)	34%	26.56% (S)	2:10	26.29% (S)	3:16
Vegetable (Powder)	3.73% (M)	NEW	3.66% (M)	3:37	iPower required	N/A
Vitamin E (Powder)	2.20% (M)	NEW	2.25% (M)	3:10	iPower required	N/A
Whey (Powder)	2.65% (M)	NEW	2.72% (M)	5:07	iPower required	N/A
Yogurt	12.55% (S)	41%	12.70% (S)	1:23	12.67% (S)	2:21

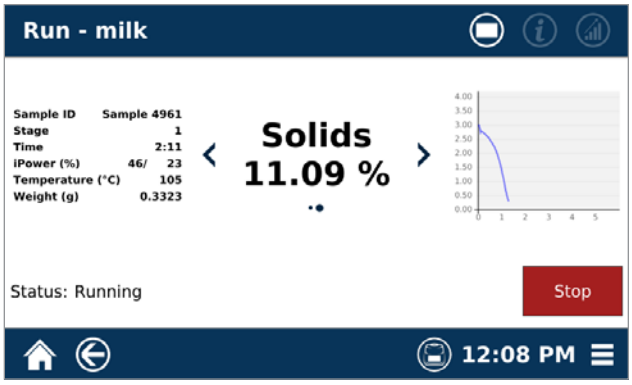
System Comparison

	SMART 6	SMART 5 Turbo
Removal Species	Free + Bound Moisture Polar + Non-Polar	Free Moisture Polar Volatiles
Moisture/Solids Range	0.01 to 99.9%, 0.01% resolution (optional 0.001%)	0.01 to 99.9%, 0.01% resolution (optional 0.001%)
Drying Energy	Dual-frequency Electromagnetic Irradiation (iPower)	Microwave Energy
Temperature Control	Infrared	Infrared
Balance	• 23 grams capacity • 0.1mg readability	• 23 grams capacity • 0.1mg readability
Thermal Nulling (Bouyancy Compensation)	Enhanced with iPower	Standard
Display	7-inch capacitive LCD touchscreen (800 x 600)	Black and White VGA (320x240)
Program/Data Storage	Unlimited	100 methods, 300 results
Data Analysis	Advanced	Standard
System Wake-up	Proximity Detection	Push Button
Exhaust	15,600 RPM (adaptable with speed control)	3,100 RPM (non-adaptable)
Electrical	• 115 VAC, 60Hz, 15 Amps • 220-240 VAC, 50Hz, 10 Amps • 100-200 VAC, 50/60Hz, 15 Amps	• 110-127 VAC, 60Hz, 10 Amps • 220-240 VAC, 50/60Hz, 5 Amps • 100 VAC, 50/60Hz, 10 Amps • 200-208 VAC, 50/60Hz, 5 Amps
Footprint	• 13.0 (W) x 23.0 (D) in (299 in2) • 33.0 (W) x 58.5 (D) cm (1931 cm2)	• 22.0 (W) x 23.3 (D) in (513 in^2) • 55.9 (W) x 59.1 (D) cm (3304 cm^2)
Weight	62 lbs (28 kg)	68 lbs (31 kg)

Easy-to-Use



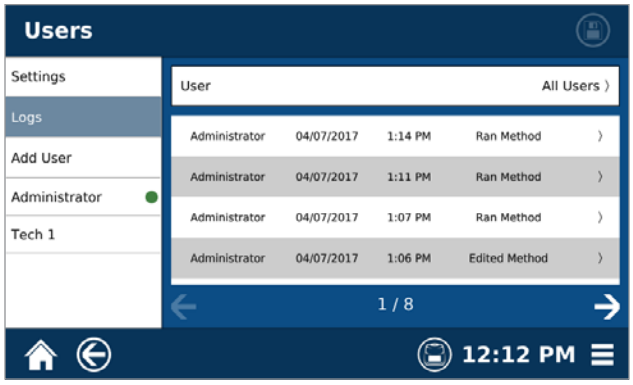
Simply add sample to balance and press “Start”.



Access real-time run data.

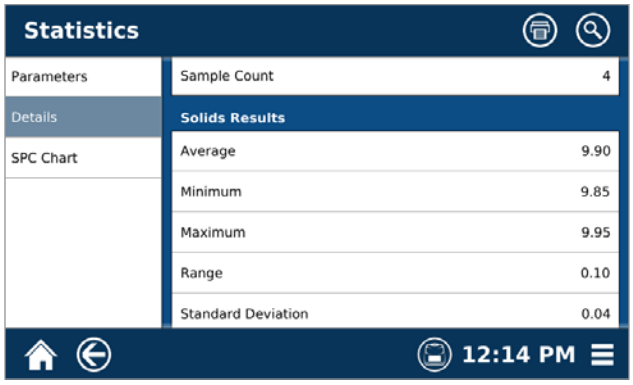
Full 21 CFR Part 11 Compliance

Protect data and methods with a hierarchy of user levels.

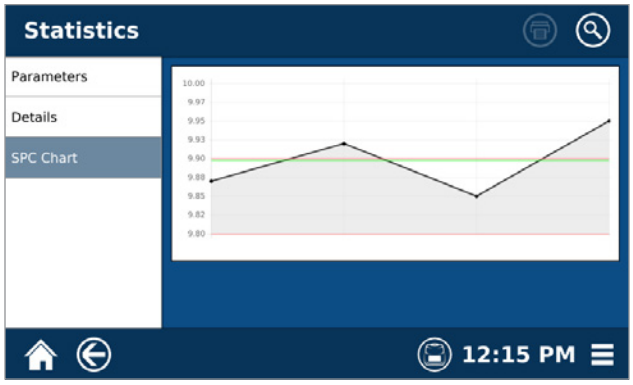


Review a complete audit trail with printable records.

Monitor Production Trends



Create SPC charts with user specified limits.



Visualize trends directly on SMART 6 or LIMS network.

Internal Printer

Thermal impact printer for printing sample results directly from the SMART 6. The printer is located inside the unit thereby not requiring extra space.

Monitor Kit

Specialized solution with measured reference value for verifying SMART 5 or SMART 6 system performance.

AutoCal

Simple and fast NIST traceable calibration for SMART 5 or SMART 6 IR temperature sensors.

Exhaust Tubing

Exhaust tubing that can be connected to the back of the SMART 6 to remove volatile fumes to a desired location.

ORACLE Universal Fat Analyzer

The first ever rapid fat analyzer with no method development.

Overview

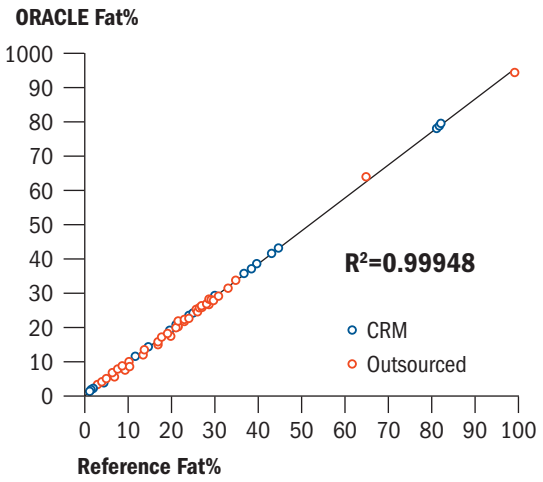
ORACLE is the first ever rapid fat analyzer with **No Method Development**. It can analyze any food sample in less than 30 seconds, and offers unmatched repeatability versus wet chemistry techniques. This is based on a revolutionary advancement of NMR technology developed in 2016 that completely isolates detection of protons on fat molecules from all other NMR signals. To date, this performance has not been achieved with existing rapid technologies (NMR, NIR, FT-NIR).

Features

- Analyze virtually any food product without wet chemistry
- No method development
- More repeatable than extraction techniques
- Options for rapid moisture/solids and sample automation (up to 100 samples)

Validation

- AOAC Official Method 2008.06 (Moisture and Fat in Meats)
- AOAC PVM 1:2004 (Moisture/Solids and Fat in Dairy Products)



Accurate Fat Results in 30 Seconds

ORACLE was verified with over 30 Certified Reference Materials (CRM's) sourced from Europe and USA. The blue data in the graph shows the linearity between the CRM reference results and the ORACLE rapid fat results. The orange data in the chart shows the comparison between the outside lab reference results and ORACLE.

No Method Development

ORACLE is the first ever rapid fat analyzer that requires absolutely no method development. At the touch of a button, ORACLE can analyze fat in any food sample with reference chemistry accuracy, without any prior knowledge of the sample matrix and composition. Simply press the run arrow, and in 30 seconds the ORACLE delivers an exceptionally accurate and precise fat result. It's really that simple.

Analyze Virtually Any Food Sample

Meats

- Beef
- Chicken
- Cod
- Duck
- Lamb
- Pork
- Salmon
- Turkey
- Venison

Dairy

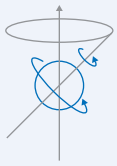
- Butter
- Cheese
- Cream (Heavy)
- Egg Whites
- Formula (Infant)
- Ice Cream Mix
- Milk
- Sour Cream
- Yogurt

Processed Foods

- Chips & Crackers
- Coffee Creamer
- Cookies
- Dog Food
- Dough
- Dressings
- Mayonnaise
- Noodles
- Nutritional Drinks

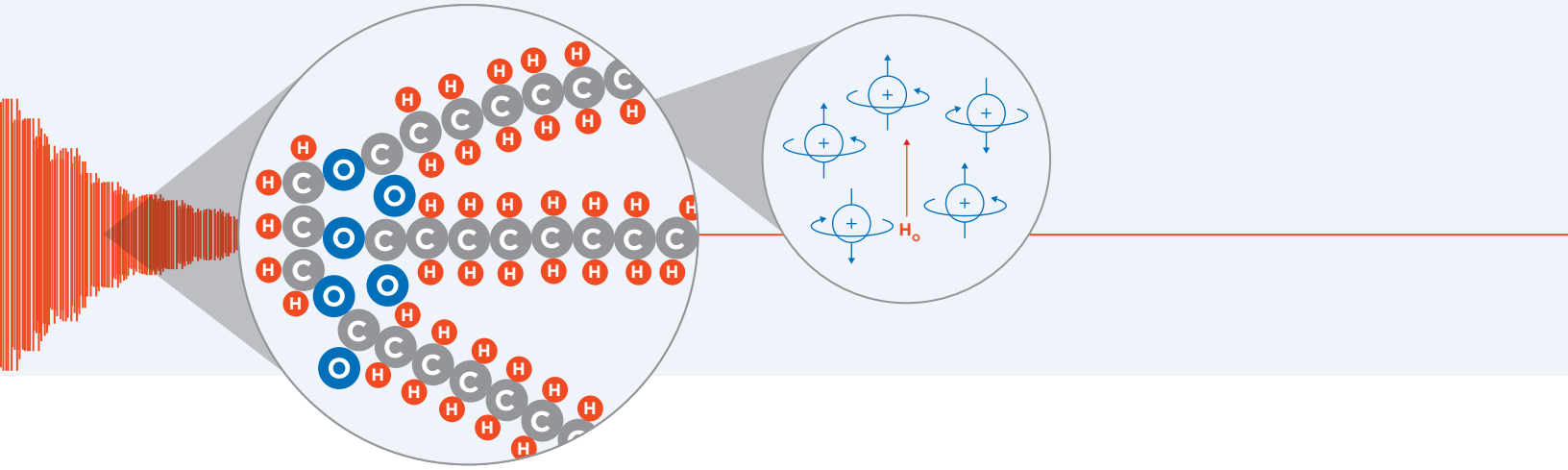
Powders

- Cheese
- Coffee Creamer
- Dairy
- Formula (Infant)
- Gravy
- Milk
- Non-Dairy
- Wheat Flour
- Whey



ORACLE NMR Technology

This newly developed technique, achieved in 2016, completely isolates the detection of the proton signal in fat molecules from all other compositional proton sources (i.e. protein, carbohydrate, ash) making universal fat analysis possible.



Consistent

All ORACLE systems are manufactured and designed to produce the same results worldwide, making the system an ideal solution for corporations seeking to standardize rapid instrumentation. Alternative rapid fat analyzers are susceptible to differences in optics and system components, which prevents them from transferring methods between various locations. That means that each system requires unique method development, which ultimately translates to extensive time and capital costs. Plus, there's no guarantee that the results will match. Not so with the ORACLE.

Versatile

ORACLE is designed to operate in any lab setting, from process control in food production sites (at-line and in-lab) to certified testing laboratories. For labs seeking rapid moisture/solids analysis, in addition to fat analysis, the ORACLE can be paired with the newly developed SMART 6 analyzer for moisture/solids results in about 5 minutes. Alternatively, labs who run 50 or more samples per day may choose the stand-alone ORACLE high throughput solution, where samples are dried in an oven overnight, and subsequently run through the ORACLE in batch mode.

ORACLE System
Universal Fat Analyzer

SMART 6 System
Moisture/Solids Analyzer

ORACLE Robot

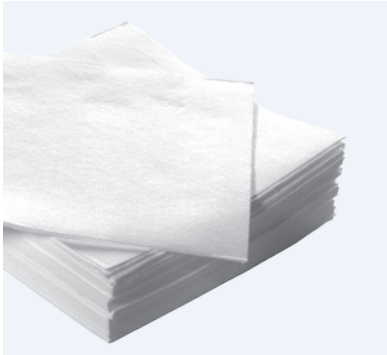
Automated High-Throughput Processing

Process up to 100 samples unattended. Analyze large batches on the ORACLE with the high-throughput robot accessory. The robot can be used with two high-throughput sample conditioning blocks. Data analysis is stored for each sample and can be reviewed at any time.

Precision Heater Block

High-Throughput Sample Conditioning

This accessory is effective for temperature conditioning large batches of up to 50 samples. Pre-dry large batches in a vacuum or convection oven, and condition in a 50 place high-precision heater block. Individual samples can then be run sequentially on the ORACLE in less than 30 seconds.



Sample Pads

These pads are tested to ensure they meet the requirements for absorbency, moisture content, and mechanical strength. They are approved for use in AOAC methods.

Trac Film

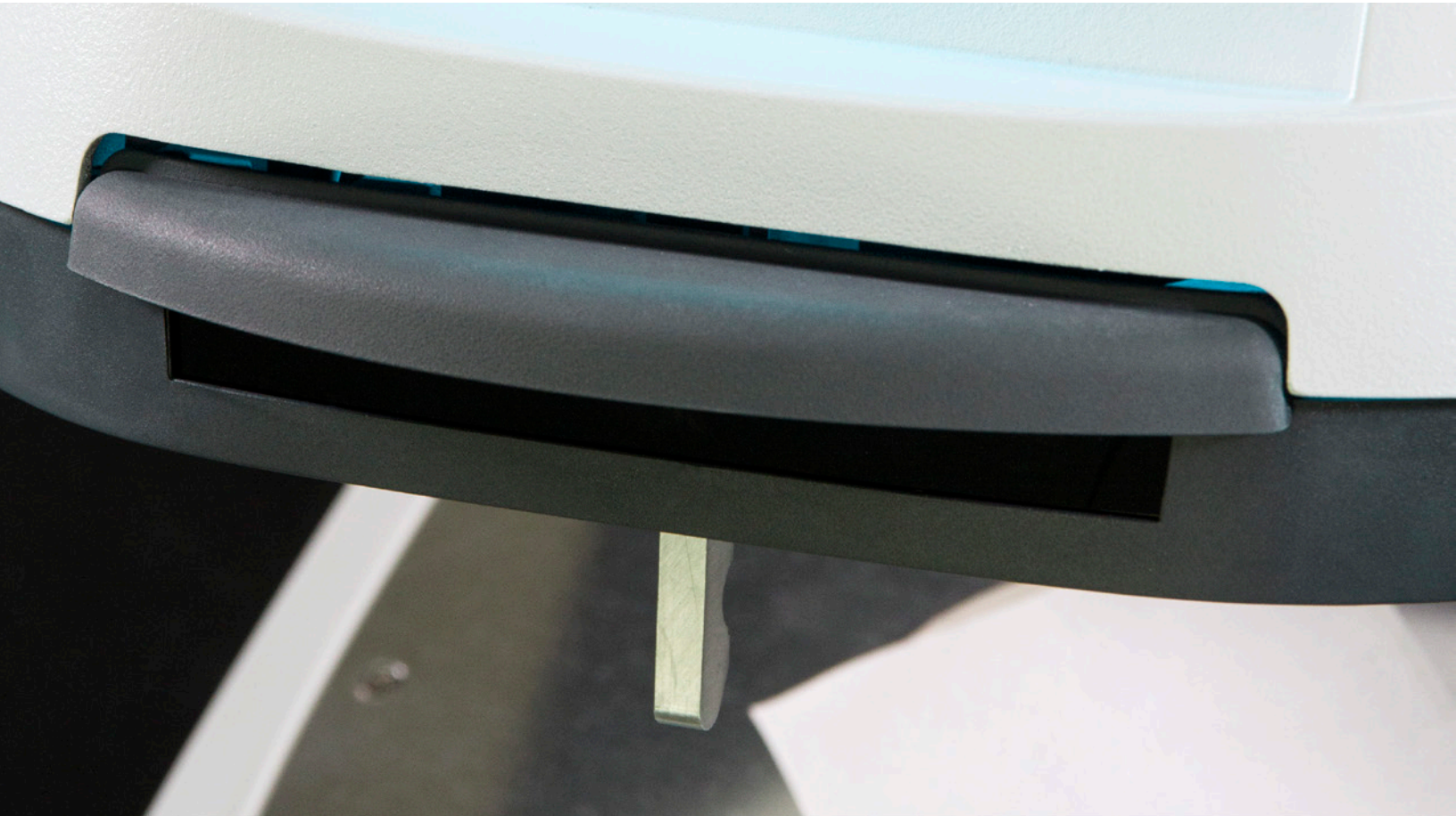
Our proprietary Trac Film™ sample wrap consists of proton-free components designed to be used with the ORACLE system. Trac Film ensures an absolute minimum interference for fat determination by NMR. Each batch is individually tested to ensure that this standard is continuously met.

ORACLE Tubes

These specialized tubes are for holding samples in the ORACLE.

Like Trac Film, ORACLE tubes are designed to minimize interference and ensure accurate fat analysis.

ProFat Raw Meat Fat Analyzer



A rapid and affordable fat analyzer for raw/pre-blended meat.

Overview

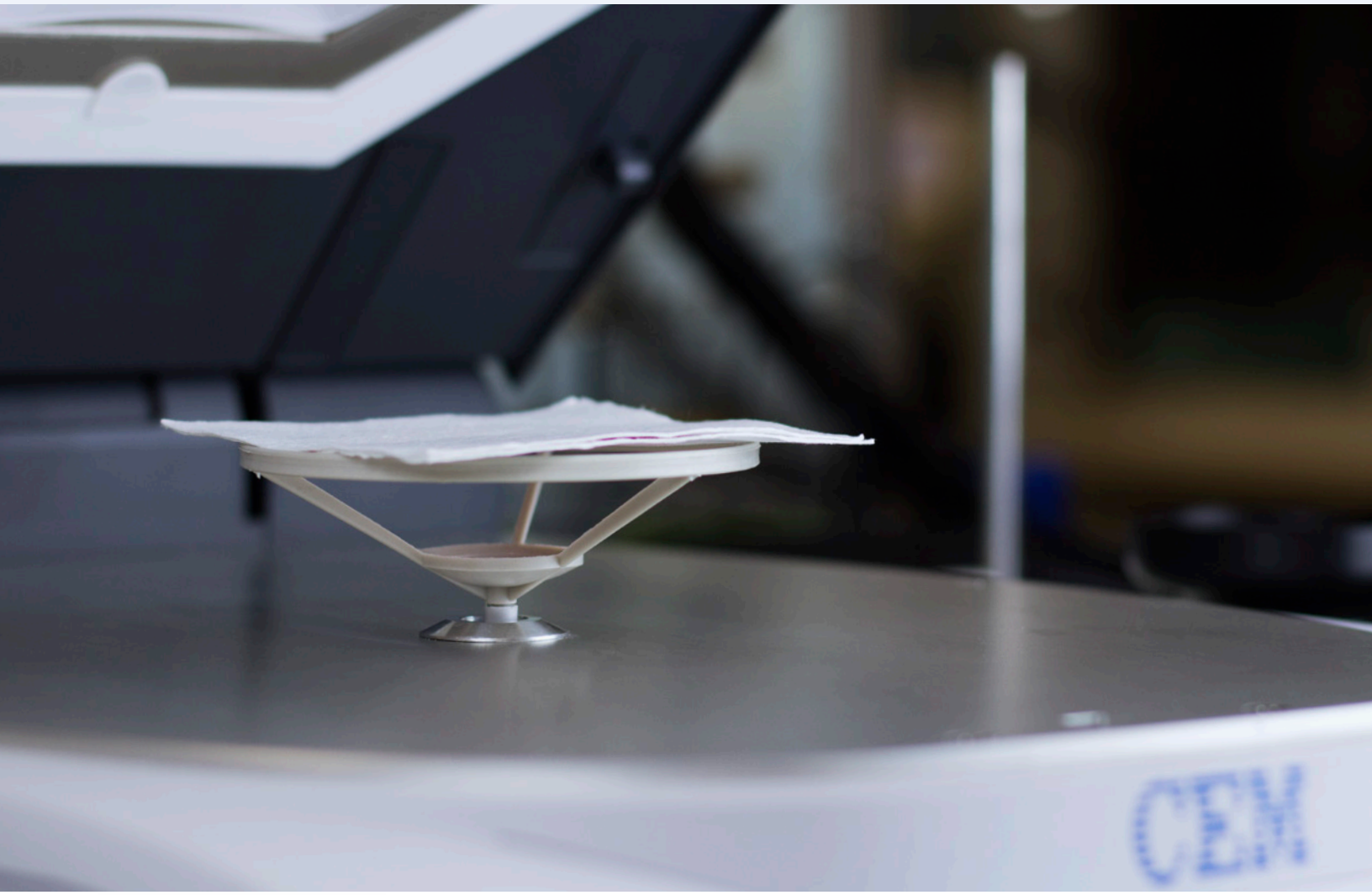
Rapidly determine fat, moisture, and protein content of raw and pre-blended meat with the ProFat system. This compact system can be placed at-line and allows for process control, using least cost formulation. The ProFat is an economical solution that provides highly accurate and repeatable fat analysis. This is based on the ProFat's ability to analyze the entire sample, which is more accurate than near-infrared (NIR) techniques that only analyze a small sample area.

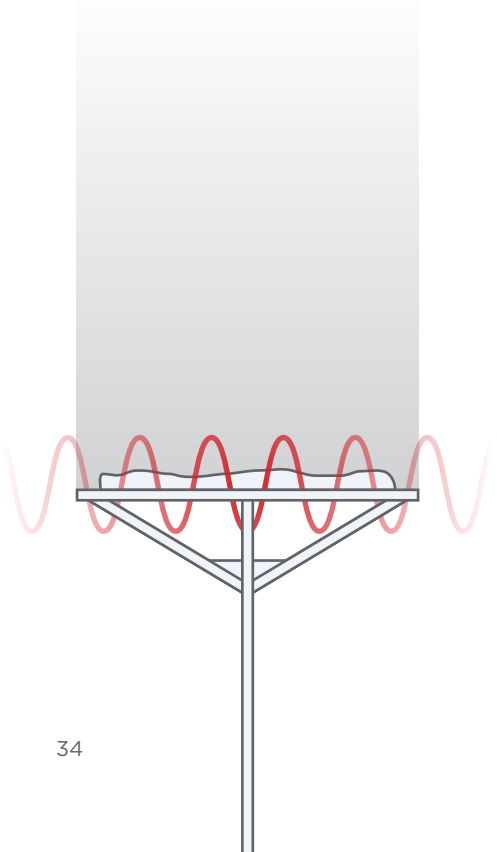
Features

- Accurate fat analysis of raw meat in < 2.5 minutes
- Provides easy verification of in-line X-ray or NIR systems
- Does not drift, and requires no recalibration
- Implements least cost formulation

Validation

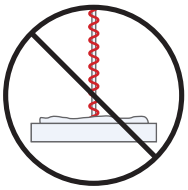
Based on the application of AOAC 985.14





Analyze your Entire Sample

A benefit of the ProFat system is that it analyzes an entire meat sample, up to 5 g in size. The ProFat process is based on an entire sample microwave drying process with fat determination, using a built-in balance. This is unique compared to near infrared (NIR) technologies that measure only very small areas of a sample. For meat samples this is useful as sample inhomogeneity is a well-known issue.



Traditional NIR Technology

Both transmissive and reflectance based NIR technologies analyze only small sample areas when taking measurements. Sample inhomogeneity can result in significant errors in fat results. These limitations require the need for frequent, costly calibration maintenance and validation.

Samples

Beef

- Cheek Meat
- Diaphragms
- FC Bull Meat
- Fine Textured Lean
- Head Meat
- Hearts
- Lean (Inedible)
- Lips
- Livers
- Lungs (Lean)
- Lungs (Regular)
- Skeletal Trim
- Spleens
- Tripe
- Weasands

Chicken

- Breast (Chunk)
- Breast (Skinless)
- Breast (With Skin)
- Drums (Skinless)
- Fat (20%)
- Fat (30%)
- Fat (Unrendered)
- Hearts
- MDB
- MDB (15% Fat)
- MDB (18% Fat)
- MDB (22% Fat)
- MDB (30% Fat)
- Meat
- Nuggets Blend
- Skin
- Thighs (Skinless)
- Thighs (With Skin)

Fish

- Lamb
- Livers
- Lungs
- Skeletal Trim
- Whitefish (Whole)

Mutton

- Livers
- Skeletal Trim

Pork

- Cheek Meat
- Diaphragms
- Esophagus Meat
- Head Meat
- Hearts
- Jowls (Skinned)
- Livers
- Livers (Inedible)
- Lungs
- Salivary Glands
- Skeletal Trim
- Snouts
- Sow Meat (Heavy)
- Spleens
- Stomachs

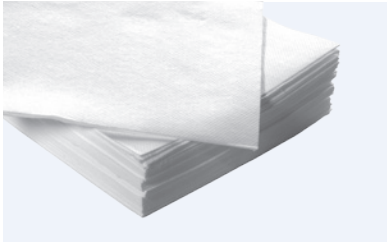
Turkey

- Breast (Skinless)
- Drum (Skinless)
- Fat (Unrendered)
- Ground Meat
- MDB
- MDB (18%)
- MDB (20%)
- Scapula
- Skin
- Tender
- Thigh Meat
- Whole (Emulsified)
- Wing

Accessories

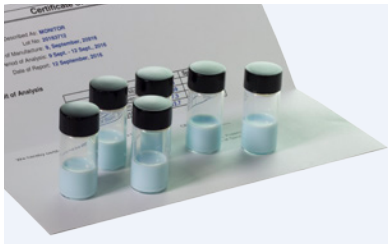
Printer Option

Print sample results directly from the ProFat. The printer is located inside the system, thereby not requiring extra space.



Sample Pads

These pads are tested to ensure they meet the requirements for absorbency, moisture content, and mechanical strength. They are approved for use in AOAC methods.



Monitor Kit

The kit includes a solution with measured reference value for verifying system performance.

Sprint Rapid Protein Analyzer

For rapid, safe, and direct determination of protein.

Overview

The Sprint is an advancement for protein analysis based on a rapid green chemistry process allowing for direct protein detection in less than 5 minutes. It replaces the conventional Kjeldahl method for analysis of dairy and meat products. Using the Sprint is as simple as weighing the sample, placing it in the system, and pressing “Start”.

Features

- Direct method for protein, not nitrogen, conversion
- Remarkably easy to use
- More repeatable than Kjeldahl & combustion techniques

Validation

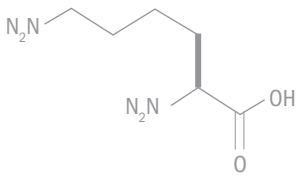
- AOAC 2011.04
- Automates AOAC Methods 967.12, 930.33, and 930.29

Awarded the Presidential Green Chemistry award in 2009 through the US Environmental Protection Agency (EPA)

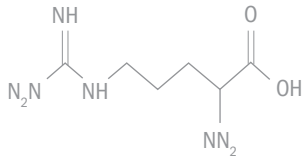
Protein Binding with iTag

All proteins contain amino acids. The basic amino acids that are found in foods are Arginine, Histidine and Lysine. Our proprietary iTag® solution binds to protein at these three amino acid sites using an acid group. The aromatic portion of the iTag molecule absorbs light and is easily detected with a colorimeter.

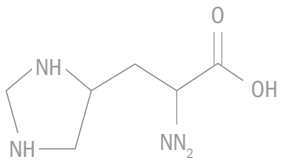
Lysine

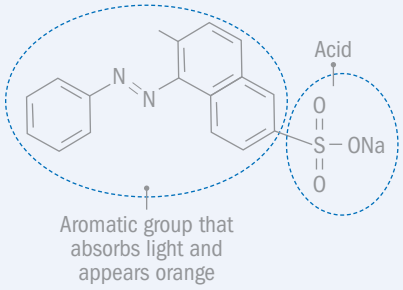


Arginine



Histidine





Our Process, More Accurate Than Kjeldahl

A pre-determined amount of iTag solution is added to a sample, then homogenized to release the proteins. The iTag molecules bind to the proteins, and are removed from solution. The remaining iTag is drawn up through a disposable filter into the built-in colorimeter. The amount of iTag bound to the protein is determined and the results displayed. The entire process takes only 2 – 3 minutes for most samples, and yields results that are more accurate than Kjeldahl or combustion techniques.

Sprint Publications

- Park, C.W..; Parker M., Drake M.A., *J. Dairy Sci.* 99, 4303-4308 **2016**
- Paiva, I.M. et al., *Rev. Inst. Laticínios Cândido Tostes,* Juiz de Fora, 70, 192-199 **2015**
- Campbell, R.E..; Boogers I.A.L.A., Drake M.A., *J. Dairy Sci.* 97, 1313-1318 **2014**
- Park, C.W..; Bastian E., Farkas, B., Drake M.A., *J. Food Sci.* 79, C19-C24 **2014**
- Desai, N.T.; Shepard L.; Drake M.A., *J. Dairy Sci.* 96, 7454-7466 **2013**
- Listiyani, M.A.D. et al., *J. Dairy Sci.* 94, 4347-4359 **2011**
- Campbell R.E.; Miracle R.E.; Drake M.A., *J. Dairy Sci.* 94, 1185-1193 **2011**
- J.K. Amamcharla, L.E. Metzger, *J. Dairy Sci.* 93, 3846-3857 **2010**
- Zhao D.; Jai V.; Farkye N.Y. T88 *J. Anim. Sci.* 88, E-Suppl. 2 **2010**.

Green Technology

No Hazardous Waste For Disposal

The sample and Sprint's non-toxic iTag solutions are environmentally friendly. Sprint generates no hazardous waste at all. So, not only do you enjoy better results, you also help the environment and save money by removing hazardous waste disposal costs, while making your workplace safer.

Ideal Samples

Dairy

- Cheese
- Cream
- Ice Cream
- Milk
- Sour Cream
- Whey Protein Concentrate
- Yogurt

Beverages

- Energy drinks
- Frappuccino®
- Nutritional Drinks
- Protein Drinks

Meat

- Bologna
- Chicken Broth
- Hot Dogs
- Pork Sausage
- Turkey Sausage

Other

- Egg
- Pea Protein
- Protein Alternatives
- Soy Protein

Accessories

Sprint Paks

Kit includes necessary items for running samples on the Sprint.

Sprint Standards Kit

Includes 5 vials of standard reference material with certified protein analysis for confirming Sprint unit performance.

Static Elimination Device

Aids in speed and accuracy when analyzing dry powdered samples, or when analyzing in a low humidity environment.

Phoenix Ash/Bone Content Analyzer

Unmatched versatility and speed in a rugged, easy-to-use system.

Overview

Ash samples with unmatched speed, safety, ease-of use, and energy savings with the Phoenix™ Microwave Muffle Furnace. This system will help improve your process control, allow for rapid adjustments, and reduce out-of-specification products.

This system can perform many high temperature applications up to 97% faster than traditional muffle furnaces.

Features

- Rapid 15 minute ashing of food samples
- Direct bone determination for mechanically separated products
- Safer and more efficient than conventional muffle furnaces

Validation Methods

AOAC official methods 923.03 (flour), 930.30 (dried milk), 945.46 (milk), 935.42 (cheese), 920.153 (meat), 942.05 (animal feed), 938.08 (seafood)

Over 5,000 microwave muffle furnaces sold worldwide

Safety

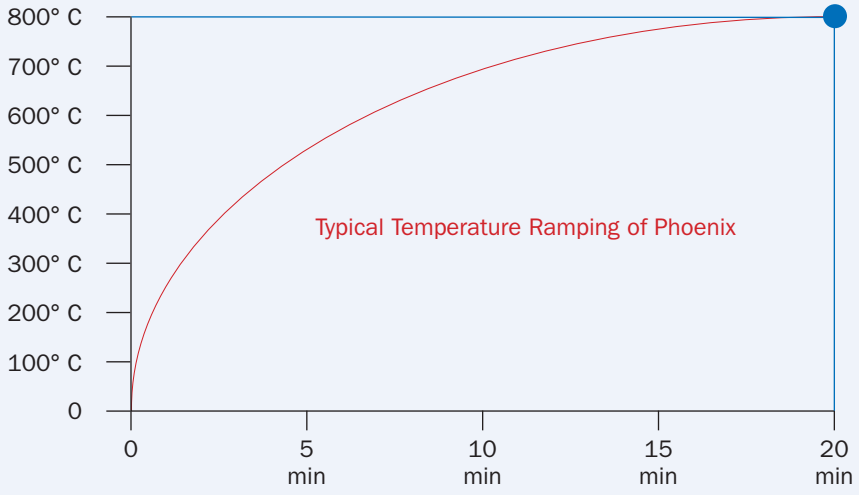
The Phoenix provides the unique ability to put your samples into the furnace at room temperature. This protects the operator from rapid sample decomposition upon initial placement that can result in dangerous flames and heat. This is due to the ability of the Phoenix to rapidly increase the furnace temperature after the method is started.

Ease-of-use

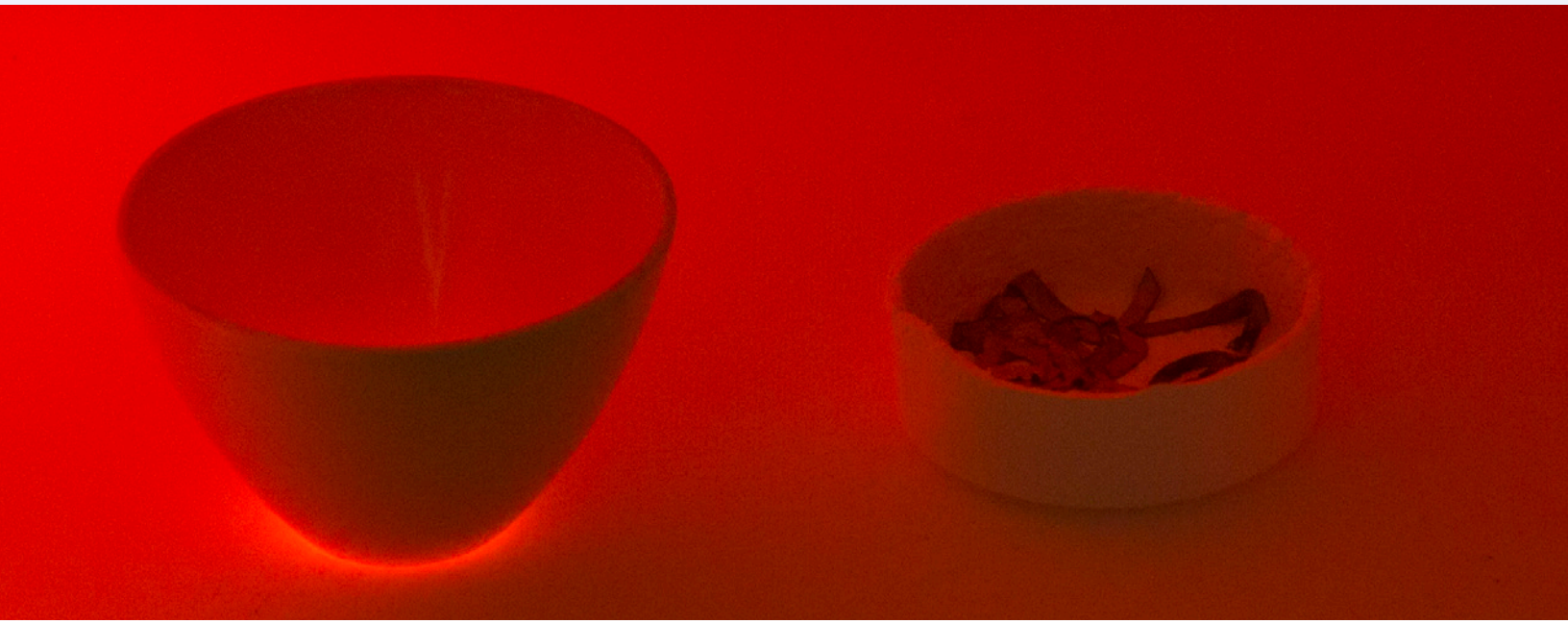
Conventional muffle furnaces are kept hot and therefore often require an initial “pre-burn” step to avoid excessive initial burning of the sample. This is typically done with the use of a Bunsen burner which requires extra effort and time. With the Phoenix, the sample can be inserted at room temperature with a rapid temperature ramping that eliminates the need for a “pre-burn” step. This significantly simplifies the work flow.

Energy Savings

Due to the unique temperature ramping capabilities of the Phoenix system, it can be left idle in a non-heated state. This results in significant energy savings versus conventional muffle furnaces that are kept constantly in a high temperature state.



Food/Feeds Ashing Applications



Sample	Crucible	Weight (g)	Temp (° C)	Time (min)
Beef Liver	20 mL – CEM Quartz	2	950	30
Cat Food (canned)	20 mL – CEM Quartz	2-5	600-950	10-90
Dog Food (dry)	20 mL – CEM Quartz	2.5	575	30
Eggs	20 mL – CEM Quartz	5	925	20-35
Feed, poultry layer	20 mL – CEM Quartz	2	600	10
Feed, turkey	20 mL – CEM Quartz	2	600	20
Flour, soy	20 mL – CEM Quartz	1	935	15
Flour, wheat	20 mL – CEM Quartz	2	935	10
Lactose	20 mL – CEM Quartz	5	550	30-35
Meat & Bone Meal (dog)	20 mL – CEM Quartz	2.5	575	10
Milk, powdered	20 mL – CEM Quartz	2	935	10
Noodle Mix	20 mL – CEM Quartz	3	935	15
Oil (residual)	50 mL – porcelain	50*	540	75
Oil (soybean)	25 mL – porcelain	10	600	10
Rice Germ & Bran	20 mL – CEM Quartz	2	550	20
Salts	20 mL – CEM Quartz	10	350	10
Starch, corn	20 mL – CEM Quartz	2	575	10
Starch, pre-jelled tapioca	20 mL – CEM Quartz	1	650	120
Sugar, granulated**	25 mL – porcelain	10	550	240
Sugar, raw**	25 mL – porcelain	4	550	180
Whey	20 mL – CEM Quartz	2	935	10

*AirWave Configuration / **Sulfated Ash Configuration

Sulfated Ashing Option

This Vapor Scrubbing System features a vapor scrubber to safely remove harmful fumes from the furnace cavity and neutralize any residual acid exhausted (sulfur dioxide and nitric acid). This setup meets ISO 14000 regulations and can be rapidly disconnected in less than 5 minutes without the use of tools.

AirWave Option

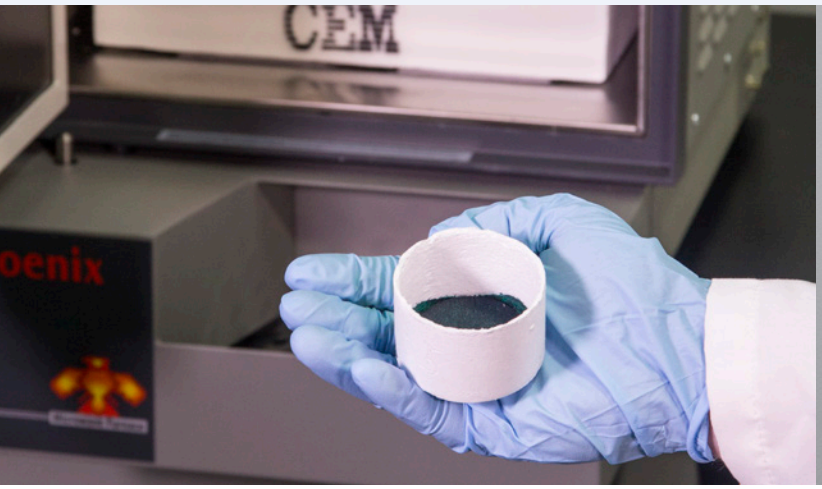
AirWave™ provides increased airflow for high organic sample ashing. This system configuration meets the most demanding requirements of large organic samples with ease, and eliminates volume reduction/carbonization on hot plate or Bunsen burner. The compressed air driven exhaust system features no moving parts and will not require excessive maintenance or clog.

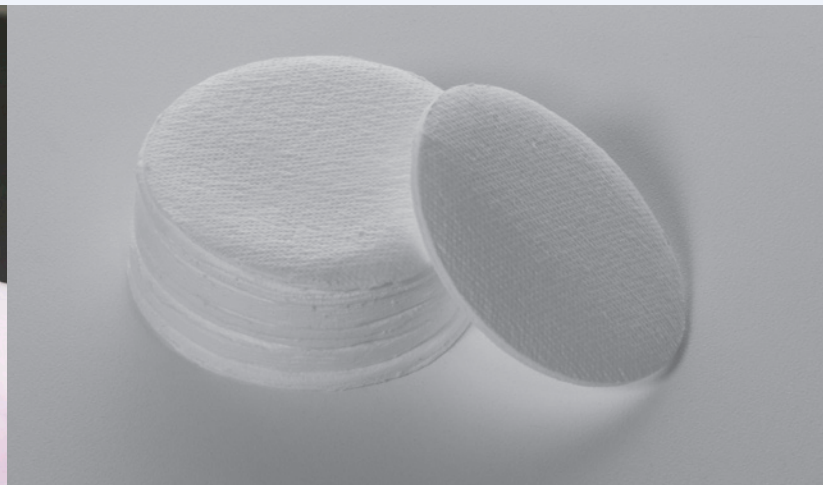
High Temperature Furnace Setup

The High Temperature Furnace holds up to 8 (25 mL) crucibles up to 1,200° C.

High Capacity Furnace Setup

The High Capacity Furnace holds up to 15 (25 mL) crucibles up to 1,000° C.



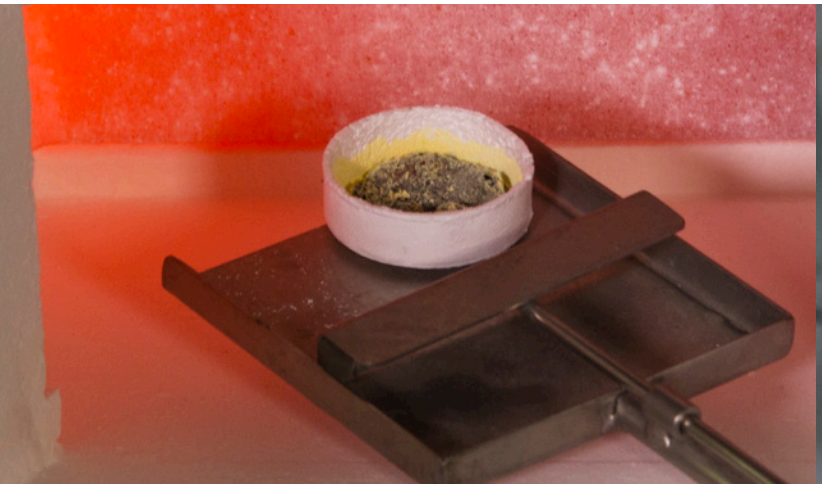


Crucibles

Quartz-fiber crucibles dramatically reduce ashing times and cools in seconds. The quartz fiber material allows oxygen to circulate around the sample speeding combustion. They are disposable and can withstand temperatures up to 1,000° C.

Ashing Disks

The ashing disk fits into the crucible and will extend the crucible life while making removal of ash easier. A second ashing disk can also be placed on top of the sample for containing sample mass of highly combustible materials.



Crucible Tray

This tray allows for placement of up to 4 crucibles at a time into the furnace.

Crucible Marking Pen

Pen for marking crucibles that withstands temperatures up to 1,200° C.

Over 100,000 systems sold worldwide

CEM has been an ISO-certified facility since 1994

All systems serviced & supported by experts with an average of 15 years of experience

CEM invests 11% of annual revenue into R&D, the result... 11 R&D 100 awards

IQ/OQ/PQ Validation by certified CEM Technicians

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