



Compositional Analysis

Meat & Poultry Industry



Moisture

Fat

Protein

Bone/Ash Content

Who we are

At our core, we are Chemists, Engineers, and Manufacturers, 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 50,000 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 (Left)

Mechanical Engineer: Bill Cruse Jr. (Right)



Greetings.

I feel very fortunate to be living the American Dream. In 1978, CEM started 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 50,000 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.

Our approach is focused on developing the absolute best technique possible for the compositional analysis of meat 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 food companies.

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,

A handwritten signature in black ink that reads "Mike Collins". The signature is written in a cursive, flowing style.

Michael J. Collins PhD
President and CEO



Maximize Profit with Raw Beef & Poultry

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The Gold Standard for Least Cost Formulation

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ORACLE Rapid NMR Fat Analyzer

The first ever rapid
fat analyzer with no
method development.

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ProFat Raw Meat Fat Analyzer

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

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Sprint Rapid Protein Analyzer

For rapid, safe, and
direct determination
of protein.

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Phoenix BLACK Microwave Muffle Furnace

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

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Maximize Profit with Raw Beef & Poultry

- CEM's ProFat™ provides a direct method that analyzes the entire sample
- 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".

Fast and Accurate

Fat, Protein, & Moisture Analysis in 2 Minutes

Sample	Fat			Protein			Moisture		
	Reference Method	ProFat	Error	Reference Method	ProFat	Error	Reference Method	ProFat	Error
Beef	43.4	43.5	-0.1	12.5	12.3	0.2	43.8	43.9	-0.1
Pork	26.3	26.2	0.1	15.3	15.5	-0.2	57.7	57.6	0.1
Chicken (MSP)	20.9	20.7	0.2	12.5	12.6	-0.1	63.5	63.7	-0.2
Turkey (MSP)	19.6	19.5	0.1	13.5	13.6	-0.1	63.1	63.2	-0.1

* Moisture/solids analysis with ProFat in 2-3 minutes

Peer Reviews

"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.

Accuracy of SMART 6 and ORACLE

	Moisture/Solids			Fat		
Sample	SMART 6	Oven	Difference	ORACLE	Solvent Extraction	Difference
Hot Dog	52.97	53.66	0.60	30.25	30.09	0.15
Beef	67.57	67.82	0.34	12.08	11.94	0.14
Beef (deboned)	67.01	66.86	0.15	15.95	15.68	0.27
Chicken (low fat)	72.65	73.05	0.53	7.95	7.84	0.11
Chicken (high fat)	66.43	66.69	0.02	18.33	17.95	0.38
Chicken (MSC)	70.10	70.43	0.12	13.87	13.78	0.09
Turkey	68.27	68.15	0.53	13.64	13.37	0.27
Pork	70.23	70.08	0.26	10.26	10.14	0.12
Fish (Salmon)	74.45	74.63	0.33	4.08	4.00	0.08
Fish (Catfish)	66.56	67.09	0.08	15.60	15.57	0.03
Potted Meat	69.99	70.00	0.19	12.87	13.04	0.17
Bacon	34.20	33.96	0.16	54.58	54.60	0.02
Viscera	68.05	68.70	0.65	16.05	15.49	0.56
Average			0.30	Average		0.18

Peer Reviews

“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



ORACLE™

Rapid NMR Fat Analyzer

The first ever rapid fat analyzer with no method development.

Overview

ORACLE is the first ever rapid fat analyzer that requires absolutely **no method development** for fat only analysis. 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 or composition. Simply press the run arrow and ORACLE delivers an exceptionally accurate and precise fat result in 30 seconds. Alternatively, ORACLE can be paired with the SMART 6 for combined rapid fat and moisture/solids analysis in less than 5 minutes.

Features

- Rapid- 30 second analysis
- Analyze any sample from 0.05 – 100.00 % fat
- Direct isolation and measurement of hydrogen protons on fat molecules
- Precise- better repeatability than wet chemical extraction techniques

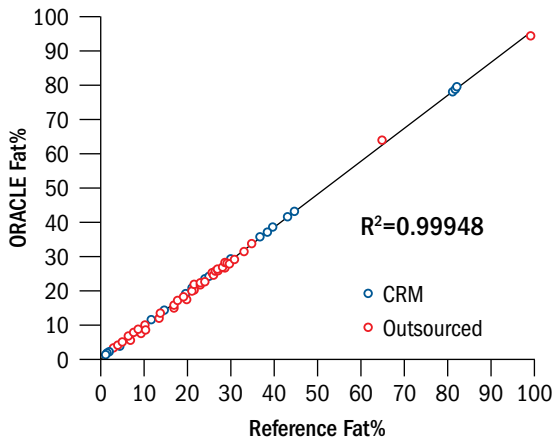
Validation

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

Awards

- 2017 IFT Food Expo Innovation Award
- Top 3 New Products at PITTCO 2017

Benefits



Accurate Analysis of Any Food Sample in Only 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 red 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.



Sample Types

Beef

Chicken

Cod

Duck

Lamb

Pork

Salmon

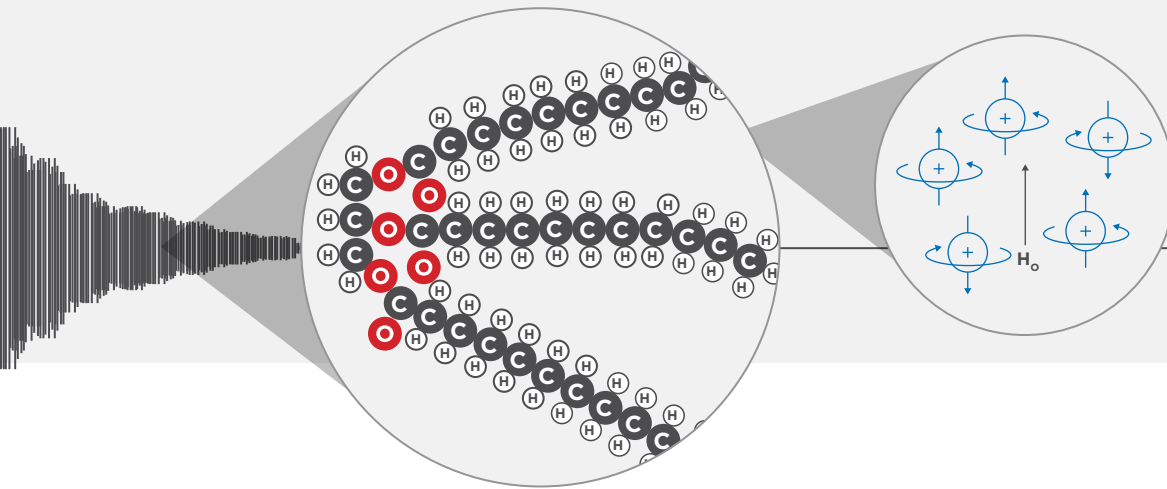
Turkey

Venison



A Major Breakthrough in 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. Alternative rapid techniques are unable to fully isolate fat from other components, which is why extensive calibration development is often required.



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
Rapid NMR Fat Analyzer



SMART 6
Microwave + Infrared
Moisture & Solids Analyzer

Accessories & Consumables



Precision Heater Block

High-Throughput Sample Conditioning

This accessory is effective for temperature conditioning large batches of up to 50 samples. Predry 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

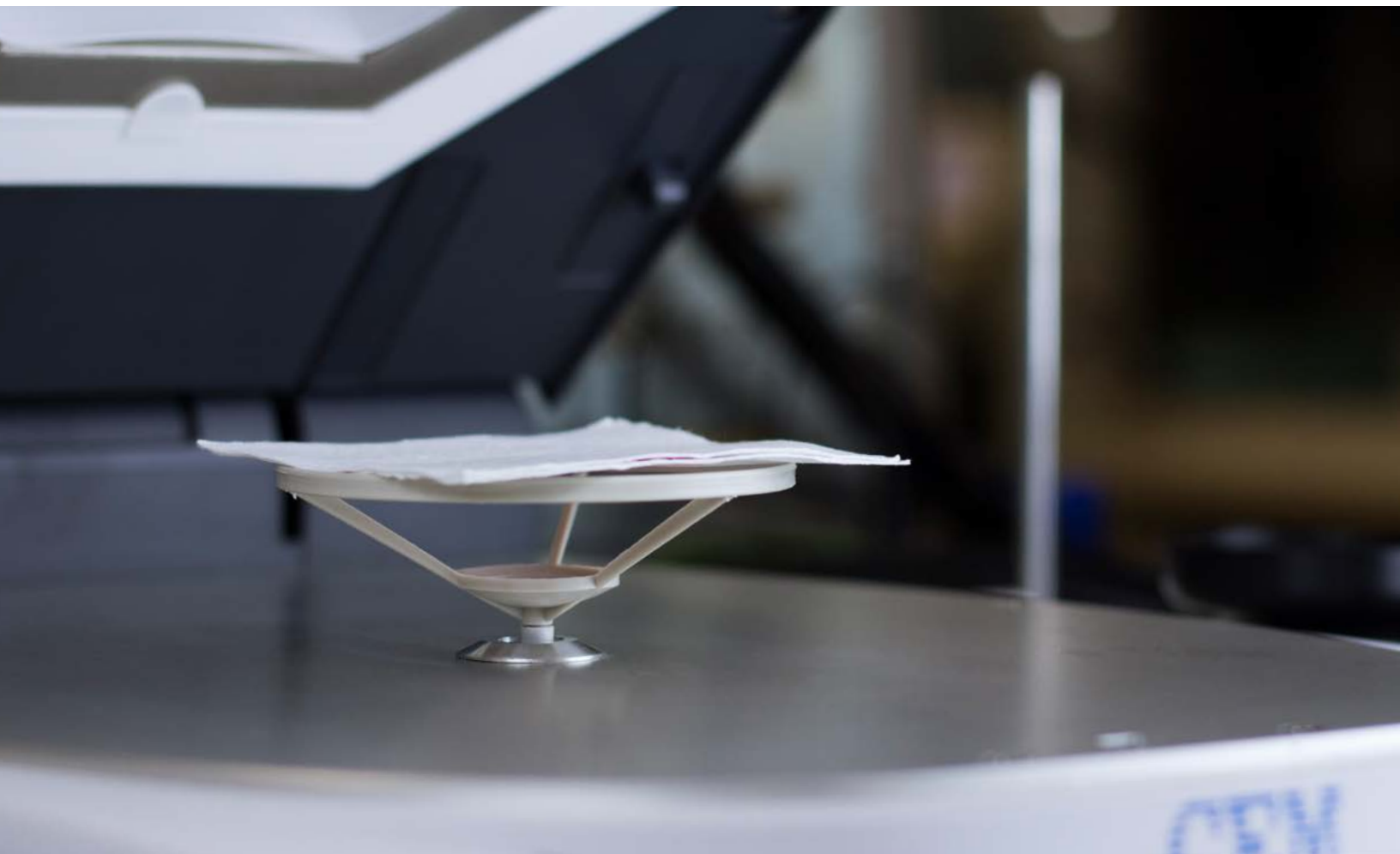
Rapidly determine fat, moisture, and protein content of raw and pre-blended meat with the ProFat system. This compact system can be placed at-line and allows for process control, using least cost formulation. The ProFat is an economical solution that provides highly accurate and repeatable fat analysis. 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

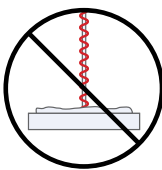
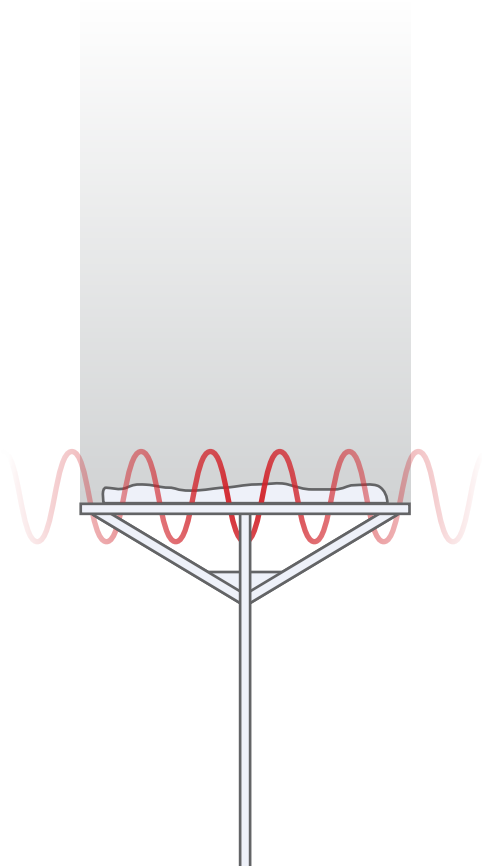
Validation

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.



Sprint®

Rapid Protein Analyzer

For rapid, safe,
and direct protein
determination.

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 determination (not nitrogen conversion)
- Remarkably easy to use
- More repeatable than Kjeldahl & combustion techniques

Validation

- Automates AOAC Methods 967.12 (Milk), 930.33 (Ice Cream & Frozen Desserts), and 930.29 (Milk Powder)



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

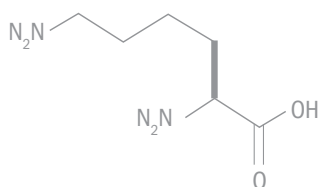
Key Technologies



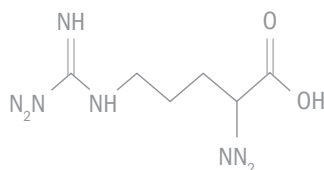
Protein Binding with iTag[®]

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.

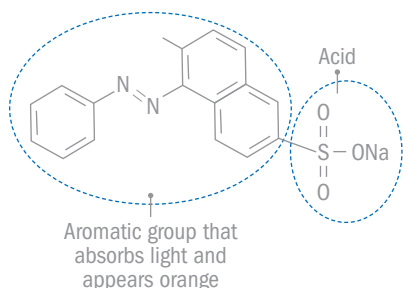
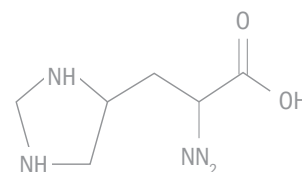
Lysine



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**.



Phoenix BLACK™

Microwave Muffle Furnace

Ash samples up to 97% faster than other muffle furnaces.

Overview

Ash samples with unmatched speed and safety with the Phoenix BLACK™. With an on-board touch-screen interface you'll save time and simplify workflow. Two powerful magnetrons heat the cavity which allows for exceptional temperature control and lightning fast ramp times. Make rapid adjustments to reduce out-of-specification products and improve your process control.

Features

- Ash up to 15 samples at one time
- Use any type of crucible normally used in conventional ashing systems, even platinum
- Meets requirements of electrical and microwave 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)

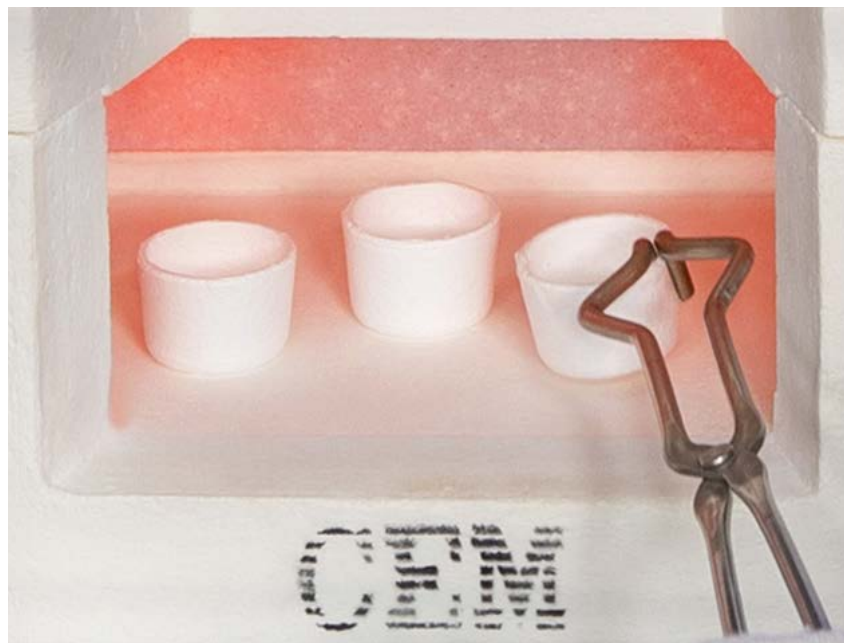


Over 10,000 microwave muffle furnaces sold worldwide

Benefits

Safety

The Phoenix BLACK 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 BLACK to rapidly increase the furnace temperature after the method is started.

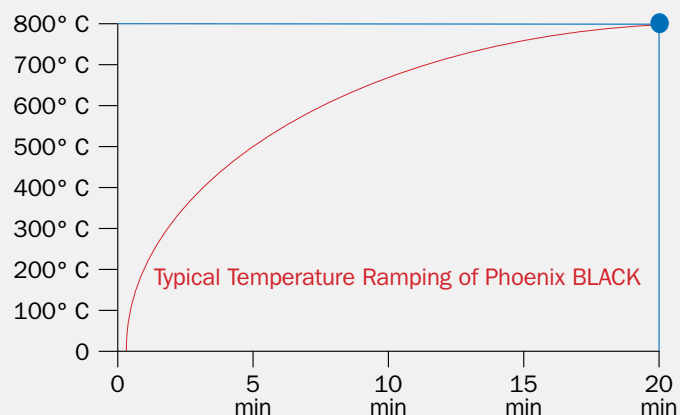


Ease-of-use

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 BLACK, 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 BLACK 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.





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
Feed, poultry layer	20 mL – CEM Quartz	2	600	10
Feed, turkey	20 mL – CEM Quartz	2	600	20
Meat & Bone Meal (dog)	20 mL – CEM Quartz	2.5	575	10

Accessories & Consumables



Quartz-fiber Crucibles

Our 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 1000 °C.



Ashing Disks

The ashing disk fits into the crucible and will extend the crucible life while making the 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.



Self-sealing Crucibles

For oxygen-free ashing, self-sealing quartz crucibles are available. Ideal for applications such as carbon black determination in polymer samples.



Crucible Marking Pen

Pen with heat-proof ink that will not fade during ashing.



We Simplify Science

cem.com



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