Moisture, Fat, and Protein Analysis for Processed Meat Producers

Summary

CEM has been a pioneer of food analysis for over 40 years, working with companies large and small to develop better processes for improved product quality. In this application note, we show the benefits of direct analysis of processed meat products, which often contain a mix of ingredients that do not always conform to traditional test methods. Having the right moisture, fat, and protein levels translates into high-quality products that are safe, flavorful, and long lasting.

Introduction

Processed meat products such as sausage, salami, and jerky are often difficult to analyze due to the non-homogeneous nature of the product, often containing herbs, spices, preservatives, and other non-meat ingredients. Traditional wet chemistry analysis such as chemical fat extraction or Kjeldahl digestion for protein analysis are expensive, time consuming and require the use of hazardous chemicals. Wet chemistry methods are often skewed by non-meat additives, resulting in inaccurate results and subsequent errors in formulation. Near infrared spectroscopy (NIR) is a rapid alternative to wet chemistry methods, providing results in less than a minute with no hazardous chemicals. However, optical methods such as NIR and FT-IR require very high levels of sample homogeneity, and must be calibrated according to the amounts of additives used in formulation. Changes in color, consistency, or formulation can negatively impact results, making it difficult to obtain accurate results.

The combination of the SMART 6™ and ORACLE™ systems provide a rapid moisture and fat determination, with results in less than 5 minutes. The SMART 6 moisture and solids analyzer utilizes dual-frequency energy to rapidly analyze any product, wet or dry, in 3 minutes or less. ORACLE eliminates the need for method development by completely isolating the signal from fat molecules, even in complex sample matrices. Sprint® is a direct protein measurement system, which utilizes dye-binding technology to ensure only true protein is detected, not total nitrogen, which can result in erroneous measurements when non-protein nitrogen is present. Sprint does not require regular calibrations, and methods are easy for any lab user to create. Competitive rapid technologies (NIR, FT-IR, TD-NMR) require ongoing, expensive calibrations and method development for each unique sample due to variations in color, texture, and consistency.

This study demonstrates that CEM's innovative technology can rapidly analyze a wide range of processed meats for moisture, fat, and protein with accuracy and precision that matches reference methods.

Experimental

To evaluate the performance of the SMART 6, ORACLE and Sprint, five processed meat products were obtained: hot dog, sausage with cheese, sausage, semi-dry sausage, beef stick and turkey stick. For moisture determination, a 2 gram sample of each product was analyzed in the SMART 6. Reference testing was performed in an air oven in triplicate to establish a

basis of comparison. The air oven method was set for 8 hours at 100 °C, followed by a cooling period under desiccation, to ensure complete drying. For fat analysis, the dried samples were removed from the SMART 6, placed in the ORACLE and scanned for 30 seconds, with no need for calibration or method development prior to testing. Fat reference testing was performed using Soxhlet extraction. For protein analysis, a 1 gram sample was weighed into a Sprint sample cup and placed into the Sprint unit. The dye-binding reaction is completely automated and takes approximately 4 minutes to complete. Protein results were compared to Kjeldahl digestion.

Results

The average results for moisture, fat and protein using CEM's rapid technology compared closely to reference results, as illustrated in **Tables 1, 2, and 3**.

Table 1: Comparison of Moisture Content Between SMART 6 and Air Oven

Product	SMART 6 Replicates			SMART 6 Average	Air Oven Average	Difference
	1	2	3			
Hot Dog	60.20	60.54	60.37	60.37	59.97	0.40
Sausage w Cheese	52.78	52.46	52.33	52.52	52.23	0.29
Sausage	52.92	53.58	53.31	53.27	53.46	0.19
Semi Dry Sausage	53.24	53.13	53.09	53.15	53.18	0.03
Beef Stick	30.44	30.54	31.03	30.67	30.98	0.31
Turkey Sticks	46.52	47.01	46.43	46.65	47.09	0.44

Table 2: Comparison of Fat Content Between ORACLE and Reference Chemistry

Product	ORACLE Replicates			ORACLE Average	Soxhlet Average	Difference
	1	2	3			
Hot Dog	19.40	19.63	19.62	19.55	20.37	0.82
Sausage w Cheese	27.84	28.00	27.91	27.92	27.62	0.30
Sausage	26.41	25.89	25.94	26.08	25.95	0.13
Semi Dry Sausage	24.36	25.06	23.99	24.47	24.52	0.05
Beef Stick	31.29	31.59	31.38	31.42	31.89	0.47
Turkey Sticks	19.47	19.32	19.53	19.44	20.02	0.58

Table 3: Comparison of Protein Content Between Sprint and Kjeldahl

Product	Sprint Replicates			Sprint Average	Kjeldahl Average	Difference
	1	2	3			
Hot Dog	17.39	16.78	16.98	17.05	17.16	0.11
Sausage w Cheese	11.38	11.49	11.65	11.51	11.64	0.13
Sausage	15.47	15.39	15.42	15.43	15.31	0.12
Semi Dry Sausage	17.75	16.71	17.35	17.27	17.29	0.02
Beef Stick	28.27	27.82	27.61	27.90	28.08	0.18
Turkey Sticks	34.01	33.67	34.04	33.91	33.89	0.02

Conclusion

For processed meat products where correct moisture, fat, and protein levels are essential to product quality and production profitability, CEM offers rapid testing options with results that match reference methods. CEM's combination of proprietary and patented technology translates into some of the fastest and most accurate food composition tests on the market. With short test times and accurate results, the SMART 6, ORACLE, and Sprint analyzers save time, improve least-cost formulation, and ultimately save money.

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