Moisture, Fat, and Protein Analysis for Meat and Dairy Alternatives

Summary

CEM has been a pioneer in moisture 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 accurate moisture, fat and protein analysis of meat and dairy alternatives, which 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

The demand for vegan, vegetarian, and clean-label foods has undergone unprecedented growth in recent years. With ever-increasing focus on sustainability and health, the meat and dairy alternative market in particular is expected to continue to grow for years to come. With new ingredients being regularly introduced, traditional meat and dairy tests are not always the best option for accuracy, particularly for fat and protein, which are typically unique to the food source. One test that affects all food products is moisture. If moisture levels are too high in ingredients or final products, the shelf life will be significantly diminished. Careful control of moisture, fat, and protein levels in meat and dairy alternatives ensures least-cost formulation while maintaining high-quality and good consistency.

The SMART 6™ and ORACLE™ can be paired together for rapid moisture and fat determination, with results in less than five minutes. Sprint® is a direct protein measurement system which utilizes dye-binding technology. Direct protein detection ensures 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 meat and dairy alternatives 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 meat (or dairy) alternative products were obtained. For moisture determination, a 2 g 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 h 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 s, with no need for calibration or method development.

Fat reference testing was performed using Soxhlet extraction, or acid hydrolysis for meat alternatives and dairy alternatives, respectively. For protein analysis, 1 g samples were weighed into a Sprint sample cup and placed into the Sprint unit.

The dye-binding reaction is completely automated and takes approximately four minutes to complete. Protein results were compared to Kjeldahl digestion.

Results

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

Table 1: Accuracy of CEM's ORACLE for Fat Analysis of Meat and Dairy Alternatives

Sample		1	2	3	Average	STDEV
Non-meat Burger Patty	Reference	12.05	10.14	10.15	10.78	1.10
	ORACLE	12.03	10.47	10.19	10.90	0.99
Soy Meatballs	Reference	15.66	15.02	15.61	15.43	0.36
	ORACLE	15.04	14.56	14.51	14.70	0.29
Chickenless Tenders	Reference	17.93	17.54	17.47	17.65	0.25
	ORACLE	17.93	17.39	17.11	17.48	0.42
Almond Yogurt	Reference	1.76	1.72	1.79	1.76	0.04
	ORACLE	1.75	1.78	1.80	1.78	0.03
Rice Milk	Reference	0.90	0.94	0.98	0.94	0.04
	ORACLE	1.01	1.04	0.98	1.01	0.03

Table 2: Accuracy of CEM's SMART 6 for Moisture Analysis of Meat and Dairy Alternatives

Sample		1	2	3	Average	STDEV
Non-meat Burger Patty	Reference	58.44	62.35	57.12	59.30	2.72
	SMART 6	58.54	62.27	57.13	59.31	2.66
Soy Meatballs	Reference	59.80	62.42	62.42	61.55	1.51
	SMART 6	59.90	62.23	62.65	61.59	1.48
Chickenless Tenders	Reference	57.24	58.36	58.68	58.09	0.76
	SMART 6	57.25	58.35	58.60	58.07	0.72
Almond Yogurt	Reference	37.72	37.81	37.82	37.78	0.06
	SMART 6	37.80	37.73	37.76	37.76	0.04
Rice Milk	Reference	84.50	84.55	84.30	84.45	0.13
	SMART 6	84.46	84.49	84.52	84.49	0.03

Table 3: Accuracy Of CEM's Sprint for Protein Analysis of Meat and Dairy Alternatives

Sample		1	2	3	Average	STDEV
Non-meat Burger Patty	Reference	19.67	17.17	18.03	18.29	1.27
	Sprint	19.67	17.57	18.11	18.45	1.09
Soy Meatballs	Reference	19.94	19.65	19.70	19.76	0.16
	Sprint	20.01	19.56	19.66	19.74	0.24
Chickenless Tenders	Reference	17.74	17.80	17.62	17.72	0.09
	Sprint	17.78	17.71	17.76	17.75	0.04
Almond Yogurt	Reference	9.36	8.89	9.29	9.18	0.25
	Sprint	9.27	8.94	9.31	9.17	0.20
Rice Milk	Reference	0.28	0.20	0.23	0.24	0.04
	Sprint	0.24	0.23	0.21	0.23	0.02

Conclusion

For meat and dairy alternatives where moisture, protein, and fat levels are formulated to match flavor and texture profiles of true meat and dairy products, 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.