

Rapid Analysis throughout the Pet Food Production Process

Abstract

CEM equipment has been trusted for over 40 years, as a source of dependable process control. The ORACLE™, SMART 6™, Phoenix BLACK™, and Sprint® instruments all provide rapid and direct analysis for pet food manufacturing and process control. To demonstrate the ability of the ORACLE, SMART 6, Phoenix BLACK, and Sprint to accurately and reliably determine the fat, moisture, ash, and protein content throughout the pet food manufacturing process, an assortment of in-process and finished product samples were obtained and analyzed.

Introduction

With increasing competition in the pet food industry, manufacturers need to ensure the product they make is not only up to the expectation of the consumers, but economically viable, so the product can be offered at a competitive price. Moisture, fat, and protein are three of the most important and expensive components of both wet and dry pet foods. Whether testing protein of incoming meats, fat content in finished kibble, or water concentration of the flour additives, not having an accurate analysis of these ingredients will lower yields and result in a loss in revenue. The ORACLE and SMART 6 are able to analyze both incoming raw meats and finished dry products for moisture and solids, as well as fat. The Phoenix BLACK can analyze any sample for ash or bone content, and the Sprint directly analyzes any food product for true protein.

Technology

ORACLE with SMART 6

With CEM's ORACLE and SMART 6, fat and moisture are tested, using NMR coupled with microwave and infrared technology, which has been proven to be the most accurate rapid method available. By analyzing the entire sample on a molecular level, not just the surface, precise, real-time results are ensured. Additionally, NMR never requires calibration, which not only removes the possibility of results that may drift, but also saves time and money throughout the life of the instrument, over typical NIR systems.

The ORACLE rapid fat analyzer is the first system that can accurately test fat content of any food product in 30 seconds, with no method development, calibration, or sample validation. The ORACLE can achieve accuracy equal to standard extraction methods for any food product with no solvents.

This means results that are equal to reference extraction techniques, with better consistency and repeatability than NIR technologies can obtain. The ORACLE can test both liquid and powder products, and with no calibration maintenance or frequent validation necessary, the system can help save thousands of dollars a year in calibration costs.

Phoenix BLACK

The Phoenix BLACK muffle furnace is the fastest on the market for determining ash, bone, or total mineral content for pet food samples. What previously took hours, can now be accomplished in minutes with this 1200 °C ASTM conforming muffle furnace. The Phoenix BLACK performs many high-temperature applications, up to 10 times faster than traditional methods. Most pet food analyses can be performed in 10-15 minutes, versus hours, using standard methods. Having test results within minutes transforms the exercise from mundane record keeping to active process control.

Sprint

Protein is directly tested, using the Sprint rapid protein analyzer, eliminating calibrations and drifting results. The Sprint uses dye-binding technology with CEM's proprietary iTag® solution to bind directly to protein molecules at four distinct locations, ensuring only true protein is detected. Other technologies use nitrogen analysis, which can produce inaccurate data as a result of adulterants or miscalculations.

The Sprint protein analyzer uses an AOAC-approved technology that automates and advances dye-binding techniques that have proven effective since 1970. Because it directly measures protein, there is no need for the calculation or calibration that is seen with Kjeldahl and combustion, and it is not swayed by the presence of adulterants or other NPN molecules. Analysis is simple enough for first day technicians to use, and results are immediately recorded after a rapid four-minute test and stored for future reference.

Results and Conclusion

The tables below highlight the accuracy of the ORACLE, SMART 6, Phoenix BLACK, and Sprint. All results were within an acceptable amount of error. Each analysis takes only a few minutes and provides direct, reliable results that can be used to optimize manufacturing processes.

Table 1. Accuracy of the ORACLE, SMART 6, and Sprint for Fat, Moisture, and Protein in Raw Chicken and Beef Blend

Sample Number	Fat (%)			Moisture (%)			Protein (%)		
	Reference	Results	Error	Reference	Results	Error	Reference	Results	Error
1	17.54	17.54	0.00	63.22	62.99	0.23	13.38	13.32	0.06
2		17.57	0.03		62.92	0.30		13.65	0.27
3		17.33	0.21		63.07	0.15		13.47	0.09
4		17.43	0.11		63.11	0.11		13.88	0.50
5		17.52	0.02		62.90	0.32		N/A	N/A
Average		17.48	0.06		62.99	0.23		13.58	0.2

Table 2. Accuracy of the ORACLE, SMART 6, and Sprint for Fat, Moisture, and Protein in Raw Meat Slurry

Sample Number	Fat (%)			Moisture (%)			Protein (%)		
	Reference	Results	Error	Reference	Results	Error	Reference	Results	Error
1	26.52	26.69	0.14	56.53	56.23	0.30	8.42	8.46	0.04
2		26.24	0.28		56.44	0.09		8.35	0.07
3		26.63	0.11		56.36	0.17		8.42	0.00
4		26.68	0.16		56.73	0.20		8.44	0.02
5		26.39	0.13		56.65	0.12		8.50	0.08
Average		26.53	0.01		56.48	0.05		8.44	0.02

Table 3. Accuracy of the ORACLE, SMART 6, and Sprint for Fat, Moisture, and Protein in Finished Kibble

Sample Number	Fat (%)			Moisture (%)			Protein (%)		
	Reference	Results	Error	Reference	Results	Error	Reference	Results	Error
1	15.27	15.32	0.05	6.42	6.51	0.09	21.29	21.35	0.06
2		15.17	0.10		6.61	0.19		21.38	0.09
3		15.23	0.04		6.19	0.23		21.14	0.15
4		15.09	0.18		6.37	0.05		21.33	0.04
5		15.15	0.12		6.46	0.04		21.30	0.01
Average		15.19	0.08		6.43	0.01		21.30	0.01

Table 4. Accuracy of the ORACLE, SMART 6, and Sprint for Fat, Moisture, and Protein in Finished Canned Pet Food

Sample Number	Fat (%)			Moisture (%)			Protein (%)		
	Reference	Results	Error	Reference	Results	Error	Reference	Results	Error
1	5.62	5.60	0.02	75.26	75.43	0.17	10.29	10.34	0.05
2		5.59	0.03		75.20	0.06		10.40	0.11
3		5.64	0.02		75.29	0.03		10.33	0.04
4		5.58	0.04		75.37	0.11		10.31	0.02
5		5.59	0.03		75.27	0.01		10.33	0.04
Average		5.60	0.02		75.31	0.05		10.34	0.05



Table 5. Repeatability of the Phoenix BLACK for Ashing Various Pet Food Samples

Sample Name	Specification	Sample 1	Sample 2	Sample 3	Average	Standard Deviation
Pet Food	15%-22%	19.71	19.48	19.81	19.67	0.17
Chicken Meal	<12%	11.91	12.02	12.07	12	0.08
Turkey Meal	<18%	15.66	15.12	15.29	15.36	0.27
BSA	<1.94%	1.81	1.80	1.60	1.74	0.12
Supplement	N/A	1.70	1.70	1.75	1.72	0.03

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