Moisture Analysis Options for Snack Food Manufacturing

Introduction

Moisture analysis plays a critical role throughout the snack food manufacturing process, from verifying incoming dry ingredients, to final product release. Moisture levels are not only critical to shelf life and flavor of the final product, but can also dramatically affect processing and extrusion characteristics. Traditionally, moisture analysis has been performed using an air-oven method, which typically takes hours to perform, making it longer than the mix cycle of most dough-state extruded snacks. Because of the short mixing period of snack food doughs, true at-line process control has historically been nearly impossible. For this reason, direct moisture testing is typically only performed on final product as a quality control measure. Various rapid, indirect techniques (NIR, FT-IR) have been introduced, but are limited in the types of products that can be tested, and require expensive calibrations for each sample type.

The SMART™ line of moisture/solids analyzers is uniquely designed to handle the wide variety of sample types in snack food manufacturing, from dry powder ingredients to high moisture doughs, hydrates and liquid brews. The SMART Q™ is a robust infrared-based analyzer that uses direct sample temperature feedback to dry samples quickly without scorching. The SMART Q is ideal for low-moisture products such as dry ingredients and finished goods. The SMART 6™ utilizes dual-frequency energy, specifically microwave and infrared, to rapidly analyze any sample, regardless of moisture content, in a matter of minutes. The SMART 6 is ideal for when a mixture of wet and dry products need to be analyzed, or when short test times are critical. Both the SMART Q and SMART 6 incorporate active ventilation to the sealed sample cavity, which pulls moisture vapors away from the sample and expedites the drying process. In addition to moisture/solids analysis, CEM offers an upgrade option to include fat testing with the SMART 6 – ORACLE™ system.[1]

This study demonstrates that the SMART Q and SMART 6 can rapidly analyze a wide range of snack food products for moisture with an average difference of less than 0.03% compared to reference methods.

Key Benefits

- **Rapid At-Line Testing** - Results in minutes
- **Accurate** - Not sensitive to color, density, or consistency changes
- **Rugged** – Designed to withstand the toughest manufacturing environments
- **Direct Loss on Drying** – SMART Q and SMART 6 utilize direct, primary methods that do not require calibrations

Experimental

To evaluate the performance of the SMART Q and SMART 6 moisture analyzers, seven different samples were commercially obtained: Hot Cheetos, Ritz crackers, vegetable chips, corn tortilla chips, dry pretzels, Nilla Wafers and Saltine crackers. For moisture determination, a 2 g sample of each product was analyzed in the SMART Q and the SMART 6. Reference testing for moisture content was performed in an air oven in triplicate to establish a basis of comparison. The air-oven method was set for 5 hours at 100 °C, followed by a cooling period under desiccation to ensure complete drying.

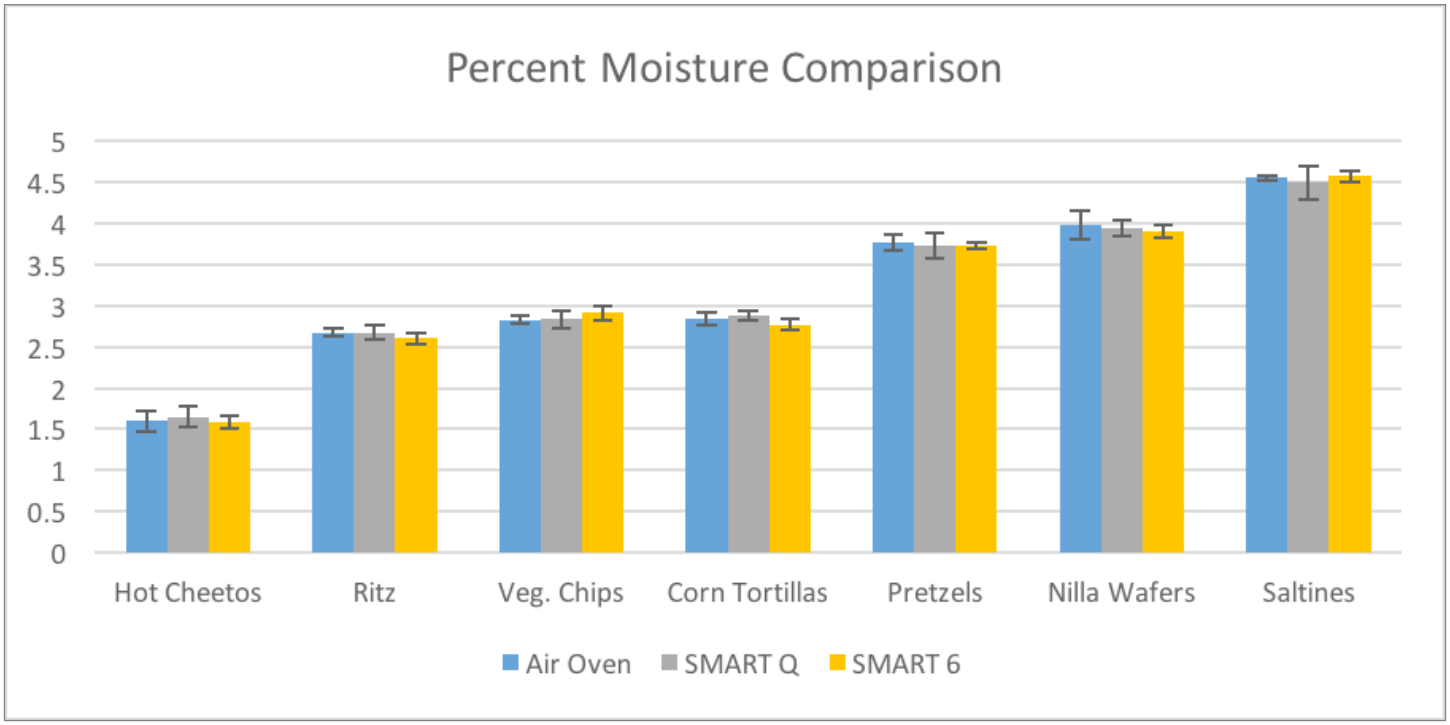
Results

Results for average percent moisture using the SMART Q and SMART 6 compared favorably to air-oven results. The average standard deviation for the SMART Q was 0.117%. The SMART 6, utilizing dual frequency energy, exhibited the best precision, with an average standard deviation of 0.077%. The SMART 6 precision outperformed the air-oven reference results, which exhibited an average standard deviation of 0.087%. The average dry time for the SMART 6 was less than 2 minutes, whereas the average dry time for SMART Q was approximately 3 minutes.

Table 1: Percent Moisture Comparison of Drying Methods For Snack Foods

Sample	Air Oven		SMART Q		SMART 6	
	Average	SD	Average	SD	Average	SD
Hot Cheetos	1.60	0.13	1.65	0.13	1.58	0.05
Ritz	2.67	0.05	2.67	0.09	2.60	0.06
Veg. Chips	2.83	0.06	2.84	0.11	2.91	0.10
Corn Tortillas	2.84	0.08	2.88	0.05	2.77	0.09
Pretzels	3.77	0.10	3.73	0.15	3.72	0.11
Nilla Wafers	3.98	0.17	3.94	0.09	3.91	0.07
Saltines	4.55	0.04	4.49	0.20	4.57	0.06

Figure 1: Percent Moisture Comparison of Drying Methods For Snack Foods



Conclusions

Depending on the needs of the end-user, CEM can provide the right tool for the job. For applications where speed is not the highest priority, the SMART Q offers reliable results that match air-oven reference methods in approximately three minutes. Customers who desire greater speed and precision can upgrade to the SMART 6, which outperforms air-oven reference methods and provides complete analysis in approximately two minutes. With short test times and accurate results, the SMART line of moisture/solids analyzers is rapid enough and rugged enough to work at-line or in the laboratory.

Reference

[1] http://cem.com/fat-analysis/

United States (Headquarters)
800-726-3331
704-821-7015
Fax: 704-821-7894
info@cem.com

France
33 (01) 69 35 57 80
Fax: 33 (01) 60 19 64 91
info.fr@cem.com

Germany, Austria, Switzerland
(49) 2842-9644-0
Fax: (49) 2842-9644-11
info@cem.de

Ireland
+353 (0) 1 885 1752
Fax: +353 (0) 1 885 1601
info.ireland@cem.com

Italy
(39) 35-896224
Fax: (39) 35-891661
info.srl@cem.com

Japan
+81-3-5793-8542
Fax: +81-3-5793-8543
info@cemjapan.co.jp

United Kingdom
(44) 1280-822873
Fax: (44) 1280-822873
info.uk@cem.com

www.cem.com