

Improved Process Control for Personal Care Products



Introduction

Total solids measurement in personal care items such as deodorants, oral care products, and cleansers has historically been difficult to achieve using microwave-based analyzers due to the presence of non-aqueous volatile components. Because of the wide variety of volatile components present in a given sample, solids testing has historically been performed in an air or vacuum oven, which is effective at drying all sample types, but takes hours to complete. 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 to maintain performance. Infrared moisture balances decrease test time compared to traditional oven methods, but still require up to 30 minutes to completely dry samples. Furthermore, infrared moisture balances struggle to completely dry low-solid liquids, which tend to re-condense inside the drying cavity.

The SMART 6™ Moisture & Solids Analyzer is uniquely designed to handle the wide variety of sample types in the personal care space, whether it is water-based, contains a mixture of volatile components, or is a dry powder. The SMART 6 utilizes dual-frequency energy, specifically microwave and infrared, to rapidly analyze solids content. Low frequency microwaves penetrate the entire sample to rapidly remove volatiles through dipole rotation, while high frequency infrared energy evenly heats the surface to remove non-polar components through molecular vibration. The two energy sources work in unison, providing benefits over microwave-only and infrared-only analyzers.

This study demonstrates that the SMART 6 can rapidly analyze a wide range of personal care products for total solids with an average difference of less than 0.05% compared to reference methods.

Key System Benefits

- **Rapid at-line testing** – Results in minutes.
- **Accurate** – Not sensitive to color, density, or consistency changes. Works with all sample types from 0.01 – 99.90% solids.
- **Advanced control** – Programmable constant-weight setting ensures every sample is completely and uniformly dry, while active temperature control prevents the sample from overheating or scorching.
- **Direct loss on drying** – SMART 6 is a direct, primary method with no calibration required.

Experimental

To evaluate the performance of the SMART 6 Moisture & Solids Analyzer, five different personal care products were commercially obtained: roll-on deodorant, stick deodorant, mouthwash, lotion and soap. For solids determination, a 2 g sample of each product was analyzed in the SMART 6 using a combination of microwave and infrared energy for rapid and consistent drying. Reference testing for solids content was performed in triplicate to establish a basis of comparison.

Results

Results for percent solids using the SMART 6 ranged from 0.01 – 0.07 % difference compared to oven methods, demonstrating the high degree of accuracy of the SMART 6 analyzer, as shown in **Table 1**. **Table 2** highlights the precision of the SMART 6 dual frequency drying capabilities, which was ≤ 0.10 % standard deviation for all samples analyzed.

Conclusion

Using dual-frequency energy, the SMART 6 Moisture & Solids Analyzer completely dries all sample types regardless of the makeup of volatile components. Historically, microwave-only analyzers have been limited to samples with polar volatile components. Infrared-only analyzers take much longer to completely dry samples, and are ineffective at completely driving off bound moisture in solid samples. By combining microwave with infrared energy, the benefits of both sources are realized and the result is rapid, complete drying for all sample types with excellent precision and accuracy.

Table 1: Accuracy of CEM technology compared to reference methods

Sample	Percent Solids		
	SMART 6	Oven	Difference
Roll Deodorant	23.36	23.37	0.01
Stick Deodorant	60.51	60.46	-0.05
Mouthwash	9.87	9.94	0.07
Lotion	13.45	13.42	-0.03
Liquid Soap	28.54	28.57	0.04

Table 2: Precision of CEM technology

Sample	Component	Replicates					Average	Range	StDev
		1	2	3	4	5			
Roll Deodorant	Solids	23.47	23.46	23.36	23.27	23.26	23.36	0.21	0.10
Stick Deodorant	Solids	60.58	60.59	60.55	60.38	60.44	60.51	0.20	0.09
Mouthwash	Solids	9.99	9.92	9.84	9.83	9.76	9.87	0.23	0.09
Lotion	Solids	13.46	13.39	13.41	13.52	13.45	13.45	0.13	0.05
Liquid Soap	Solids	28.62	28.55	28.53	28.50	28.48	28.54	0.14	0.05

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

© 2018 CEM Corporation
All rights reserved. This may not be reproduced or published without written permission from CEM.