Rapid & Precise Moisture Analysis for Healthcare Products

Introduction

Healthcare products come in many forms and are made by a wide variety of processes. However, the one parameter that nearly all products share is the need for precise control of moisture content. Pills with too much moisture will agglomerate, while those with too little moisture may fail to hold their form. Water-based liquid products experience changes in consistency and dosage when moisture content fluctuates batch-to-batch.

Moisture analysis in the pharmaceutical industry is widely accomplished using infrared gravimetric moisture balances. Traditional infrared moisture balances are a relatively rapid approach to verifying moisture content, but can take 20 minutes or more to complete. Furthermore, traditional moisture balances only measure the temperature of the drying cavity, not of the sample itself. The inability to directly measure sample temperature can easily result in scorched samples and inaccurate results.

The SMART Q™ infrared moisture analyzer is uniquely designed to accurately and rapidly measure moisture content in a wide variety of healthcare products. By combining active cavity ventilation and patented quartz-halogen drying technology with direct sample temperature feedback, the SMART Q analyzes samples up to 3-times faster than traditional infrared moisture balances with no risk of burning. With a highly accurate 4-place analytical balance and 3-digit moisture readout, the SMART Q provides reliable, repeatable results in approximately 5 minutes. For even faster test times, the SMART Q can be upgraded to the SMART 6, which combines microwave and infrared technology for the fastest direct moisture analysis on the market.

This study demonstrates that the SMART Q can rapidly analyze a wide range of healthcare products for moisture content with an average difference of 0.002% compared to oven reference results.

Key Benefits of SMART Q

- **Rapid at-line testing** - Results in minutes.
- **Easy to use** - Not sensitive to color, density, or consistency changes
- **Rugged** - Designed to withstand the toughest manufacturing environments
- **Direct Loss-on-drying** - direct, primary method with no calibration required

Experimental

To evaluate the performance of the SMART Q, five healthcare samples were obtained: Acetaminophen, Gelatin supplement, Vitamin C, Vapor Rub, and a nutritional shake. For moisture determination, a 5 g sample of each product was analyzed in the SMART Q using a constant-weight end parameter. Testing took approximately 5 minutes for all samples. Reference testing was performed in an air oven in triplicate to establish a basis of comparison. The oven method was set for 8 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 compared closely to air oven results, as illustrated in **Table 1**. The average absolute difference between the SMART Q results and air oven results are less than 0.003%. **Table 2** highlights the precision of the SMART Q. The SMART Q outperformed the air oven reference method, exhibiting average standard deviations of 0.011 % and 0.013% respectively. The average dry time for the SMART Q was approximately 5 minutes with no cavity pre-heat, a necessary feature common among other leading brands of infrared moisture analyzers.

Table 1: Accuracy of SMART Q for Moisture Analysis of Powdered Products

	Percent Moisture		
Sample	**SMART Q**	**Air Oven**	**Difference**
Acetaminophen	1.364	1.359	0.005
Gelatin Supplement	10.276	10.275	0.001
Vitamin C	0.557	0.550	0.007
Vapor Rub	11.621	11.623	-0.002
Nutritional Shake	31.265	31.265	0.000

Table 2: Precision of SMART Q for Moisture Analysis of Powdered Products

	Percent Moisture Replicates						
Sample	**1**	**2**	**3**	**4**	**5**	**Average**	**Std. Dev.**
Acetaminophen	1.351	1.345	1.361	1.369	1.351	1.360	0.010
Gelatin Supplement	10.297	10.253	10.277	10.293	10.262	10.276	0.019
Vitamin C	0.551	0.555	0.560	0.545	0.573	0.557	0.011
Vapor Rub	11.582	11.642	11.636	11.645	11.599	11.621	0.028
Nutritional Shake	31.261	31.260	31.266	31.265	31.273	31.265	0.005

Conclusion

For healthcare applications where accuracy and precision are critical, the SMART Q offers reliable results that match oven reference methods in only a few minutes. CEM's combination of proprietary and patented technology translates to one of the fastest and most reliable primary moisture tests on the market. With short test times and accurate results, the SMART Q is rapid and rugged enough to work at-line, or in the laboratory.

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