CEM CORPORATION

APPLICATION NOTES

Analysis of Moisture and Fat in Dairy Powders Using the FAST Trac

Introduction

Time Domain NMR (TD-NMR) is a technology ideally suited for the measurement of moisture and fat (oil) in dairy powders. This technology works by exploiting the differences in NMR relaxation rates between solids and bound moisture (rapid relaxation) and oil (slow relaxation). Because moisture is tightly bound in dairy powders, it can be readily distinguished from the fat.

Unlike other rapid methods, NMR measures moisture and fat throughout the entire sample (not just the surface), ensuring representative sampling and the most accurate results.

Calibration is performed through simple linear regressions (no multivariate techniques required), so it is quick, easy, and highly robust. Only a handful of samples are needed to create new calibrations, which are not affected by changes in additives, sample granularity, or color.

FAST Trac

The FAST Trac is a newly developed 2nd generation NMR system from CEM specifically designed to accurately determine moisture and fat in low-moisture samples in less than 2 minutes. Though 1st generation NMR systems require extended sample conditioning times, FAST Trac with patent-pending QuikPrep Technology reduces the total sample conditioning and analysis time to 2 minutes. This compact system features an easy-to-use touch screen interface with intuitive software. You don't have to be experienced in chemometrics or spectroscopy to obtain accurate and reliable results.

Key Features and Benefits:

- 2-minute analyses using new QuikPrep™ Technology* for rapid sample conditioning
- IFM™ Technology* (Interference-Free Moisture) for reliable moisture determinations across wide fat ranges
- More accurate and robust than NIR
- Accuracy comparable to standard methods
- Calibrations are simple to create, and are not affected by changes in additives, sample color, or granularity
- Intuitive software and easy-to-use touch screen interface

*Patents Pending

Method Development

To demonstrate the potential of the FAST Trac for analysis of dairy powders, separate moisture and fat methods were created using 3 – 4 samples selected to cover the component ranges of the available samples. The samples (several powdered infant formulas, skim milk powder, and full cream milk powder) were obtained from a local supermarket and analyzed directly from their supplied container. To extend the moisture range, a higher moisture sample (5.69 % moisture) was created by exposing one of the samples to ambient air. Reference analyses were completed using standard methods (Rose Gottlieb and oven drying). Statistics for each calibration are shown in the table below, and the calibration curves are shown in Figures 1 and 2.

Component	Range	R2
Fat	1.30 – 28.44	0.9996
Moisture	1.93 – 5.69	0.9999

To complete each analysis, the sample was weighed on a glass fiber pad, rolled up in Trac film, and inserted in a Trac tube. The samples were conditioned using QuikPrep Technology, then inserted in the magnet for analysis. For batch analyses, it is recommended that samples be conditioned for at least 30 minutes on a heater block set at 40 °C. Once inserted in the magnet, analysis is complete within 1 minute.

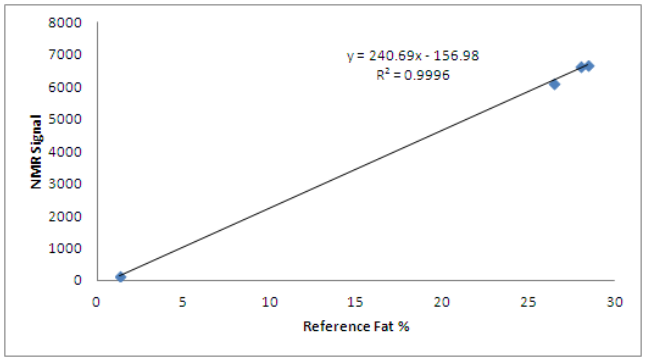

Figure 1: Fat calibration curve

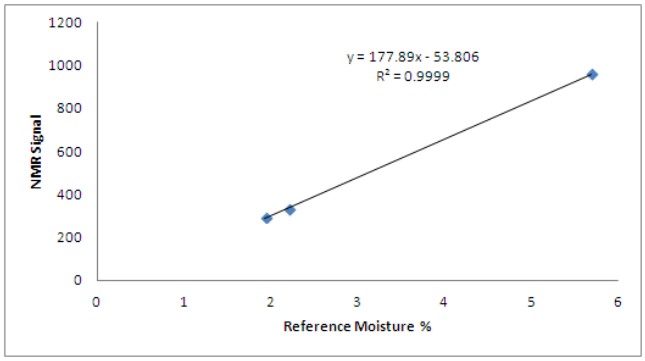

Figure 2: Moisture calibration curve

Results and Discussion

To demonstrate the performance of the FAST Trac, an unknown milk powder sample was analyzed using the fat and moisture methods. Ten replicates (different preparations of the same sample) were analyzed with the fat and moisture methods, and the results were compared to those obtained by the reference methods. These results indicate that the FAST Trac is able to accurately analyze a broad range of dairy powders using only a single calibration with a small number of reference points.

Fat Results

Replicate	Reference Fat %	FAST Trac Fat %	Error
1	27.66	27.66	0.00
2		27.66	0.00
3		27.63	0.03
4		27.68	0.02
5		27.71	0.05
6		27.69	0.03
7		27.70	0.04
8		27.69	0.03
9		27.72	0.06
10		27.66	0.00

Moisture Results

Replicate	Reference Moisture %	FAST Trac Moisture %	Error
1	2.81	2.82	0.01
2		2.80	0.01
3		2.81	0.00
4		2.81	0.00
5		2.81	0.00
6		2.79	0.02
7		2.80	0.01
8		2.83	0.02
9		2.80	0.01
10		2.81	0.00

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