ORACLE
Fat Analyzer

The first ever rapid fat analyzer
with no method develpment.

Introduction

Fat and moisture testing for foodstuff samples has
traditionally been done by wet chemistry techniques,
which are laborious and time consuming and often
involve skilled technicians and hazardous solvents.
Various rapid techniques (TD-NMR, NIR, FT-IR, and FT-NIR)
have been introduced, but none have been universally
accepted due to the need for often extensive calibration
development and maintenance.

The ORACLE is a rapid time-domain NMR (TD-NMR)
instrument incorporating breakthrough technology that
allows for direct determination of fat/oil in foodstuffs.
Unlike other rapid techniques, the ORACLE is able
to completely isolate the detection of fat in complex
matrices which eliminates the need for calibration
development. To allow for rapid moisture/solids as well
as fat testing, the ORACLE can be coupled with a SMART
6 moisture/solids analyzer.

To demonstrate the ability of the ORACLE and SMART 6
to accurately and reliably determine the fat and moisture
content in dairy samples, an assortment of 11 samples
were obtained and analyzed. The samples were selected
to represent a range of both matrix types as well as
relative component concentrations.

Key Benefits of ORACLE

· Direct technique, requiring no calibration
· Rapid (less than 5 minutes for moisture and fat)
· Bulk measurement (insensitive to color and granularity)
· Better repeatability than reference methods

Robot and high capacity heater blocks (100 positions) with ORACLE

Experimental

To complete each analysis, the samples were pre-dried on the SMART 6 (ca. 3 – 4 minutes) and then prepared for analysis in the ORACLE. Once inserted into the ORACLE magnet, the samples are rapidly conditioned (30 s) using the QuikPrep™ prior to NMR analysis (35 s). Samples sizes ranged from 2 – 3 grams. Each sample was analyzed at least in duplicate for the reference analyses (AOAC approved methods), and at least 5 times for the SMART 6 – ORACLE analyses.

Note: High-throughput analyses can be enabled through the use of batch automation using an optional robot and high capacity heater blocks (100 positions).

Results and Discussion

The accuracy of the SMART 6 and ORACLE results is demonstrated in Table 1, where the average reference results are compared with the average of the SMART 6 and ORACLE results. The average difference ranged from 0.01 - 0.29 % for moisture/solids, and from 0.01 – 0.15 % for fat. Repeatability is shown in Table 2, where the standard deviations ranged from 0.01 – 0.11 % for moisture/solids, and from 0.01 – 0.12 % for fat.

These results suggest the ability of the SMART 6 – ORACLE to reliably determine the moisture/solids and fat content in dairy samples with an accuracy closely matching that of the reference methods. In addition, there are inherent repeatability advantages over the reference methods, which are error prone due to a strong dependence on a range of experimental factors (e.g. extraction time, solvent composition, temperature, etc.).

Table 1: Accuracy

Sample	Moisture/Solids			Fat		
	SMART 6	Oven	Difference	ORACLE	Mojonnier	Difference
Skim Milk	90.73	90.74	0.01	0.19	0.18	0.01
Yogurt	20.92	21.10	0.18	0.86	0.81	0.05
Low Fat Milk	89.20	89.11	0.09	2.03	2.02	0.01
Whole Milk	88.03	87.88	0.15	3.41	3.41	0.00
Ice Cream	39.12	39.07	0.05	13.51	13.56	0.05
Half and Half	18.57	19.24	0.67	10.79	10.75	0.04
Processed Cheese	46.63	46.07	0.56	21.36	21.44	0.08
Natural cheese	39.74	39.52	0.22	29.85	29.90	0.05
Cream Cheese	54.60	54.77	0.17	33.58	33.70	0.12
Cream	42.09	42.43	0.34	37.02	37.06	0.04
Sour Cream	24.94	25.23	0.29	17.54	17.69	0.15
		Average	0.25		Average	0.06

Table 2: Repeatability

Sample	Component	Replicates					Average	Range	Std. Dev.
		1	2	3	4	5			
Skim Milk	Moisture/Solids	90.73	90.72	90.72	90.72	90.74	90.73	0.02	0.01
	Fat	0.17	0.19	0.2	0.2	0.21	0.19	0.04	0.02
Yogurt	Moisture/Solids	20.92	20.91	20.95	20.87	20.94	20.92	0.08	0.03
	Fat	0.84	0.87	0.84	0.89	0.85	0.86	0.05	0.02
Low fat milk	Moisture/Solids	89.16	89.25	89.20	89.17	89.23	89.20	0.09	0.04
	Fat	2.04	2.02	2.05	2.04	2.02	2.03	0.03	0.01
Whole Milk	Moisture/Solids	88.02	88.02	88.02	88.06	88.04	88.03	0.04	0.02
	Fat	3.43	3.41	3.4	3.42	3.41	3.41	0.03	0.01
Ice Cream	Moisture/Solids	39.16	39.16	39.06	39.10	39.14	39.12	0.10	0.04
	Fat	13.56	13.46	13.54	13.48	13.51	13.51	0.10	0.04
Half and Half	Moisture/Solids	18.61	18.55	18.55	18.58	18.56	18.57	0.06	0.03
	Fat	10.78	10.82	10.78	10.80	10.78	10.79	0.04	0.02
Processed Cheese	Moisture/Solids	46.55	46.68	46.79	46.53	46.60	46.63	0.26	0.11
	Fat	29.82	29.82	29.89	29.90	29.82	29.85	0.08	0.04
Natural Cheese	Moisture/Solids	39.79	39.75	39.72	39.76	39.70	39.74	0.09	0.04
	Fat	21.22	21.47	21.27	21.41	21.45	21.36	0.25	0.11
Cream Cheese	Moisture/Solids	54.57	54.58	54.53	54.64	54.69	54.60	0.16	0.06
	Fat	33.63	33.63	33.58	33.65	33.40	33.58	0.25	0.10
Cream	Moisture/Solids	42.00	42.06	42.05	42.20	42.12	42.09	0.20	0.08
	Fat	37.00	36.93	37.07	37.05	37.04	37.02	0.14	0.06
Sour Cream	Moisture/Solids	24.88	24.86	25.03	25.07	24.88	24.94	0.21	0.10
	Fat	17.40	17.58	17.56	17.71	17.45	17.54	0.31	0.12