



the minispec

● Fat & Moisture in Milk Powder & Milk Powder Products

Fat & moisture Analysis

- Fat and moisture in milk powder
- Fat and moisture in milk powder based products
- Fast and accurate - and superior to wet chemistry
- Independent of color or particle size of milk powder

Milk powders and milk powder based products are widely produced and sold. They are used as a base for bottled milk for weaning babies, as a base for a number of different kind of "instant" milk drinks, and in the confectionary industry as a conveniently storable form of milk for chocolate products etc. In addition, vast quantities of milk powders are exported to developing nations

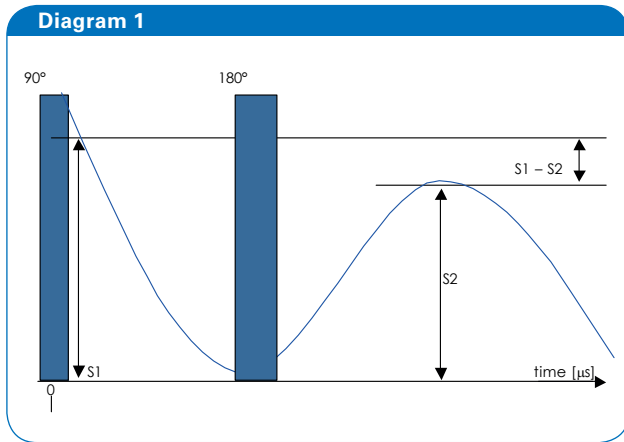
where there are often acute food shortages. Producers typically supply a whole product range of milk powders for customers with different fat content requirements. Therefore it is obviously necessary to measure all these products for fat content. The water content is measured and should be less than about 4% for all products, because an excess will cause product deterioration.

Conventional Methods

Conventionally the oil content of milk powders is measured by solvent extraction, this is obviously time consuming, relatively slow, and requires solvents, glassware, laboratory personnel etc. The water is measured by drying, or more accurately by the Karl Fischer method, which again requires time and laboratory personnel.

The minispec method

Here the minispec method is shown by describing an experiment with a series of 40 samples of several different products from a major multinational food company. These samples had fat contents ranging from 15% to 30% and water contents of 0% to 3% (both by weight). The mea-

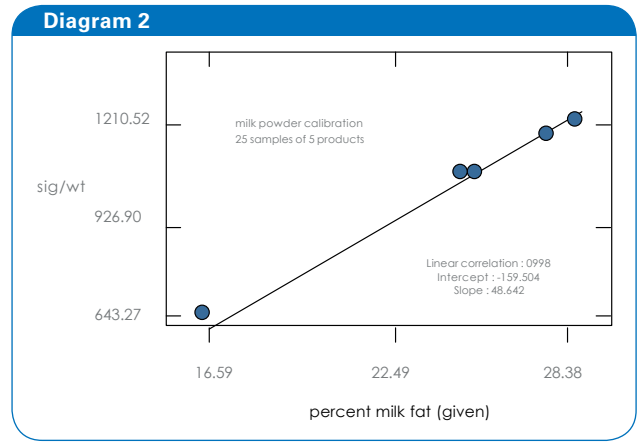


The spin-echo pulse sequence showing measured points S1 and S2

Measurements were made using a "Spin Echo" technique, represented diagrammatically by diagram 1, which shows the time evolution of events after firstly a 90 degree radio frequency pulse, followed by a 180 degree pulse. The amplitudes S1, S2 represent the points at which the NMR signal amplitudes are measured. In the case of milk powder, we know the water to be essentially "bound" water, in a semi-liquid state, which means that at S1, the amplitude represents the total amount of liquid (water and fat) present in the sample. However this "bound" water also has a very short "relaxation time" T2, which means that the signal at S2 represents only the oil present in the sample.

$S2 / \text{weight} \propto$
oil content per gram

$S1 - S2 / \text{weight} \propto$
moisture content per gram



minispec Configurations:

mq-one

- 10 MHz NMR system
- Sample volume: ~ 40 ml
- Tube diameter: ~ 40 mm
- Included in a package with tubes, aluminium block and calibration standards
- Recommended for seeds such as rape or semi-homogenized materials

mq20

- 20 MHz NMR system
- Sample volume: ~ 8 ml
- Tube diameter: ~ 18 mm or others
- Recommended for little amounts of seeds down to a single seed

Table 1

ID	Product	% oil (ext)	% oil (error) (NMR)	% water (KF)	% water (error) NMR
1	A	16.75	16.72 (-0.03)	2.00	2.02 (+0.02)
2	A	16.87	16.93 (+0.04)	1.50	1.80 (+0.30)
3	B	18.40	18.70 (+0.30)	2.36	2.34 (-0.02)
4	C	24.90	24.95 (+0.05)	2.65	2.56 (-0.09)
5	D	25.74	25.86 (+0.12)	2.73	2.51 (-0.22)
6	D	25.34	25.54 (+0.20)	2.46	2.48 (+0.02)
7	D	25.41	25.59 (+0.18)	2.51	2.65 (+0.14)
8	E	27.47	27.35 (-0.12)	2.40	2.50 (+0.10)
9	E	27.31	27.21 (-0.10)	2.33	2.33 ()
10	F	28.73	28.57 (-0.16)	2.70	2.80 (+0.10)
11	F	27.50	27.50 ()	2.66	2.44 (-0.22)

Analysis of Fat and Water in Milk Powder Based Products. For fat the accuracy is +/- 0.06 with s. d. = 0.08, and for the moisture measurement an accuracy of +/- 0.05 with s.d. = 0.1.

● **Bruker BioSpin**

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Bruker BioSpin is ISO 9001 certified.

Magnetic safety measures apply to the operation of the minispec.