Measurement of Oil and Fat Content in Animal Feed without Drying

Fat content is an important nutritional and quality control parameter in the manufacture of animal feed, therefore a fast and reliable measurement is required for process optimisation. Nuclear Magnetic Resonance (NMR) relaxometry can determine fat content of animal feed in the presence of 9-14% moisture without pre-drying.

Method

Solvent extraction techniques are commonly used for determination of fat content. However, they tend to be slow, cumbersome, inaccurate and require skilled personnel. In addition, many of the often hazardous chemicals used are becoming increasingly unacceptable according to current international health, safety and environmental standards.

In contrast, NMR relaxometry is quick and easy to perform, simple to calibrate and not dependent on the sample matrix. Samples are simply loaded into pre-tared glass vials, weighed, conditioned, then inserted into the instrument, automatically starting the NMR analysis. The instrument returns the oil content values in less than one minute.

Calibration and Results

NMR relaxometry is used to determine the quantity of hydrogen protons present in the liquid components of the sample. In animal feeds, water is bound to the solid matrix, while the oil is free: this difference allows the signals to be separated on the basis of their relaxation times.

Figure 1 shows the calibration graph with a standard error of 0.21% fat, using a measuring time of 32 seconds. This clearly demonstrates that a high quality calibration can easily be obtained, even with inhomogeneous samples.
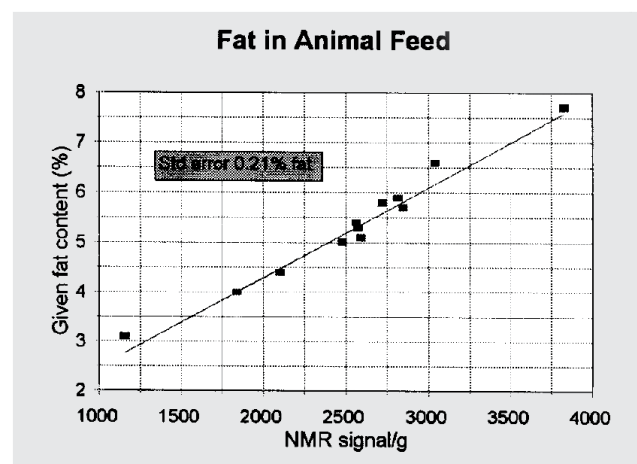

Figure 1: Calibration of the NMR signal against the oil and fat content

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Value	Repeat Measurements						MEAN	SD
5.59	5.59	5.62	5.64	5.66	5.68	5.64	5.64	0.03
Value	Portion Measurements						MEAN	SD
5.82	5.88	5.80	5.68	6.00	6.04		5.88	0.15

Results of instrument and sample repeatability

Instrument repeatability was then tested by measuring one sample six times without removing it from the instrument. Sample repeatability was tested by measuring five different portions of the same sample.

Instrument and sample repeatability were shown to be 0.03% and 0.15% respectively.

Recommended Instrument

The **MQC+**23 with a 0.55 Tesla (23 MHz) magnet, fitted with a 26mm diameter (10 ml sample) probe is a suitable instrument for this application. The Oil in Animal Feed package comprises:

- **MQC+**23 with a built-in computer operating under Microsoft® Windows® (no separate PC is required)

- **MultiQuant** software including **RI Calibration**, **RI Analysis**, and the **EasyCal** 'Oil in Animal Feed' application

- Three Calibration Maintenance Standards (CMSs) with nominal values of 10, 25 and 40% oil content for calibration maintenance and quality control

- 26mm diameter sample vials

- PTFE sample holder

- PTFE sample packing tool

- Installation manual

- Method sheet

In addition to this package you will also require:

- A dry heater and aluminium block with holes for sample conditioning at 40°C

- A precision balance

The **MQC+**23 Oil and Fat in Animal Feed system offers many advantages:

- Minimal sample preparation

- Low maintenance

- Small benchtop footprint

- The sample tubes are recyclable, lowering consumable costs

- High signal sensitivity

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