

Measurement of Oil 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. Low resolution Nuclear Magnetic Resonance (NMR) can determine fat content of animal feed in the presence of 9-14% moisture without pre-drying, in contrast to most other samples, particularly seeds, which must be < 10%.

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 international environmental standards.

In contrast, low resolution NMR 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 which detects the sample, automatically starting the NMR analysis. The instrument returns the oil content values in less than one minute.

Calibration and Results

Low resolution NMR determines the quantity of hydrogen protons present in the liquid components of the sample. In many materials, signals from water and fat cannot be distinguished. In this application, however, the water appears to be quite tightly bound to the solid matrix, and the oil and water signals can be separated on the basis of their relaxation times.

The calibration graphs using the complete calibration set, and with one sample removed, are shown in Figure 1. On removal of the outlier, the standard error of the resulting calibration was 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.

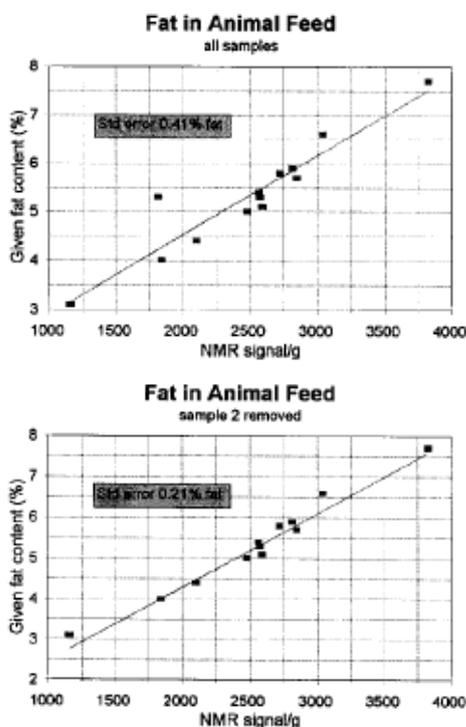


Figure 1: Calibration of the NMR signal against the fat content before and after removal of an outlier



NMR



Benchtop NMR for Food & Agriculture



Results of instrument and sample repeatability

Value	Repeat Measurements						MEAN	SD
5.59	5.59	5.62	5.64	5.66	5.68	5.64	0.03	
Value	Portion Measurements						MEAN	SD
5.82	5.88	5.80	5.68	6.00	6.04	5.88	0.147	

Instrument repeatability was then tested by measuring one sample five 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:

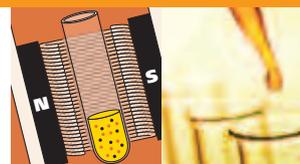
- **MQC-23** with a built-in computer operating the latest version of Microsoft® Windows® (no separate PC is required)
- **MultiQuant** software including **RI Calibration, RI Analysis**, and the **EasyCal** 'Oil in Animal Feed' application
- Three setting up standards (SUS's) at 10, 25 and 40% oil content 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 instrument offers multiple advantages over other instruments on the market:

- High signal sensitivity
- Small benchtop footprint
- Low maintenance
- The sample tubes are recyclable, lowering consumable costs
- Minimal sample preparation



NMR

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