



Simultaneous determination of water and oil content in seeds using TD-NMR

GENERAL NOTES

Seeds such as sunflower, soybean, groundnut, cotton seeds and rape are grown for their oil content; therefore, an accurate and fast determination of oil content is important to breeders, growers and buyers. On the other hand, excess of water or moisture content reduces cost and shelf life of agriculture products.

The traditional method of oil determination is based on solvent extraction, which is time consuming, uses harmful reagents and solvents, moreover results depends on operator experience. Thus, such methods are characterized by low accuracy and poor reproducibility. Infrared spectroscopy is very suitable for this assessment but the device calibration is not trivial. Moisture content can be evaluated by consequent drying and weighting but this is a time-consuming technique.

Time-Domain NMR is a powerful technique for rapid simultaneous determination of both parameters. NMR provides the quantitative determination of water and oil fractions because water is bound to the cellulose matrix and NMR signal from water content decays quickly in comparison with relatively free oil signal.

In this application 2 pulses sequence FID-Spin echo is used (figure 1).

The NMR signal immediately after the 90° RF pulse is proportional to the total oil plus water content, and the echo signal after 180° RF pulse proportional to the oil content only. Pure water content can be determined by subtracting spin echo amplitude from initial FID amplitude.

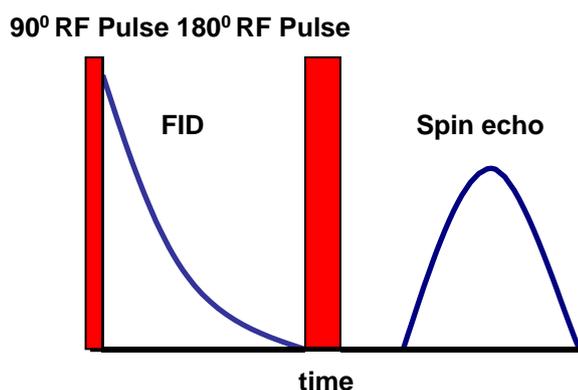


Fig 1. FID-Spin echo sequence

EQUIPMENT

Resonance Systems NMR-analyzer **Spin Track** (fig. 2) is an ideal instrument for oil and moisture application because of short dead time, high acquisition rate and high signal to noise ratio that make measurements very reproducible and accurate. Small weight and mobility allow its using in industrial routine analysis as well as in specialized laboratories. **Spin Track** fulfills requirements of standards **ISO 10565** and **ISO 10632**.



Fig 2. NMR analyzer **Spin Track**

Since it is based on modern electronics and all measurements are implemented as automatic routines pressing one button, **Spin Track** is highly user friendly.

Spin Track can operate with sample volumes up to 45 cm³. Calibration procedure for oil and moisture content also fully corresponds to **ISO 10565** and **ISO 10632**. Typical calibration curves are shown at figure 3.

The **Seeds Analyzer** package comprises:

- Spin Track NMR Analyzer with thermally stabilized magnetic system;
- PC with pre-installed Microsoft OS © Windows 7, 8 or 10* and Relax 8 software;
- Test tubes with outer diameter 10, 18 or 40 mm**;
- Plastic caps for test tubes;
- Installation Manual;
- Method Sheet;
- Calibration/Validation samples;
- Autosampler (optionally).

* Determined by the PC manufacturer

**Depends on investigated samples

Precision electronic balance is also included.



CALIBRATION AND MEASUREMENT

The workflow consists of the following steps:

1. Calibrating by several samples with known values of moisture/oil content (prepared by reference technique);
2. Filling sample tube;
3. Weighting;
4. Inserting sample tube in a detector manually or by the autosampler;
5. Running a measurement which takes normally below 1 minute;
6. All measurement results are recorded in a spreadsheet, saved and can be accessed both on a computer and on-line.

- Same results of total fat content at varying air humidity;
- Process can be fully automated;
- Technical support

As it is mentioned before, the Spin Track fulfills the requirements of the international standards ISO 10565 and ISO 10632.

CONTACTS

Please refer to additional information on the website of Resonance Systems

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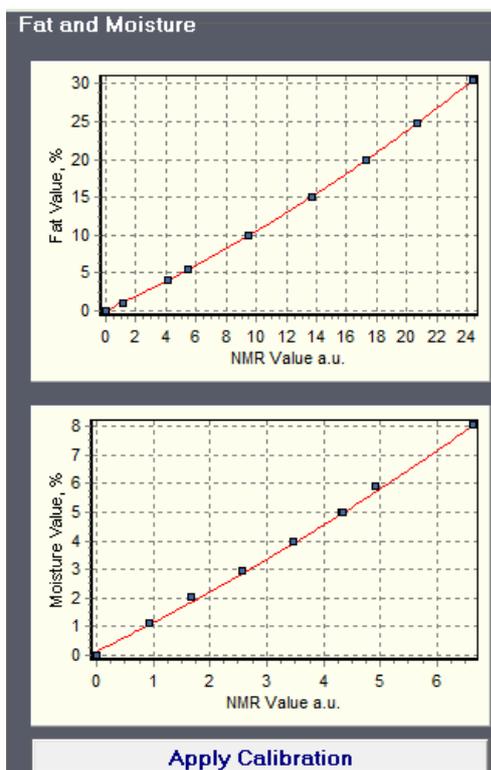


Fig 3. Calibration curves.

FEATURES AND BENEFITS

Main advantages of **Spin Track** TD-NMR analyzer:

- Fast measurement with high results accuracy;
- Minimal reagents costs and reduction in the number of operations performed by staff;