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Animal feeding stuffs, cereals and milled cereal products — Guidelines for the application of near infrared spectrometry

Aliments des animaux, céréales et produits de mouture des céréales — Lignes directrices pour l'application de la spectrométrie dans le proche infrarouge

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 10, *Animal feeding stuffs*.

This second edition cancels and replaces the first edition (ISO 12099:2010), which has been technically revised.

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Introduction

This document has been drafted using, as a basis, ISO 21543 | IDF 201, which was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 5, *Milk and milk products*, and the International Dairy Federation (IDF).

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Animal feeding stuffs, cereals and milled cereal products — Guidelines for the application of near infrared spectrometry

1 Scope

This document gives guidelines for the determination by near infrared spectroscopy of constituents such as moisture, fat, protein, starch and crude fibre and parameters such as digestibility in animal feeding stuffs, cereals and milled cereal products.

The determinations are based on spectrometric measurement in the near infrared spectral region.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
near infrared instrument
NIR instrument
apparatus which, when used under the conditions defined in this document, predicts *constituent contents* (3.3) and *technological parameters* (3.4) in *animal feeding stuffs* (3.2), cereals and milled cereal products through relationships to absorptions in the near infrared range

3.2
animal feeding stuffs
substance or product, including additives, whether processed, partially processed or unprocessed, intended to be used for oral feeding to animals

EXAMPLE Raw materials, fodder, meat and bone meal, mixed feed and other end products, pet food, etc.

3.3
constituent content
mass fraction of substances determined using the appropriate, standardized or validated chemical method

Note 1 to entry: The mass fraction is often expressed as a percentage.

Note 2 to entry: For examples of appropriate methods, see References [1] to [12].

EXAMPLE Moisture, fat, protein, crude fibre, neutral detergent fibre and acid detergent fibre.

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3.4
technological parameter
property or functionality of *animal feeding stuffs* (3.2), cereals and milled cereal products that can be determined using the appropriate, standardized or validated method(s)

Note 1 to entry: It is possible to develop and validate NIR methods for other parameters and sample types than listed above, as long as the procedure from this document is observed. The measuring units of the parameters determined follow the units used in the reference methods.

EXAMPLE Digestibility.

4 Principle

Spectral data in the near infrared region are collected and transformed to constituent or parameter concentrations by calibration models developed on representative samples of the products concerned.

5 Apparatus

5.1 Near infrared instruments.

Instruments based on diffuse reflectance or transmittance measurement covering the near infrared wavelength region of 770 nm to 2 500 nm (12 900 cm^{-1} to 4 000 cm^{-1}) or segments of this or at selected wavelengths or wavenumbers. The optical principle may be dispersive (e.g. grating monochromators), interferometric or non-thermal (e.g. light emitting diodes, laser diodes and lasers). The instrument should be provided with a diagnostic test system for testing photometric noise and reproducibility, wavelength/wavenumber accuracy and wavelength/wavenumber precision (for scanning spectrophotometers).

The instrument should measure a sufficiently large sample volume or surface to eliminate any significant influence of inhomogeneity derived from chemical composition or physical properties of the test sample. The sample path length (sample thickness) in transmittance measurements should be optimized according to the manufacturer's recommendation with respect to signal intensity for obtaining linearity and maximum signal/noise ratio.

5.2 Appropriate milling or grinding device, for preparing the sample (if needed).

NOTE Changes in grinding or milling conditions can influence NIR measurements due, for example, to heating which can drive off volatile components such as water.

6 Calibration and initial validation

6.1 General

The instrument shall be calibrated before use. Calibration involves the comparison with a reference and adjustment processes to the instrument. Because a number of different calibration systems can be applied with NIR instruments, no specific procedure can be given for calibration.

For an explanation of methods for calibration development, see Reference [16] and the respective manufacturer's manual. For the validation, it is important to have a sufficient number of representative samples, covering variations such as the following:

a) combinations and composition ranges of major and minor sample components;

b) seasonal, geographic and genetic effects on forages, feed raw material and cereals;

c) processing techniques and conditions;

d) storage conditions;

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