Stool analysis with NIR Spectroscopy

Determination of fat, nitrogen, dry matter content without sample preparation

The Metrohm Near-Infrared DS2500 Solid Analyzer has been proven to be a valuable instrument for easy and reliable stool tests in biomedical laboratories. Fecal nitrogen and fat, dry matter and many more key parameters can be quantified in less than a minute without any sample preparation required.

Laurence Barbot-Trystram from the Charles Foix University Hospital from Pitie Salpetriere (France) is a medical biologist, PhD pharmacist, specialized in biochemistry. She is using this device and agreed to share her experience.

Ω Metrohm

DEAR MRS. BARBOT-TRYSTRAM PLEASE BRIEFLY DESCRIBE THE LAB YOU ARE WORKING AT?

The lab of functional coprology is headed by Prof. Nathalie Kapel in the department "BioGeM" at Pitie Salpetriere at the Charles Foix University Hospital (France). It is recognized as the reference laboratory in France for biochemical exploration of stools and exploration of intestinal homeostasis (nutrients absorption, electrolyte secretion, faecal biomarkers, and bacterial metabolites production).

WHAT IS YOUR ROLE WITHIN THE LABORATORY OF FUNCTIONAL COPROLOGY?

As a biologist, I participate in the development/ validation of new methods and the medical validation of results which includes not only an analytical critical look at the results but also a medical interpretation based on the confrontation between qualitative and quantitative data with those of the patient's clinical history and symptoms.

I am also responsible for the quality assurance process and method validation according to ISO 15189 accreditation, in collaboration with the other medical biologists and the technical team.

WHICH ANALYSES ARE CONDUCTED IN THE FUNCTIONAL COPROLOGY LAB?

We analyze lipids, nitrogen, carbohydrates, energy, bacterial metabolites, electrolytes, calprotectin, elastase in stool samples to identify mechanism of chronic diarrhea, to explore alterations of digestive functions such as malabsorption, to discriminate between organic and non-organic symptoms and explore severity and to assess and adapt treatment management (medical and/or nutritional).

WHY DID YOU CONSIDER NEAR-INFRARED SPECTROSCOPY (NIRS) FOR YOUR LAB?

Reference methods for measurement of water, lipid and nitrogen in stools are mostly not-automated time-consuming method requiring a long extraction process leading to performing serial assays. We thus looked for a faster method allowing results to be rendered on an ad hoc basis. We also wanted to limit the use of solvents and to facilitate sample preparation. Near-infrared spectroscopic (NIRS) technology meets these specifications.

A short introduction into NIRS

A NIR absorption spectrometer measures the interaction between light and matter and generates spectra. The spectra can be used to quantify key quality parameters.
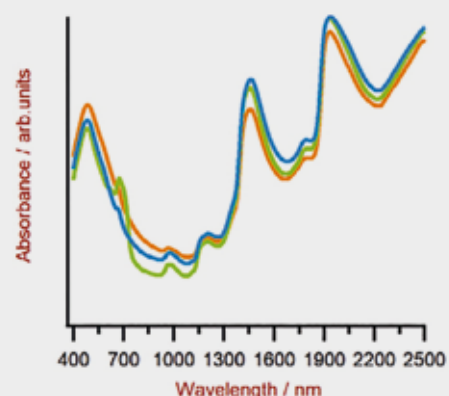
LEARN MORE HERE!

Figure 1. Spectra of feces resulting from the interaction of NIR light with the respective samples.

We have also chosen this methodology for the hygiene aspect, its complete automation facilitating the work for technicians and the speed of dosages allowing a daily realization of the assay. Moreover, this method provides three results at a time (lipids, nitrogen, and hydration) on the same aliquot.

WHAT WERE THE CHALLENGES YOU HAD TO OVERCOME WHEN IMPLEMENTING THE NIRS METHOD?

We tested previous generations of NIRS analyzers not from Metrohm, but results were not satisfactory,

namely for pathologic samples, either watery or greasy stools. We were thus interested in evaluating the new analyzer with a new software for mathematical processing, but we had to be convinced of its performances for all samples (normal and pathologic).

WHY DID YOU CHOOSE METROHM AS A SUPPLIER FOR A NEAR-INFRARED ANALYZER?

We choose Metrohm because this company is both the supplier and the manufacturer allowing a direct support by the company for the development and validation processes. Such a link is essential for the

Pre-calibrations: Ready to use analyzer for stool analysis

Based on data collected from our many customers using our system for stool analysis we can offer the Metrohm DS2500 Solid Analyzer pre-calibrated for direct use.

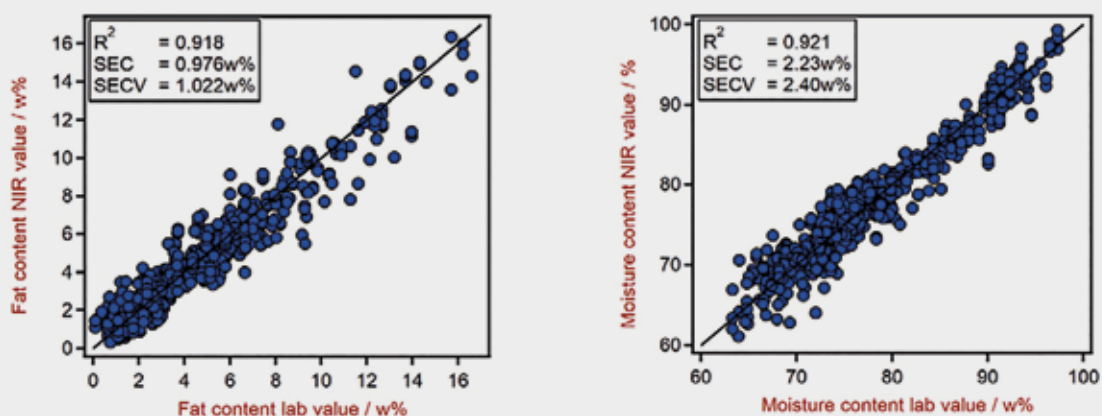**FIND HERE MORE INFORMATION WHICH PARAMETER WE COVER.**

Figure 2 Display of correlation diagramms NIR prediction vs laboratory value for Metrohm pre-calibrations fat and moisture content in human stool samples.

implementation of a new automate completely modifying our practices. Among all the NIRS analyzers, the DS2500 analyzer is the best suited to fecal samples.

Collaboration between Metrohm engineers and the laboratory team was essential to validate the method on pathologic samples (very liquid, very greasy, etc.).

WHERE DO YOU USE THE METROHM NIRS DS2500 SOLID ANALYZER?

The fecal analyses performed on the NIRS (lipids, nitrogen, dry weight) participate in two areas:

1. A routine sector that groups the main biological analyses performed for exploration of diarrhea (nutrients, electrolytes, and metabolites measurements)
2. A specialized sector dedicated to nutritional assessments and follow-up of patients who have undergone digestive surgery such as extensive intestinal resection leading to malabsorption and wasting conditions leading to intestinal failure, by-pass, or intestinal transplantation

WHAT IS YOU EXPERIENCE WITH THE NIRS DS2500 SOLID ANALYZER FOR STOOL ANALYSIS?

The switch from our technologies to the DS2500 Solid Analyzer was a real challenge for our team, moving from classical analytical methods to a physical technique associated with a mathematical treatment. It has resulted in interesting exchanges within the whole team, technicians, and biologists.

However, the DS2500 Solid Analyzer saves time at the technical level (preparation of samples, measurement, analyzer maintenance) allowing faster medical validation and overall, a reduce turnaround time of the results to clinicians.

The software is user-friendly, and sample preparation is easy to understand. We have trained several people without difficulty, including people without laboratory experience.

As the analysis is nondestructive, the sample can be recovered if necessary for other assays, which may be interesting in some cases.

The ease to use of the assays should not make us forget the need for a critical look at the results. The method is not classical in Biology, the interferences are thus to be reviewed before a routine implementation.

Sample preparation with NIR spectroscopy

Measurement with NIRS is straightforward. The sample stored in an appropriate sample vessel (e.g., a petri dish) is placed on the analyzer. Stool samples are measured in diffuse transflection. Light reflected from the sample is collected by the analyzer and used for the analysis.

Figure 3 Stool sample with DS2500 Solid Analyzer and the measuring mode diffuse reflectance.

PRODUCT CONFIGURATOR ARTICLE NUMBERS

Instrument	
2.922.0010	NIRS DS2500 Solid Analyzer
6.7450.000	NIRS reflection standard, set of 2
6.6072.201	Vision Air 2.0
6.6072.314	Pre-calibration for the analysis of human stool

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