

Application Note AN-NIR-019

Human stool analysis by near-infrared spectroscopy

Determination of moisture, fat, and nitrogen

Several diseases like pancreatic insufficiency or hepatic disorders cause malabsorption or maldigestion. The resulting changes in stool composition (e.g., in moisture, nitrogen content, or fat content) provide important information for medical diagnostics.

Time-consuming lab methods which require a significant amount of sample preparation can be replaced by near-infrared spectroscopy (NIRS) for fast screening of human stool samples with no sample preparation. The NIRS method is easy to use – no chemicals are required and results are given for several parameters within one minute.

EXPERIMENTAL EQUIPMENT

522 human stool samples were analyzed on a Metrohm DS2500 Solid Analyzer with a modified DS2500 Holder for petri dishes (Figure 1). Stool samples were positioned into the petri dishes for the analysis in diffuse reflection mode. Reference values for moisture, fat, and nitrogen content were obtained with the respective primary methods.



Figure 1. DS2500 Solid Analyzer with human stool samples.

Equipment	Metrohm number
DS2500 Solid Analyzer	2.922.0010
DS2500 Holder	6.7430.040
Vision Air 2.0 Complete	6.6072.208

RESULTS

The obtained Vis-NIR spectra (Figure 2) were used to create prediction models for the different reference parameters. The data set was split into calibration and validation sets to verify the quality of the prediction models. Correlation diagrams which display the relation between the Vis-NIR prediction and the reference values are shown in Figures 3–5 together with the respective figures of merit (FOM).

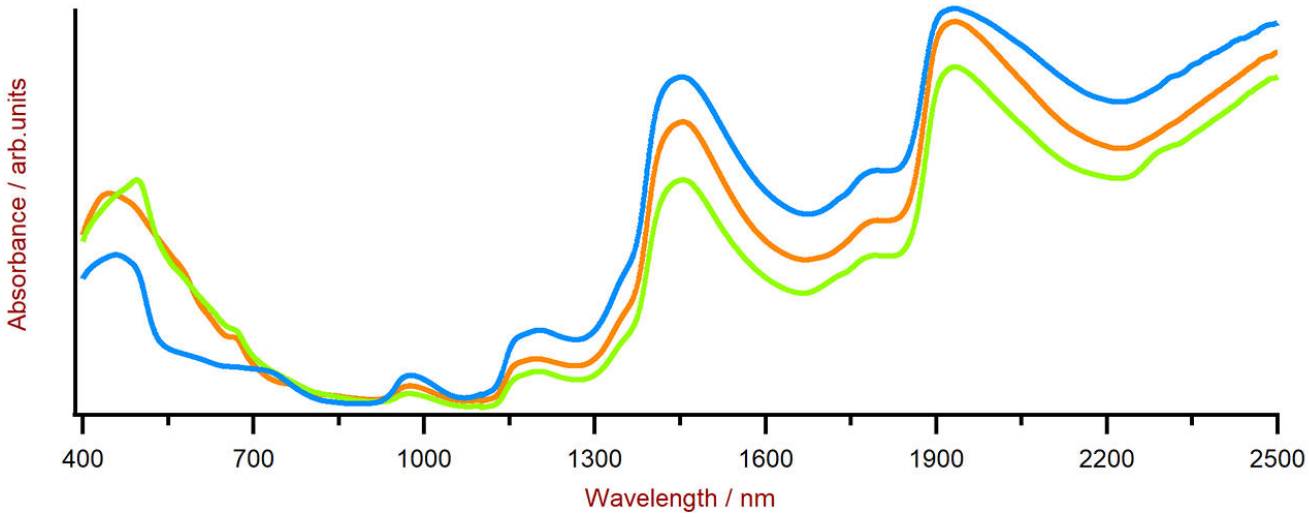
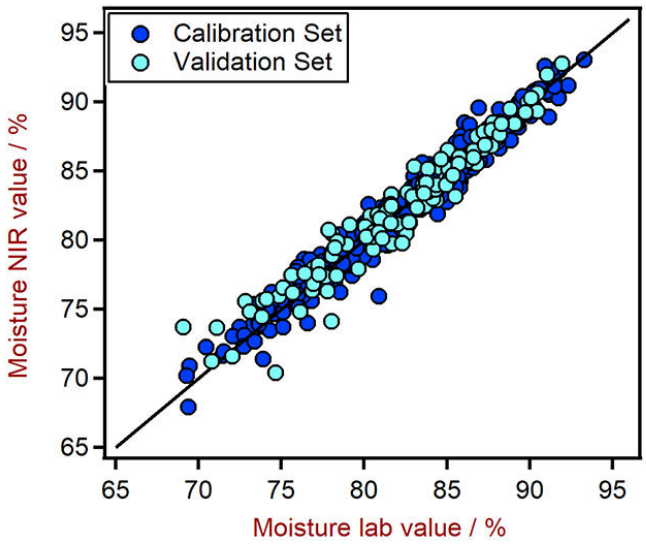


Figure 2. Selection of Vis-NIR spectra of human stool samples. Data was obtained with a DS2500 Solid Analyzer.

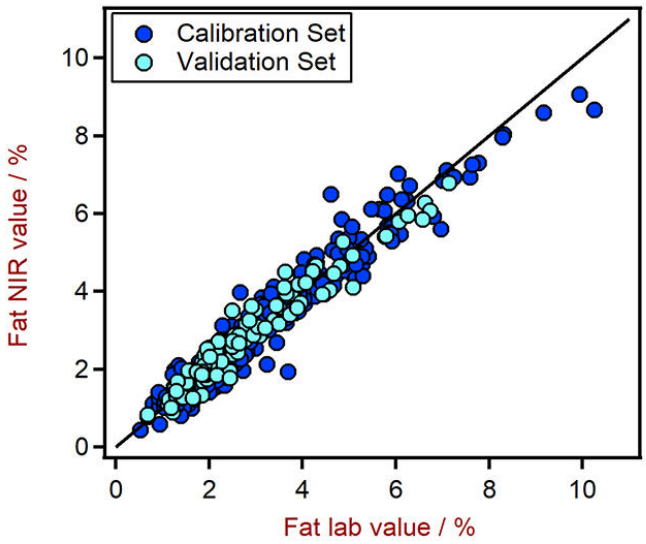
RESULT MOISTURE IN HUMAN STOOL



Figures of Merit	Value
R^2	0.962
Standard Error of Calibration	0.979%
Standard Error of Cross-Validation	1.103%
Standard Error of Prediction	1.266%

Figure 3.

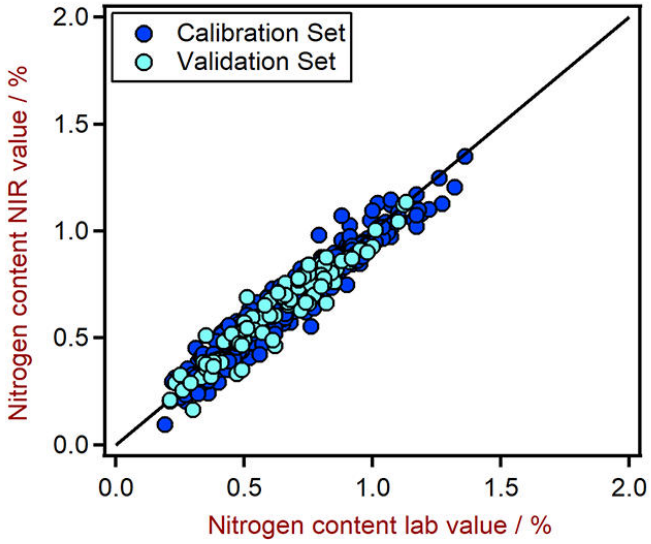
RESULT FAT IN HUMAN STOOL



Figures of Merit	Value
R^2	0.942
Standard Error of Calibration	0.3696%
Standard Error of Cross-Validation	0.3811%
Standard Error of Prediction	0.3523%

Figure 4.

RESULT NITROGEN IN HUMAN STOOL



Figures of Merit	Value
R^2	0.936
Standard Error of Calibration	0.057%
Standard Error of Cross-Validation	0.060%
Standard Error of Prediction	0.061%

Figure 5.

CONCLUSION

This Application Note shows the feasibility of NIR spectroscopy for the analysis of moisture, fat, and nitrogen content in human stool samples by NIRS, which can be conducted without chemicals or sample preparation.

CONTACT

Metrohm Taiwan Ltd.
開封街二段 46 號 5 樓
108 台北市
info@metrohm.com.tw

CONFIGURATION



DS2500 Solid Analyzer

坚固结实的近红外光谱仪,用于生产环境和试验室中的质量检查。

DS2500 分析仪是经过验证的灵活解决方案,用于对整个生产链过程中的固体、乳膏和液体进行常规分析。其坚固结实的设计使 DS2500 Analyzer 分析仪不受灰尘、湿度、振动和温度波动的影响,因此非常适用于在恶劣的生产环境中使用。

DS2500 涵盖了从 400 到 2500 nm 的整个光谱范围,并能在不到一分钟时间内提供准确和可再现的结果。DS2500 Analyzer 满足制药行业的要求,并由于操作简便而能帮助用户完成其日常工作任务。

由于与设备匹配,附件可以承受任何具有挑战性的样品类型,例如:粒料之类的粗颗粒固体或乳膏之类的半固体样品,可获得结果。测量固体的时候,使用 MultiSample Cup 可以提高生产率,可以自动批量测量多 9 个样品。



DS2500

本支架使用时搭配:

- 小样品容器 (**6.7402.030**)
- DS2500 Iris (**6.7425.100**)

Vision Air 2.0 Complete

Vision Air – 通用的光谱分析软件。

Vision Air Complete 是用于监管规范环境的先进易用的软件解决方案。

Vision Air 优点一览:

- 便捷的软件应用和经过适配的用户界面保证了直观简单的操作方式
- 操作过程的创建与维护方式简单
- SQL 数据库,可安全且简单地管理数据

Vision Air Complete (66072208) 版本包含所有用于可见近红外光谱分析质量保证过程的应用:

- 仪器和数据管理应用
- 方法开发应用
- 常规分析应用

其它 Vision Air Complete 解决方案:

- 66072207 (Vision Air Network Complete)
- 66072209 (Vision Air Pharma Complete)
- 66072210 (Vision Air Pharma Network Complete)