Application Note AN-NIR-118

Quantification of cotton content in textiles by near-infrared spectroscopy

Fast, non-destructive determination of cotton with NIRS

Cotton and polyester are two of the most popular fabrics for creating garments. Polyester is a synthetic material produced from petrochemical products, and cotton is a natural and sustainable fiber harvested from cottonseeds. Polyester is the best choice for water-resistant, durable apparel, while cotton is better suited for breathable, cool summer clothing. Textile products must be labeled according to their fiber composition. The procedures for the determination of fiber composition include mechanical, chemical, and microscopic methods—all of which are time consuming. In contrast, near-infrared spectroscopy (NIRS) is a fast and chemical-free alternative. This Application Note shows how NIR spectroscopy can be used to determine the cotton content in textile products within 30 seconds.

EXPERIMENTAL EQUIPMENT

In this study, 10 textile samples of varying cotton and polyester composition were analyzed to create a prediction model for quantification. Samples were analyzed on a DS2500 Solid Analyzer using a DS2500 large sample cup, using a lid for large sample cup to ensure that the textile is evenly pressed against the measurement window (Figure 1).

The Metrohm software package Vision Air Complete was used for all data acquisition and prediction model development.

Table 1. Hardware and software equipment overview.

Equipment	Article number
DS2500 Solid Analyzer	2.922.0010
DS2500 large sample cup	6.7402.050
DS2500 lid for large sample cup	6.7402.150
Vision Air 2.0 Complete	6.6072.208

Figure 1. DS2500 Solid Analyzer with large sample cup for the determination of cotton content in textile samples.

RESULT

The 10 measured Vis-NIR spectra (Figure 2) were used to create a quantification prediction model for the percentage of cotton in different textiles. The quality of the prediction model was evaluated using correlation diagrams which display a very high correlation between the Vis-NIR prediction and the reference values. The respective figures of merit (FOM) display the expected precision and confirm the feasibility during routine analysis (Figure 3).

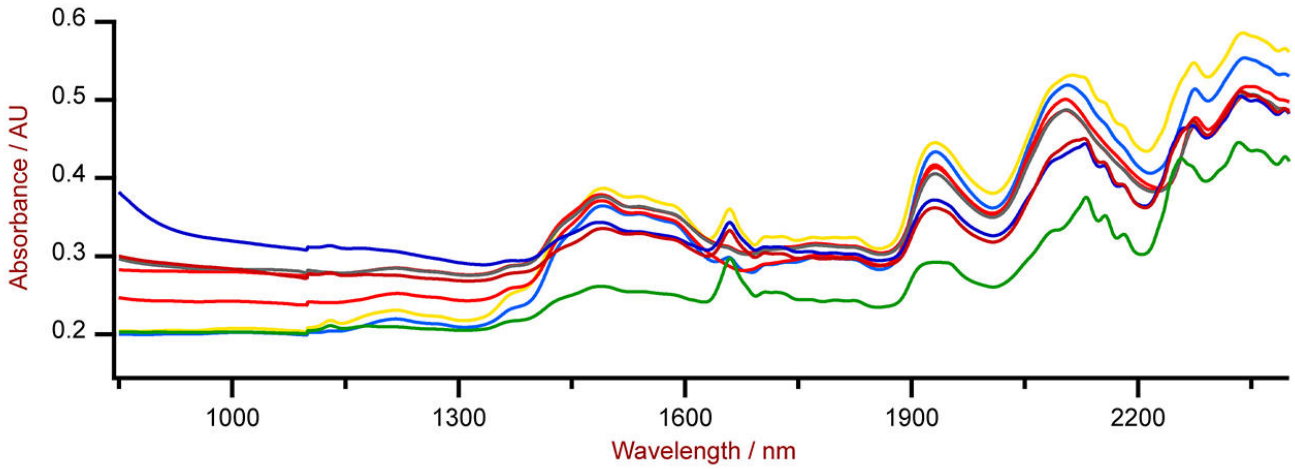

Figure 2. Vis-NIR spectra of textile samples analyzed on a DS2500 Solid Analyzer with the DS2500 large sample cup.

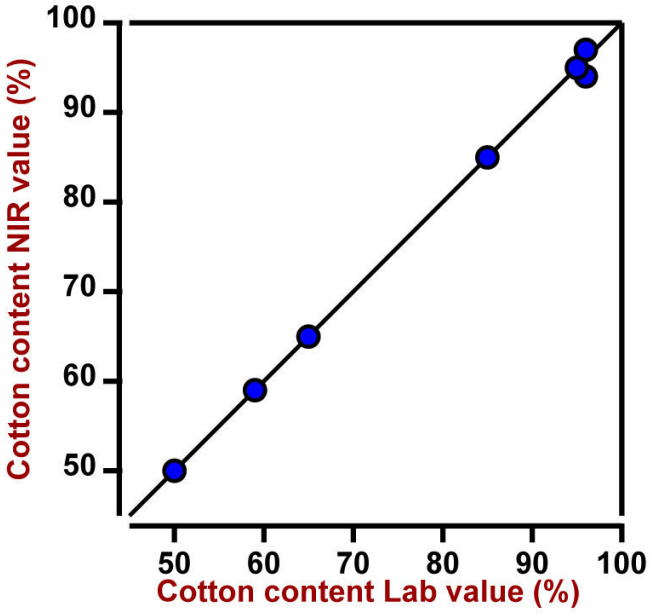

Figure 3. Correlation diagram and the respective figures of merit for the prediction of cotton content in textiles using a DS2500 Solid Analyzer.

Figures of Merit	Value
R^2	0.9975
Standard Error of Calibration	1.2 %
Standard Error of Cross-Validation	1.4 %

CONCLUSION

This Application Note demonstrates the feasibility of NIR spectroscopy to determine the cotton percentage in textile blends quickly and easily. Vis-NIR spectroscopy offers users a fast, cost-effective, and highly accurate alternative to other standard testing methods.

Additionally, NIRS analysis is non-destructive, completely reagent-free, and gives results in only 30 seconds.

CONTACT

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CONFIGURATION

DS2500 Solid Analyzer

Robust near-infrared spectroscopy for quality control, not only in laboratories but also in production environments.

The DS2500 Analyzer is the tried and tested, flexible solution for routine analysis of solids, creams, and optionally also liquids along the entire production chain. Its robust design makes the DS2500 Analyzer resistant to dust, moisture, vibrations, and temperature fluctuations, which means that it is eminently suited for use in harsh production environments.

The DS2500 covers the full spectral range from 400 to 2500 nm and delivers accurate, reproducible results in less than one minute. The DS2500 Analyzer meets the demands of the pharmaceutical industry and supports users in their day-to-day routine tasks thanks to its simple operation.

Thanks to accessories tailored perfectly to the instrument, optimum results are achieved with every sample type, no matter how challenging it is, e.g. coarse-grained solids such as granulates or semi-solid samples such as creams. The MultiSample Cup can help improve productivity when measuring solids, as it enables automated measurements of series containing up to 9 samples.

DS2500 large sample cup

Large sample cup for the spectral recording of powders and granulates in reflection at various sample positions using the NIRS DS2500 Analyzer.

DS2500 lid for large sample cup

Lid for the large sample vessel for the DS2500 Analyzer.

Vision Air 2.0 Complete

Vision Air - Universal spectroscopy software.

Vision Air Complete is a modern and simple-to-operate software solution for use in a regulated environment.

Overview of the advantages of Vision Air:

- Individual software applications with adapted user interfaces ensure intuitive and simple operation
- Simple creation and maintenance of operating procedures
- SQL database for secure and simple data management

The Vision Air Complete version (66072208) includes all applications for quality assurance using Vis-NIR spectroscopy:

- Application for instrument and data management
- Application for method development
- Application for routine analysis

Additional Vision Air Complete solutions:

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