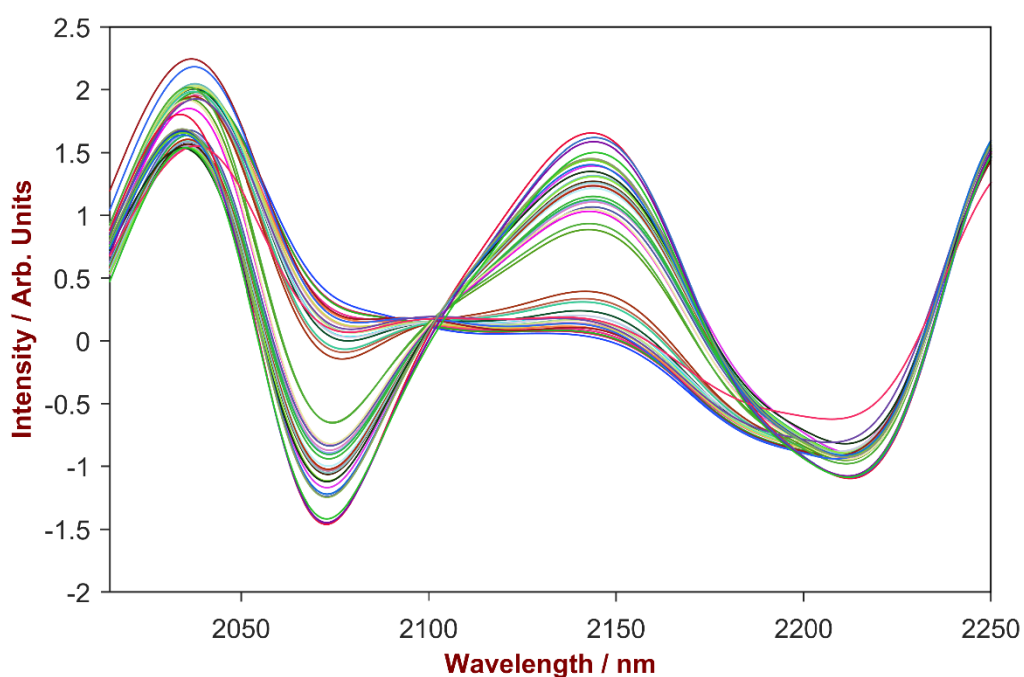# Protein content in dietary supplements and near-infrared spectroscopy (NIRS)

This application note describes the quantification of protein content in dietary supplements using Vis-NIR spectroscopy to reduce the workload of time-consuming and waste-generating primary methods, such as Kjeldahl digestion.

Ω Metrohm
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Method description

Introduction

Dietary supplements are products that are intended to supplement diets and can contain various ingredients to increase health. Therefore, they fall under FDA regulations. Dietary supplements containing proteins are mainly consumed for aiding muscle growth. The conventional method to determine the protein content, Kjeldahl digestion, is time consuming, requires hazardous chemicals and generates waste. Vis-NIR spectroscopy is a secondary analysis method that excludes such disadvantages, since reliable results can be obtained in a matter of seconds without sample preparation. NIR spectroscopy is recognized by pharmacopoeias and is applicable also for the analysis of dietary supplements.

Configuration

The spectral measurement was performed using the Metrohm NIRS DS2500 Analyzer in combination with the Large Sample Cup. The software package Vision Air 2.0 Pharma Complete was used for data acquisition, data management and development of the quantification method (Tab. 1).

Tab. 1: Used equipment for this application.

Equipment	Metrohm order code
NIRS DS2500 Analyzer	29220010
NIRS DS2500 Large Sample Cup	67402050
Vision Air 2.0 Complete Pharma	66272209

Fig. 1: The NIRS DS2500 Analyzer with Large Sample Cup.

Experimental

The protein content was determined of 43 provided dietary supplements using Kjeldahl digestion. The samples showed a protein content in between 30 – 90 %. The used Vis-NIR instrument in the study was Metrohm NIRS DS2500 Analyzer which was operated in moving diffuse reflectance mode with the Large Sample Cup (Fig. 1). This measuring mode in combination with the Large Sample Cup allows to average contributions from inhomogeneity of the samples. Absorbance spectra were obtained using 32 co-added scans. The quantification method was developed in Vision 4.1 Pharma (Metrohm chemometric software) using the algorithm of Partial Least Squares Regression (PLS). Because of the extended spectral range of the NIRS DS2500 Analyzer (400-2'500 nm), valuable information of the near-infrared, such as visible spectral range can be used in method development. This allows for enhancing the analytical figures of merit. The data was pre-treated using 1st derivative and Standard Normal Variate (SNV) (Fig. 2).
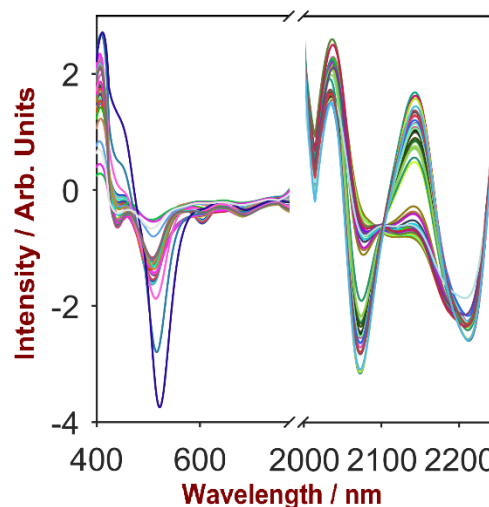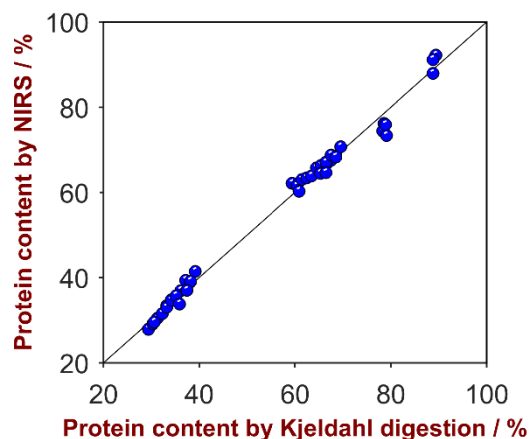

Fig. 2: Diffuse reflectance measurements of the visible and used NIR spectral range of the samples with applied pre-treatments.

The developed model yielded a Standard Error of Prediction SEP = 0.73 % with 3 factors (Fig. 3). Because of the very low SEP, this method shows very suitable for analyzing protein content in dietary supplements.

Method description

Fig. 3: Correlation plot of the predicted protein content by NIRS versus the laboratory values determined by Kjeldahl digestion.

Results

This application note demonstrates the applicability of Vis-NIR spectroscopy to determine the protein content in dietary supplements. Thus, subsequent analysis using Vis-NIR spectroscopy relieves the use of Kjeldahl digestion.

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