Application Note
Milk Powder

Introduction

NIR analysis can quickly and cost-efficiently measure components such as protein, fat and moisture in various types of milk powder such as skimmed or whole milk powder. The chemical analysis is time consuming and costly, and for the fat analysis, ether extraction is used. This can all be avoided using FT-NIR where the analysis time is only one minute with no other sample preparation than pouring the sample into a sample Petri dish or a Teflon cup. The analyser can be placed in the production area and can be operated by plant personnel.

Analyser: The FT-NIR DairyQuant

The DairyQuant FT-NIR analyser is used for non-destructive analysis of powder and solid samples. The sample is poured into a glass Petri dish or a dish made from Teflon (Teflon cup). The use of a Petri dish or Teflon cup as a sample container makes it very easy for the user to operate.

The DairyQuant is powered by the latest ABB Bomem FT-NIR technology and measures the entire spectrum of the sample, i.e. in the range 14000-3800 cm^{-1} (700-2600 nm). It generates a large amount of high-quality spectral data, which makes it possible to accurately determine multiple components.

With no scheduled maintenance for five years, the DairyQuant is practically maintenance-free. It is equipped with parts with a long lifetime. For instance, the laser and NIR source have an average lifetime of ten years.

DairyQuant is operated with the InfraQuant software, which makes it easy for everybody to work with analyses. Two clicks with the mouse is enough to make the analysis. Among the features is a wizard that guides you through the program, spectra are displayed right away, and sample information and trends can be reviewed easily.

Calibration

The DairyQuant can be used with customized calibrations, optimised to the customers own products. Customized calibrations are made by adding a number of samples from the actual production line to a set of starter calibrations from Q-Interline. The reference methods used for chemical analysis are Kjeltec for protein, Rose Gottlieb for fat and oven drying for moisture. A typical FT-NIR spectrum of regular whole milk powder can be seen on the cover of this application note. All spectra are pre-processed using mean centring and baseline correction. Partial Least Squares (PLS) models were developed based on the analytical and spectral data.

Calibration Performances

The starter calibrations are based on a set of samples containing skimmed milk powder and whole milk powder with a fat content ranging from 4% to 27%. The sample set contains both regular and instant milk powder. An example of a calibration for fat in instant milk powder can be seen in figure 1. The performance of different calibration models can be seen in table 1.
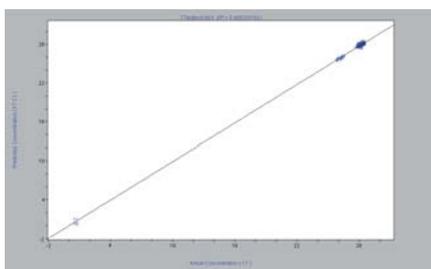

Figure 1: FT-NIR predicted concentration vs actual concentration for fat in instant milk powder

Product type	Property	Range	secv	Repeatability FT-NIR	Repeatability Lab
Regular	Protein	24.4-25.2	0.08		
Regular	Fat	25.7-26.7	0.08		
Regular	Moisture	2.7-3.3	0.035		
Instant	Protein	24.4-24.9	0.06	0.042	0.051
Instant	Fat	2-27	0.14	0.051	0.057
Instant	Moisture	2.7-4.2	0.075	0.02	0.036

Table 1: Performance of starter models for different milk powders

Conclusion

The DairyQuant FT-NIR analyser is designed for analysing powders and solids. Protein, fat and moisture content in various types of milk powders can be measured in less than one minute, and the method is very robust for rapid quality control.

The analyser can be operated with models from Q-Interline or with customised models for specific customer products. The latter is easy to optimise and maintain, since the models become a property of the customer.

Q interline
spectroscopic analytical solutions