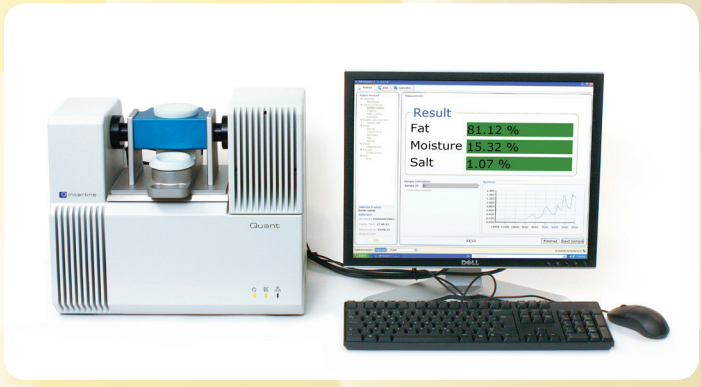
Application Note

Butter and Margarine



interline
spectroscopic analytical solutions

Introduction

Law regulates moisture and fat content in butter. To maximize profit, the final product must be as close to the legislated values as possible. Traditional laboratory methods can be cumbersome, expensive and require trained personnel. Most importantly, these methods are much too slow to allow sufficient reaction time for control of the process. As a result, NIR analysers have replaced most of the traditional methods. These analysers can be placed directly in the production area close to the churn and can be operated by plant personnel. The analysis time is less than one minute.

Analyser: DairyQuant B4

The DairyQuant B4 is based on the latest generation FT-NIR technology and has the following main features:

- Cutting edge spectral performance and best signal to noise ratio on the market
- Very easy to operate and maintain
- Optimised software suite with InfraQuant and Horizon QI
- Very low maintenance costs. The DairyQuant B4 has no scheduled maintenance

Analysis:

The sample is loaded into a Teflon cup and the excess material is removed with a spatula to secure a flat, homogenous surface for reflectance measurement. The Teflon cup, mounted in a drawer and pushed into the instrument, is rotating during analysis while analysing a large sample area averages the sample heterogeneity and improves the repeatability of the measurement.

Analysis in Teflon cups eliminates issues with glass and plastic in the production area.

See a video presentation of the DairyQuant B4 on our homepage: www.q-interline.com and experience how easy it is to perform the analysis on the DairyQuant B4.

Calibration

The Quant is calibrated against certified methods, Oven drying for determination of water and titration for determination of salt.

The NIR region contains both combination and overtone information. The most sensitive bands are those derived from the O-H and C-H stretch regions. Salt cannot be measured directly with NIR, but it causes a change in the shape of the water band and this in turn allows for determining the salt content. Partial Least Squares (PLS) models were developed based on the analytical and spectral data.

Calibration Performances, Example

Table 1 shows the performance of the calibrations. Each sample was analysed in duplicate by the factory laboratory. The butter calibrations contain over 150 spectra. These calibrations support the presence of colouring agents and temperature variations of the process, normally between 13 and 20 °C. Repeatability of the method was determined by analysing the sample 3 times in a row.

There have been made calibration models for butter and spreads, containing 60, 75 and 80% fat and for salted and unsalted butter.

The calibrations were validated using a number of samples that were not included in the calibration. The Standard Error of Prediction (SEP) was reported being 0.10% for fat and 0.09% for moisture.

Property	Range %	NIR SECV	Ref. Method RMSD	NIR Repeatability
Butter Moisture	15-18	0.10	0.08	0.03
Butter Salt	0.5-2	0.05	NA	<0.005
Spreadable Moisture	16-25	0.10	0.08	0.03
Spreadable Moisture	25-38	0.13	0.08	0.05
Spreadable Salt	0.7-1.2	0.035	NA	<0.005

Table 1: Performance of the DairyQuant B4

Conclusion

The DairyQuant B4 is equally well suited to be used in the plant and in the laboratory. It is intended to be placed near the butter churn and measures moisture and salt. Plant personnel can do sampling and analysis. The calibration is independent of temperature variations in the process and the presence of colouring agents. The DairyQuant B4 can be used as a turnkey system without any further calibration development. If a superior accuracy is needed, analysing samples collected from the plant and implementing discrimination functions would further optimise the method.

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