

Whey Protein Concentrate

Introduction

Whey protein is a by-product from cheese production. The proteins are isolated and concentrated from the whey and used as ingredients in other food products. The aim is to extract as much protein from the whey as possible. The finished product is often dried and sold as powder, but the analysis can be performed on both the liquid slurry and the final powder.

Traditional laboratory methods can be cumbersome, expensive and require trained personnel. Most importantly, these methods are 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 and can be operated by plant personnel. The analysis time is less than one minute.

The Analyser



Figure 1: The Quant FT-NIR analyser with the powder (top) and liquid (bottom) interchangeable sample accessories

The Quant FT-NIR analyser system is a revolution in FT-NIR technology and user friendliness.

Designed around new FT-NIR interferometer technology the Quant requires preventative maintenance at only 5 year intervals, has a small footprint, has no hygroscopic optics, incorporates a modular design allowing rapid detector changes and allows the development of unique sample handling accessories.

Calibration

The Quant is calibrated against certified methods, Kjeldahl titration for determination of protein, drying at 100°C for determination of moisture, Röse Gottlieb for determination of fat and an enzymatic determination of lactose.

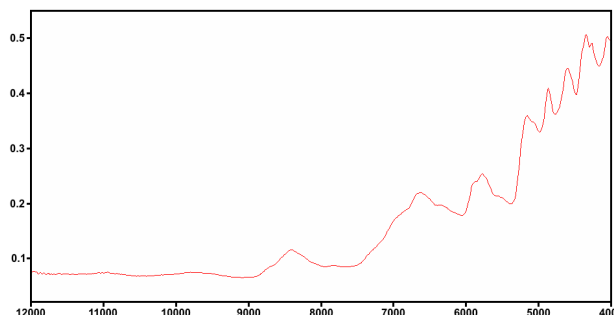


Figure 2: Typical FT-NIR spectrum of WPC powder

The NIR region contains both combination and overtone information. The most sensitive bands are those derived from the O-H, N-H and C-H stretch regions. In order to compensate for pathlength changes due to scattering effects from the sample, all spectra were pre-processed using thickness correction, baseline correction and mean centring. The calibration samples were designed to ensure that the extremes of moisture, protein and fat content were included in the set. A Partial Least Squares (PLS) model was developed based on the analytical and spectral data.

Calibration Performances

Table 1 shows the performance of the calibrations. Each sample was analysed in duplicate by a research laboratory. The WPC calibrations contain over 80 spectra. Repeatability of the method was determined by analysing 10 samples drawn from the same lot.

Property	Range %	NIR SECV	Reference Method RMSD	NIR Repeatability
Protein	76 - 80	0.35	0.20	0.06
Moisture	4.9 - 6.1	0.15	0.08	0.03
Fat	4.2 - 5.1	0.10	0.08	0.07
Lactose	5.4 - 9.0	0.15	0.08	0.03

Table 1: Performance of the WPC powder calibrations

The calibrations were validated using a number of samples that were not included in the calibration. The Standard Error of Prediction (SEP) was reported as being 0.22% for fat and 0.14% for moisture.

Conclusion

The Quant is a dual FT-NIR analyser designed for solid and liquid measurements. The results are obtained in less than one minute on multiple components. This eliminates individual analysis on each constituent and saves on manpower, training and time. The rapid analysis, in combination with highly repeatable measurements, allows effective process optimisation.