

APPLICATION NOTE – MAYONNAISE

Introduction

Mayonnaise is an emulsion of water and fat. The target is to monitor the fat and moisture balance as it determines the consistence of the mayonnaise. 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 and can be operated by plant personnel. The analysis time is less than two minutes.

The analyser



Figure 1: The QFA focus

The QFA focus is an FT•NIR analyser. Samples are measured over a 1.5 cm pathlength along a 15 cm strip at the bottom of a plastic bag. The bag contains approximately 100 g of mayonnaise. A large detector is located directly after the sampling accessory in order to intercept a significant proportion of the diffusely transmitted light. The large sample area averages the sample heterogeneity, thus improving the repeatability of the measurement.

The QFA focus uses economical, disposable, plastic bags for sampling. The plastic bag is easily filled with mayonnaise by the operator and inserted directly into the accessory for analysis.

Calibration

The QFA focus is calibrated against certified methods, Gerber for determination of fat and drying at 100 °C for determination of moisture. Salt and acid is determined by titrations.

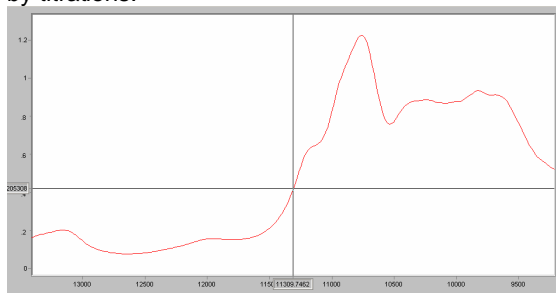


Figure 2: Typical FT•NIR spectrum of mayonnaise.

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. In order to compensate for pathlength changes due to scattering effects from the sample and pathlength differences derived from the disposable plastic bags, 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 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 mayonnaise calibrations contain over 60 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
Fat	79.5 - 83.5	0.15	0.3	0.03
Moisture	13.5 - 15.4	0.21	0.1	0.03
Salt	0.52 - 0.81	0.02	0.01	0.005
Acid	0.30 - 0.35	0.02	0.01	0.005

Table 1: Performance of the mayonnaise 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 0.25% for fat and 0.32% for moisture.

Conclusion

The QFA focus is suitable for use in the plant. Plant personnel can do sampling and analysis. The results are obtained in less than two minutes on multiple components. This eliminates individual analysis on each constituent and saves on manpower, training and time. The rapid analysis benefit, in combination with highly repeatable measurements, reduces process fluctuations.

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