

Edible Oils and Fats

Introduction

In the food and feed industry there is a need for fast and accurate determination of the quality parameters Iodine Value (IV) and %Trans in edible oils and fats. IV is the degree of hydrogenated bonds (degree of saturation) and %Trans is the amount of trans configurations in the double bonds. A high content is bad for human health.



Determining IV and %Trans by chemical analysis is time consuming and costly. Therefore NIR analysers have replaced the traditional methods. These analysers can be placed directly in the production area and can be

operated by plant personnel. The analysis time is only one minute after the sample has reached constant measurement temperature.

FT-NIR presents plant operators and laboratories with an invaluable tool for process control and quality assurance to increase profitability.

FT-NIR Analysis

The LipidQuant is an FT-NIR analyser, scanning from 3,800 to 14,000 cm^{-1} , with non-hygroscopic optics, a quartz halogen electronic stabilised source (10 year average lifetime) and a DTGS detector. Samples are analysed in 8 mm glass vials using a heatable vial holder. A temperature controller maintains a constant temperature of 75 °C during measurement. The instrument is delivered with easy-to-use InfraQuant 2.0 software.



Figure 1: Quant FT-NIR analyser and heatable vial holder

Sample Preparation

Oils and fats are placed in the vial using a pipette and then placed in the sample holder. The sample holder is preset to a specific temperature. When the sample reaches the temperature the operator starts the analysis.

Standard Parameters: IV, %Trans

Optional Parameters: Moisture %, M.P. °C, Cloud Point °C, Peroxide Value, Anisidine Value, Acid Value mgKOH/g, FFA %, Saponification Number mgKOH/g

Calibration Model Development

Either customised calibrations, optimised to the customers own products, or global calibration models from ABB Bomem can be used. The global models are calibrated against the certified Wijs method for determination of IV and a capillary GC method for % Trans. The NIR region contains both combination and overtone information. The most sensitive band for calibration of IV and % Trans is the C-H 2nd overtone. In order to compensate for scattering effects and small pathlength variations, all spectra are pre-processed using normalisation, baseline correction and mean centring. Partial Least Squares (PLS) models were developed based on the analytical and spectral data.

The global IV and %Trans calibrations are based on more than 1200 samples from all over the world. The different types of oils and fats are: **Canola, Cocoa Butter, Palm Kernel, Corn, Milk Fat, Coconut, Crude Tallow, Palm Olein, Olive, Beef Tallow, Cottenseed, Sunflower, Palm Stearin, Rapeseed, Fish, Soybean, Castor, Linseed, Crude Palm, Margarine Blend, Walnut, Almond Safflower.**

To obtain the highest accuracy different models were developed for different intervals.

Property	Range %	Quant SEP	Quant Repeatability
IV	0 - 10	0.25	0.08
IV	10 - 30	0.44	0.10
IV	30 - 60	0.30	0.08
IV	60 - 90	0.40	0.10
IV	90 - 120	0.76	0.12
IV	120 - 190	0.82	0.15
Trans	0 - 15	0.7	0.1
Trans	15 - 60	1.6	0.6

Table 1: Performance of the global calibrations for Iodine Value and %Trans

Conclusion

The LipidQuant is an FT-NIR analyser designed for liquid measurements. The IV and %Trans can be measured in edible oils and fats in less than one minute and is a very robust method for rapid quality control.

The analyser can be operated with global IV and %Trans models from ABB Bomem 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.

The IV model from ABB is an AOCS Standard Procedure and can be validated with Smalley Standards.



Calibration Model Development

Optimisation of calibration models on specific product data ensures superior analytical performance for the system's lifetime.

The FT-NIR analysers comes pre-calibrated for many applications. During commissioning local samples are added to the calibration model to optimise accuracy.

Initial calibration models for new applications can be developed based on data supplied prior to installation and commissioning. Online systems share same calibration models with laboratory / at-line systems which allows model development prior to online installation.

Superior spectrometer design ensures calibration models are transferred between systems with only minor bias adjustments and instrument component changes have no effect on analytical results.

Software tools and training available to users for internal calibration model development and maintenance.

Quant Technology

Upgrading your FT-NIR analysis with the new Quant analyser means you will be at the forefront of analytical performance and technology. The Quant is the most reliable FT-NIR system in the market with the lowest cost of ownership. Easy to use and with minimal maintenance, it will provide constant analysis results for many years. Many configurations are possible, including remote probes and automation.

Spectral Performance

The internal VCSEL solid state laser is fully self calibrating and ensures exceptional wavelength accuracy with precise results. It is highly durable and has a greater than 20 years average life-time. The innovative double pivot interferometer is designed to ensure increased robustness and allows more reproducible spectroscopy.

Signal to Noise (60s, 16 cm ⁻¹ , at peak response) > 900 000:1
Spectral Range 3,700 to 14,885 cm ⁻¹ (672 to 2702 nm)
Frequency Repeatability @ 7300 cm ⁻¹ < 0.006 cm ⁻¹
Frequency Accuracy @ 7300 cm ⁻¹ < 0.01 cm ⁻¹
Absorbance Reproducibility (toluene) < 0.002 AU

Ethernet Communication, 10 / 100 Mbps
Size w 435 x d 280 x h 372 mm, 24 kg
Operating Temperature 10 -35 °C
Operating Relative Humidity 5 - 80% (non-condensing)
Regulatory Certification and Compliance TUV, CE and RoHS

Maintenance

Preventative maintenance is recommended every 5 years to replace the source module that has a 10 year average life-time. Apart from this, the system is maintenance and adjustment free. No components to replace or adjust. No consumables. No He-Ne laser. No hygroscopic optics. No purge required. The interferometer has a life-time warranty and the analyser has a 2 year warranty.

Built to Last

Featuring rugged and durable modules, a permanently aligned optical system and a design that combines minimal mechanical components, the Quant will operate for years to come with no interference. The result: a reliable spectrometer that always produces results of great consistency.

Small Footprint

The vertical design of the Quant makes it one of the most space-efficient spectrometers in the market. Its vertical design also facilitates access to internal components.



InfraQuant 2.0

Spectroscopic Analysis Software

Designed in collaboration with NIR users, Q-Interline have developed InfraQuant 2.0, the next generation of NIR operator software. Built-in instrument validation provides a high level of security and is automatically performed on every reference collection. Based on the latest Microsoft technology it is fully compatible with the latest Windows platforms and ready for future upgrades. This technology also provides a safe and accessible platform for integration into a LIMS.

