Mid-IR Rapeseed Oil analysis Using ATR spectrometer

Summary Information

- Determination of relevant fatty acids in rape seeds to differentiate between OO, HEAR and HOLL.
- Analysis is based on mid-infrared spectroscopy and results are available in less than 7min
- Minimal effort/cost required for reference analysis to maintain calibration files

Product Description

The IR Sphinx spectrometer measures the mid-infrared spectrum of a sample and extracts the relevant parameters. The spectrometers do not contain any moving parts but use a solid state dispersion element in combination with black body infrared emitters to measure the infrared spectrum of a sample. This results in a unique product which is robust, battery operated and weighs less than 0.5 kg. The spectrometer can be configured to measure from 2.5 µm–5.0 µm or from 5.5 µm–11.0 µm. The IR Sphinx spectrometer comes with a sophisticated but user friendly software called Sphinx Suite. The software is modular and the user can choose from a number of different software modules. The software is compatible with many common operating systems.

Image 1: ATR spectrometer for rape seed analysis. The oil sample is placed on the yellow crystal and the spectrometer measures a mid-infrared absorption spectrum.

Application

Rapeseed seeds scale in quality and price depending on the concentration of specific saturated and unsaturated fatty acids whereby the unsaturated fatty acids (Oleic Acid, Linoleic Acid (Omega 6), alpha-linolenic acid (Omega 3) are valuable fatty acids and saturated fatty acids are not desired. The higher the ratio of unsaturated fatty acids to saturated fatty acids the more valuable and expensive are the seeds. Rapeseeds are classed as HOLL if the oleic acid is above 75% and it contains very low Erucic acid concentration. Rapeseeds with an Oleic acid concentration of less than 65% , low Erucic acid and Linolenic acid around 12% are classed as food grade OO. HEAR samples contains the largest concentration of saturated fats and have an Erucic concentration of more than 50%. HEAR samples are not for human consumption but for industrial or pharmaceutical applications. We have used mid-infrared absorption spectroscopy to measure the concentration of Oleic acid, Erucic acid and Linolenic acid in rapeseed oil in order to accurately categorise the types of rapeseed present in the respective samples.

In a typical application, a rapeseed mill has to decide within 20 minutes if the delivered seeds are of the required quality and the main analytical technique used today to measure the relevant acid concentrations is gas chromatography, which takes far too long and is too expensive.

Mid-infrared absorption spectroscopy presents a cost efficient, accurate and fast route to determine the relevant acids in the rapeseed samples and results are available within 10 minutes of taking a sample.

How to use

Rape seed samples are taken and the oil is extracted from the rape seeds using an electrical oil press. The oil is then filtered using a centrifuge or a syringe. The oil is subsequently placed onto the spectrometer and the infrared absorption spectrum of the oil sample is measured and analysed.

The spectrometer analyses the spectra based on a calibration file that is integrated into the software and the relevant fatty acid concentrations of the oil sample are displayed and categorised by the software. The result are displayed to the user in a very simple table showing the fatty acid concentrations and the resulting category. The software interface and the measurement process is very simple and intuitive and does not require any special knowhow.
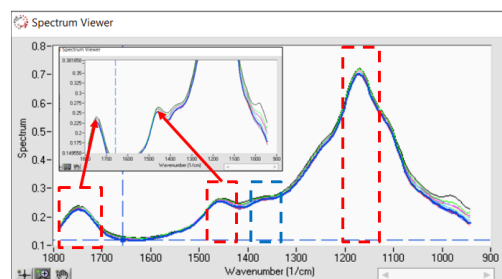
Performance

Image 2: A typical mid-infrared absorption spectrum from 5.5um-11.0um. The inset shows certain absorption bands of interest for the analysis of rapeseed oil.
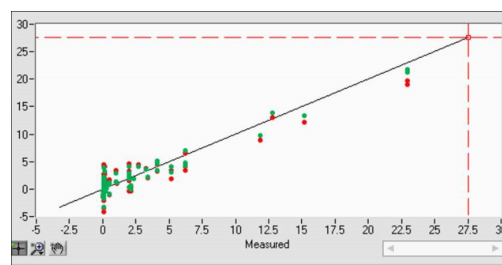
Image 3: Shows the results of a regression model for Erucic acid as an example having an R2 > 0.9. Regression models for Oleic and Linolenic acid have very similar performances.