Mid-IR Extra-Virgin Olive Oil Adulteration Analysis Using ATR spectrometer

Summary Information

- To determine EVOO adulteration and differentiate between food oil source type
- Analysis is based on mid-infrared spectroscopy and results are available in less than 5min
- 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.

Application

With extra-virgin olive oil in high demand with concomitant high prices, adulterated olive oil has become the biggest source of agricultural fraud problems in the European Union. Oil labelled "extra-virgin" is being mixed with cheaper olive oils or other types of food oils.

We have used the mid-IR ATR spectrometer to accurately determine whether a sample of Extra Virgin Olive Oil was mixed (adulterated) with a vegetable Oil based on (1) principal component analysis (PCA) of the spectral data and (2) A Classification system using boundaries incorporated with a PLS Regression Model.

Furthermore we have analysed different samples of extra virgin/classic olive oils and different vegetable, plant and nut based oils and it was possible to diffentiate the type/source from analysis of the mid-IR spectra.

How to use

The oil is placed onto the spectrometer ATR crystal (<1ml) and the infrared absorption spectrum of the oil sample is measured and analysed.

The spectrometer analyses the spectra based on a calibration file(Model) that is integrated into the software (or conversely the data can be extracted and PCA carried out) and the relevant information (sample pure - good or adulterated - warning) categorised by the software. The result is displayed to the user in a very simple table with the resulting category. The software interface and the measurement process is very simple and intuitive and does not require any special knowhow.
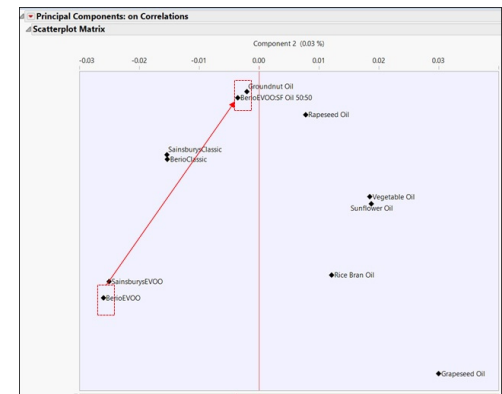
Performance

Diagram 1: PCA analysis for mixing of EVOO with sunflower oil. Clear shift in spatial component of PCA1 v PCA2.
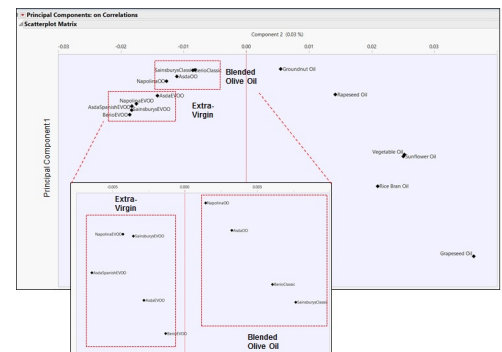

Diagram 2: PCA analysis for Food Oils. Spatial Matrix shows PCA1 v PCA2 and grouping of specific oil types.