FOSS

Application Brief

AB 5361

Rev. 1

NIRS™ DS2500 L

Vegetable Oil

NIRS DS2500 L provides fast and accurate results for vegetable oil parameters. It allows you to perform frequent checks against production specifications and control the quality of the product.

By using a FOSS NIR solution for vegetable oil analysis you will get results almost instantly instead of waiting hours for results from standard wet chemistry analysis in the laboratory.

This Application Brief describes the calibration models and the results that can be expected when analysing vegetable oil such as olive, sunflower and soybean..

Calibration Information

Samples used to develop these calibrations are collected from within the European Union, mainly Italy and Spain using disposable 8 mm glass vials.

The concentration ranges covered by these calibrations is presented in the following table.

Parameter	Type	Version	N	Mean	Min	Max
FFA (as Oleic Acid)	PLS	1.0.0.0	1943	0.29	0	1.13
Iodine Value	PLS	1.0.0.0	1157	101	35	168

Version: Latest version of the calibration
Type: ANN calibration technique (Artificial Neural Network)
PLS calibration technique (Partial Least Square)
N: Number of individual samples in the calibration set
Mean: Mean reference value in calibration set.
Min.: Minimum reference value in calibration set.
Max.: Maximum reference value in calibration set.

Performance

The performance of the calibration for 8 mm vial was evaluated using Cross Validation.

Cross validation is a validation technique based on the calibration data only. Here sample blocks of the calibration data are temporarily left out from the calibration and predictions are used for validation. This error is an estimate of the prediction accuracy of the calibration.

It should be expected that a bias adjustment or a slope and intercept adjustment will be necessary when comparing the NIR results for new samples against any local laboratory.

Note: This calibration is still under development, and we will keep updating this equation.

Cross Validation Statistics

Parameter	N	Accuracy
FFA (as Oleic Acid) 8 mm vial	1943	0.16
Iodine value 8 mm vial	1157	1.48

Table 1

Additionally, the performance of the individual calibrations for similar models developed on non-disposable 1 mm quartz cuvette are shown.

Parameter	N	Accuracy
FFA (as Oleic Acid) 1 mm cuvette	1871	0.129
Iodine value 1 mm cuvette	1148	1.43

Table 2

The graphs below show calibration sets for 8mm vial data on the left and 1 mm cuvette data on the right.

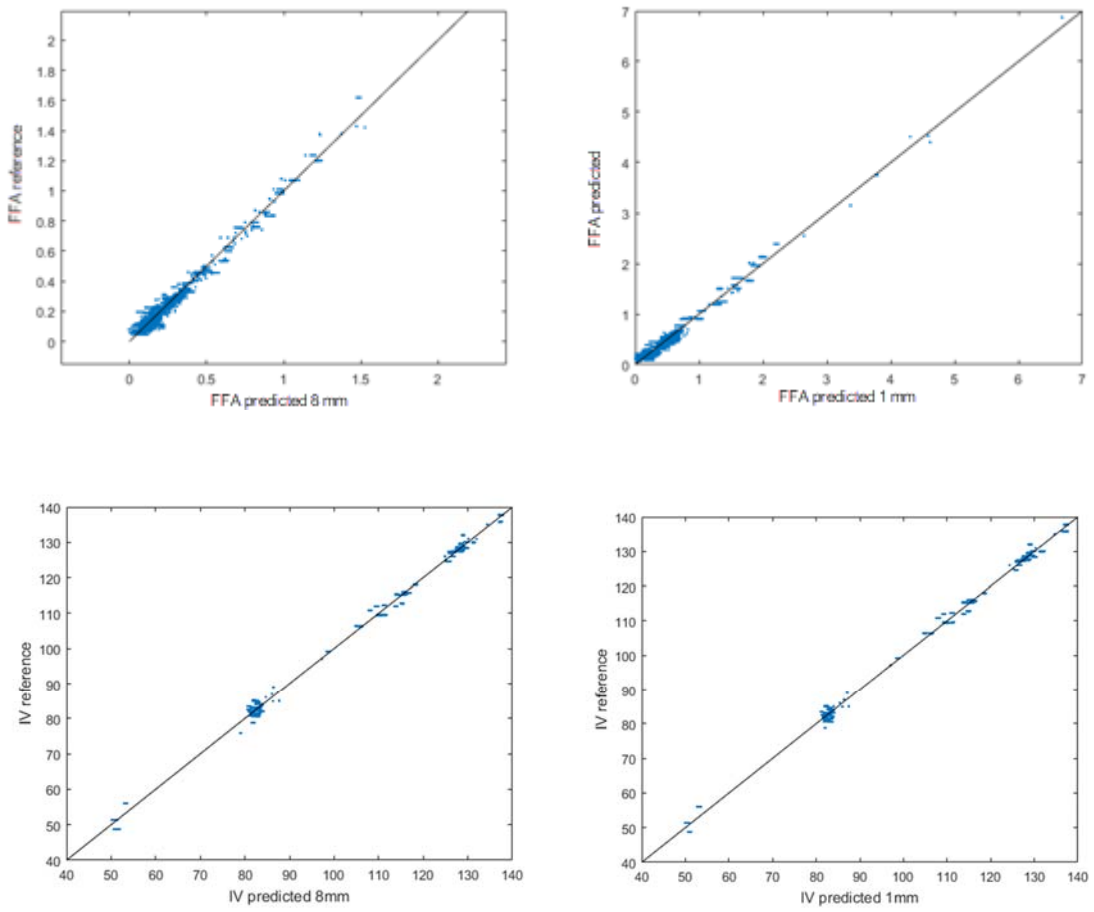

Fig. 1

Note:

The performance example outlined in this note should only be regarded as a guideline for the expected performance of new installations. The performance of new installations will always depend on the sample handling and the accuracy of the reference method used. An indication of the obtainable performance can be found as approximately 1.5 to 2 times the repeatability of the reference method.

If the samples you are measuring exceed the stated calibration ranges, or have non-common variations of other components, this might influence the performance of the calibrations.

Free Fatty Acids and Acid Value

Acid Value, also known as Acid Number or Acidity, is a quality parameter of oil and is determined by manual titration. It is defined as the mass of KOH in milligrams needed to neutralize one gram of oil. It is expressed as mg/g.

Free Fatty Acid (FFA), sometimes called Free Acidity, is a parameter calculated from the Acid Value. It is expressed as a percentage by mass of a specific free fatty acid and the unit of measurement is therefore percentage or g/100g.

The formulas for the conversion of Acid Value into FFA for common fatty acids are the following:

- FFA as Lauric Acid = Acid Value / 2.81
- FFA as Oleic Acid = Acid Value / 1.99
- FFA as Palmitic Acid = Acid Value / 2.19

The choice of the fatty acid depends on the commodity: for example FFA in Olive Oil is commonly expressed as percentage Oleic Acid, while Coconut is expressed as Lauric Acid.

To convert FFA as Oleic Acid into FFA as Lauric Acid or FFA as Palmitic Acid, the conversions are the following:

- FFA as Lauric Acid = FFA as Oleic Acid / 0.92
- FFA as Palmitic Acid = FFA as Oleic Acid / 0.91

Sample Preparation

The target sample temperature for this application is 50 °C. It is recommended to use a heater or water bath to bring the sample to 50 °C before the analysis. Alternatively, it is possible to warm up the vial / cuvette directly in the sample holder by introducing a time delay before the analysis starts, which allows the sample to equilibrate to the sample holder temperature.

When filling the vial / cuvette, make sure to avoid air bubble formation and wipe the outside walls of the vial / cuvette with a tissue to avoid fingerprint and sample stains on the walls.

Sample volumes:

- Vial 8 mm: 1200 µl
- Cuvette 1 mm: 340 µl

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Filtering the sample before analysis is not recommended.

The instrument lid should be closed during analysis.

DS2500 L is designed for analysis of liquid (homogeneous) samples.

Reference Methods

- Acidity: AOCS official method Cd 3d-63 Acid Value
- Iodine Value: AOCS official method Cd 1d-92 Iodine Value of Fats and Oils Cyclohexane - Acetic Acid Method

Ordering Information

The calibrations are developed for 8 mm disposable vials.

- 60091657 Vegetable Oil DS2500 L
- 60091681 Vegetable Oil with Color DS2500 L

Non-disposable 1 mm cuvette calibrations are also available upon request to FOSS Global Support.