

Application Note AN-NIR-153

Monitoring quality of intact olives with near-infrared spectroscopy

Determination of oil and moisture content in intact olives

Near-infrared spectroscopy (NIRS) can be used for intact olives' quality control. NIRS allows producers to evaluate olive quality faster and estimate potential economic returns. Furthermore, because olive oil quality is highly dependent on selecting the optimal harvest date – when the olives should be delivered to the mill – methods capable of monitoring oil content in olives at various ripeness stages are crucial for the olive oil industry. This helps ensure the best possible oil yield.

NIR spectroscopy provides fast and chemical-free analysis of oil content, moisture, and maturity index without any sample preparation. The NIRS solution is easy to use and can be applied in oil mills before oil production, or in quality control laboratories.

EXPERIMENTAL EQUIPMENT

This application studied 800 samples of olives composed of two varieties (Picual and Arbequina). Intact olives with different oil content, moisture content, and maturity index were measured in an OMNIS NIR Analyzer Solid (Figure 1) in diffuse reflection mode (1000–2250 nm) using a large cup OMNIS NIR, 100 mm and large holder OMNIS NIR (Table 1). To compensate for the inhomogeneity of the samples, rotating and multipoint measurement were used.



Figure 1. OMNIS NIR Analyzer Solid.

Table 1. Hardware and software equipment overview.

Equipment	Article Number
OMNIS NIR Analyzer Solid	2.1071.0010
Large holder OMNIS NIR, 100 mm	6.07402.100
Large cup OMNIS NIR, 100 mm	6.07402.110
OMNIS Stand-Alone	6.06003.010
Software license Quant Development	6.06008.002

RESULT

The obtained NIR spectra of olive samples (Figure 2) were used to create prediction models for the different parameters. The quality of the prediction models was evaluated using correlation diagrams which display a high correlation coefficient between the NIR prediction and the standard reference method for all parameters (Figures 3–5).

Out of the total, 25% of the samples were selected as a validation set and the other 75% as a calibration set. A leave one out validation procedure was used. The respective figures of merit (FOM) display the expected precision and confirm the feasibility during routine analysis.

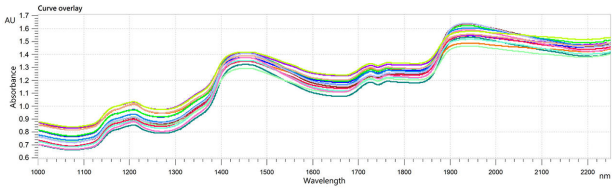


Figure 2. NIR spectra of different olive varieties measured on an OMNIS NIR Analyzer Solid.

RESULT OIL CONTENT IN INTACT OLIVES

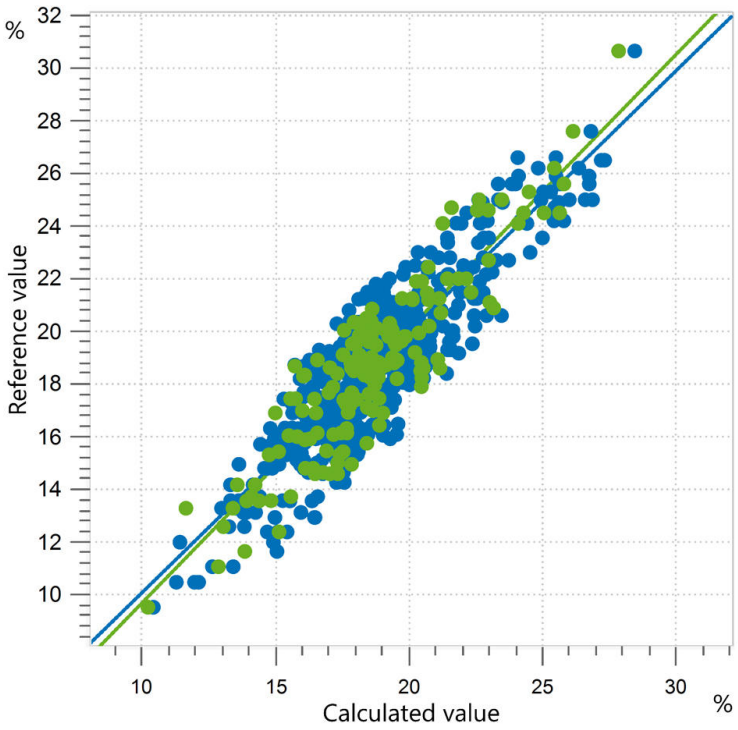


Figure 3. Correlation diagram and the respective FOMs for the prediction of oil content in intact olives using an OMNIS NIR Analyzer Solid. Oil content lab values were obtained using Soxhlet extraction.

R^2	SEC (%)	SECV (%)	SEP (%)
0.811	1.39	1.43	1.44

RESULT MOISTURE CONTENT IN INTACT OLIVES

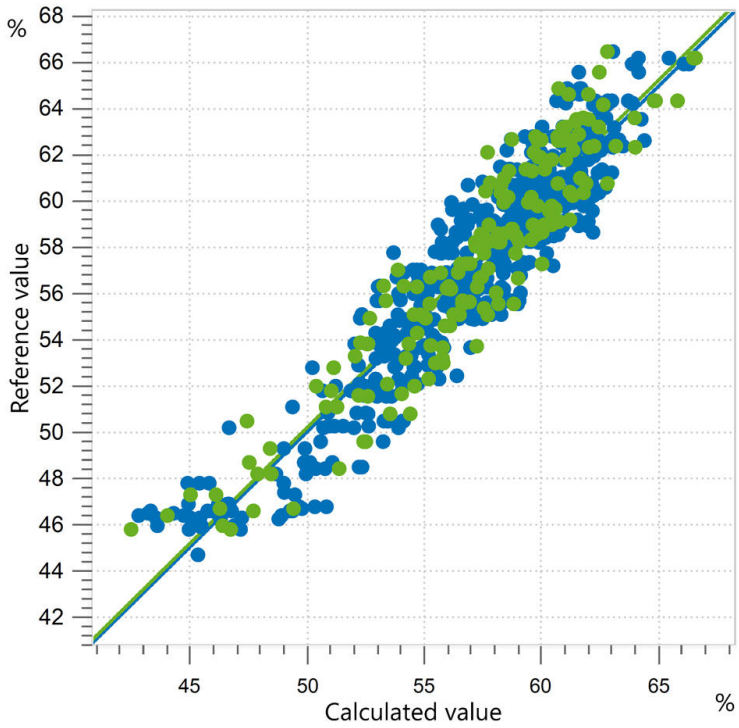


Figure 4. Correlation diagram and the respective FOMs for the prediction of moisture content in intact olives using an OMNIS NIR Analyzer Solid. Moisture lab values were obtained using the loss on drying method.

R^2	SEC (%)	SECV (%)	SEP (%)
0.868	1.70	1.75	1.81

RESULT MATURITY INDEX IN INTACT OLIVES

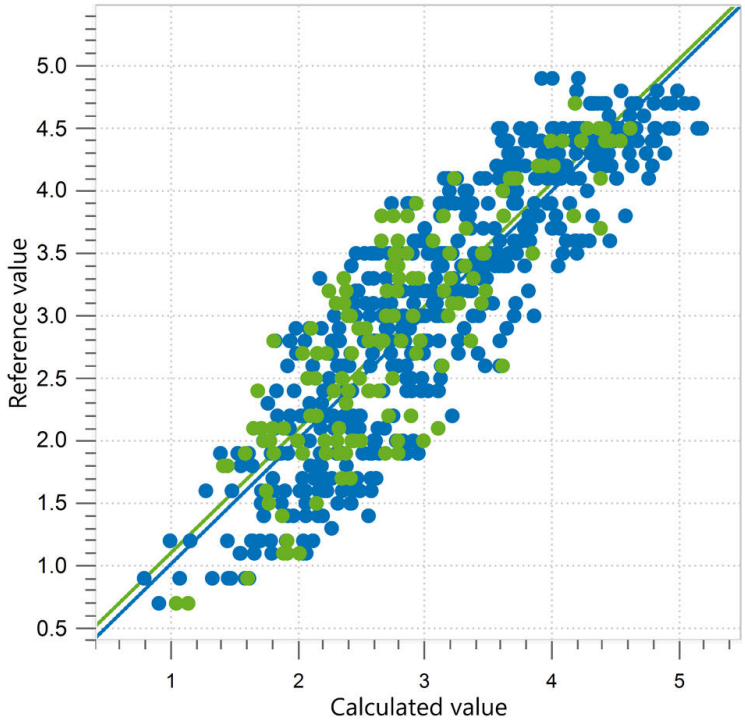


Figure 5. Correlation diagram and the respective FOMs for the prediction of olive maturity index in intact olives using an OMNIS NIR Analyzer Solid. Lab values were obtained according to guidelines from the International Olive Council (IOC Standards, Methods and Guides).

R^2	SEC	SECV	SEP
0.706	0.48	0.49	0.51

CONCLUSION

Oil content and moisture determinations by NIRS in olive paste were habitually applied for routine analysis. Now analysis of intact olives by NIR spectroscopy is possible and grinding them to a paste is unnecessary.

NIRS shows comparable efficacy against well-established methodologies such as NMR (nuclear magnetic resonance) and Soxhlet extraction. These established traditional methods are time consuming and require solvents and specialized personnel. Alternatively, NIR spectroscopy is fast, reagent free, and easy to use.

This Application Note shows the feasibility of using near-infrared spectroscopy to analyze intact olives, making the use of NIR spectroscopy even easier since no sample preparation is required.

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CONFIGURATION



OMNIS NIR Analyzer Solid

Spectromètre proche infrarouge pour échantillons solides et visqueux.

L'OMNIS NIR Analyzer est la solution de spectroscopie proche infrarouge (NIRS) développée et produite selon les normes de qualité suisses pour les analyses de routine tout au long de la chaine de fabrication. L'application des technologies les plus récentes et l'intégration dans le logiciel OMNIS moderne se reflètent dans la vitesse, la facilité du maniement et la flexibilité d'utilisation de ce spectromètre NIR.

Apercu des avantages de l'OMNIS NIR Analyzer Solid :

- Mesures d'échantillons solides et visqueux en moins de 10 secondes
- Mesures multi-positions automatisées pour des résultats reproductibles, même avec des échantillons non homogènes
- Intégration simple dans un système d'automatisation ou liaison avec d'autres technologies d'analyse (titrage)
- Prise en charge de nombreux récipients d'échantillon



Grand support OMNIS NIR, 100 mm

Grand support pour grand récipient d'échantillon OMNIS NIR, 100 mm (6.07402.110).

Permet un positionnement univoque du récipient d'échantillon et sa rotation.



Grande coupelle OMNIS NIR, 100 mm

Grand récipient d'échantillon pour l'enregistrement de spectres par réflexion de poudres et de granulés en différents points de l'échantillon.
Le fond en verre est en Gorilla® Glass résistant.
Compatible avec:

- Grand support OMNIS NIR, 100 mm (6.07402.100)

OMNIS
A WHOLE NEW LEVEL OF PERFORMANCE

Licence OMNIS autonome

Elle permet l'exploitation autonome du logiciel OMNIS sur un ordinateur WindowsTM.

Caractéristiques :

- La licence comprend déjà une licence pour appareils OMNIS.
- Elle doit être activée via le portail d'octroi de licences Metrohm.

OMNIS
A WHOLE NEW LEVEL OF PERFORMANCE

Licence logicielle Quant Development

Licence logicielle pour la création et l'édition de modèles de quantification dans une installation du logiciel OMNIS Stand-Alone.