

Application Note AN-NIR-153

近红外光谱技术用于整果橄榄品质检测

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.

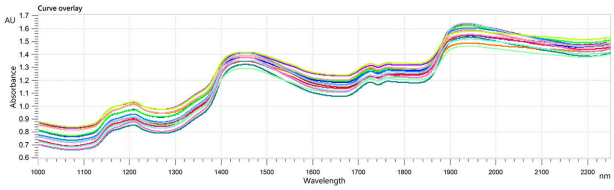


Figure 2. NIR spectra of different olive varieties measured on an OMNIS NIR Analyzer Solid.

RESULT OIL CONTENT IN INTACT OLIVES

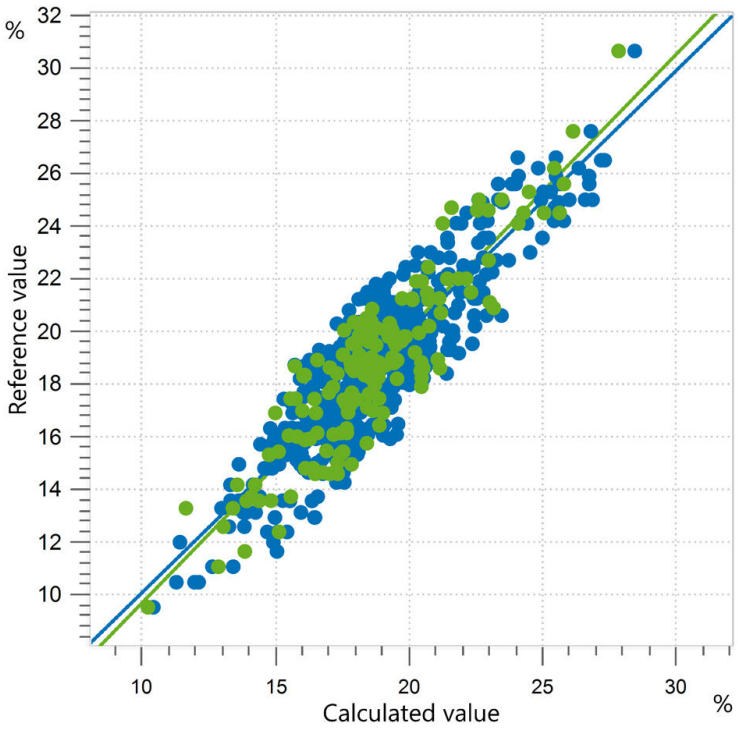


Figure 3. Correlation diagram and the respective FOMs for the prediction of oil content in intact olives using an OMNIS NIR Analyzer Solid. Oil content lab values were obtained using Soxhlet extraction.

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

RESULT MOISTURE CONTENT IN INTACT OLIVES

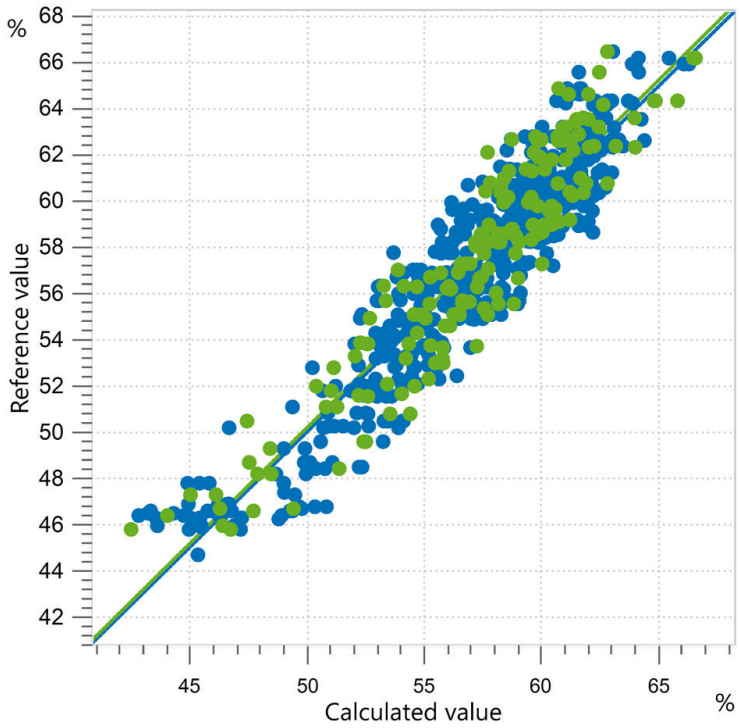


Figure 4. Correlation diagram and the respective FOMs for the prediction of moisture content in intact olives using an OMNIS NIR Analyzer Solid. Moisture lab values were obtained using the loss on drying method.

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

RESULT MATURITY INDEX IN INTACT OLIVES

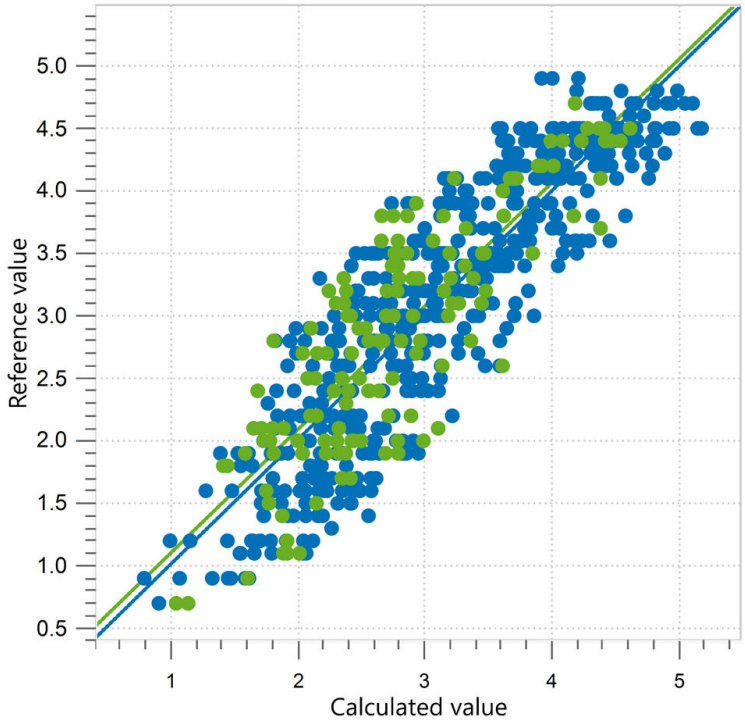


Figure 5. Correlation diagram and the respective FOMs for the prediction of olive maturity index in intact olives using an OMNIS NIR Analyzer Solid. Lab values were obtained according to guidelines from the International Olive Council (IOC Standards, Methods and Guides).

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

用于固体物质和粘稠样品的近红外光谱仪。

OMNIS NIR Analyzer 按照瑞士质量标准开发和制造,是用于整个生产链中常规分析的近红外光谱 (NIRS) 解决方案。最新技术的应用以及与现代 OMNIS Software 的集成,体现在这款 NIR 光谱仪的速度、操作性和灵活应用上。

OMNIS NIR Analyzer Solid 的优势概览:

- 固体物质和粘稠样品测量时间小于 10 秒
- 自动多位置测量,确保即使在非均质样品中也能获得可重现的结果
- 可轻松集成至自动系统,或与其它分析技术(滴定)联用
- 支持多种样品容器



OMNIS NIR100 mm

适合大样品容器的大支架 OMNIS NIR,100 mm (6.07402.110)。

允许明确地定位样品容器和旋转样品容器。



OMNIS NIR100 mm

用于在不同样品位置处通过反射进行粉末和颗粒光谱记录的大样品容器。

玻璃底板由坚固耐用的 Gorilla® 玻璃制成。

兼容:

- 大支架 OMNIS NIR,100 mm (**6.07402.100**)

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- 须通过万通许可授权平台进行激活。

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Quant Development

用于在独立 OMNIS Software 安装套件中编写和编辑量化模型的软件许可证。