



Application Note AN-NIR-145

Coconut water analysis by NIRS

Determination of Brix, salinity, conductivity, and pH with one instrument

Fresh coconut water is the main edible part of the coconut (aside from the coconut meat) and has gained popularity as a health drink in recent years. Multiple factors influence the quality, such as harvesting time, growth location, and storage duration. This poses a challenge for industrial producers to achieve and maintain the desired product quality.

Testing the properties of coconut water with standard laboratory methods can be

challenging, since trained lab personnel are needed. In contrast, near-infrared spectroscopy (NIRS) is fast, chemical-free, and does not require sample preparation. This Application Note explains how NIRS is used for the multiparameter analysis of coconut water. The NIRS solution is easy to use and can be implemented either atline or in a quality control lab.

EXPERIMENTAL EQUIPMENT

An OMNIS NIR Analyzer Liquid with a 1 mm flow-through cell (**Figure 1**) was used to analyze 206 coconut samples from a commercial supplier. In this configuration, a peristaltic pump injects the sample into the flow-through cell, which is inserted into the cuvette holder. The cell is rinsed with water after each measurement.



Figure 1. The OMNIS NIR Analyzer Liquid from Metrohm featured with a flow-through cell and holder.

RESULT

The obtained NIR spectra (**Figure 2**) were used to create prediction models for the different reference parameters (i.e., Brix, salinity, conductivity, and pH). An independent validation set of 25% was used to validate the calibration models. Correlation diagrams which display the relation between the NIR prediction and the reference values are shown in **Figures**

3–7 together with the respective figures of merit (FOM). The displayed standard errors of cross validation (SECV) and standard errors of prediction (SEP) show the expected accuracy during routine analysis in QC laboratories. The pH value FOM data indicate that the model can be used for classification or trend monitoring because of the limited NIRS correlation.

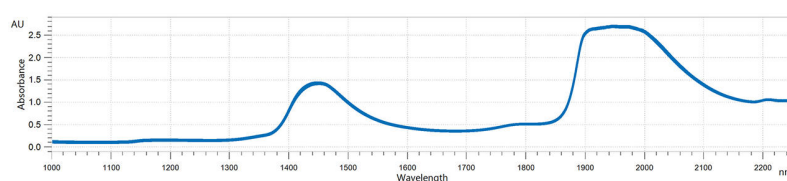


Figure 2. Selection of NIR spectra of coconut water samples measured with a 1 mm flow-through cell on an OMNIS NIR Analyzer Liquid.

RESULT BRIX VALUE

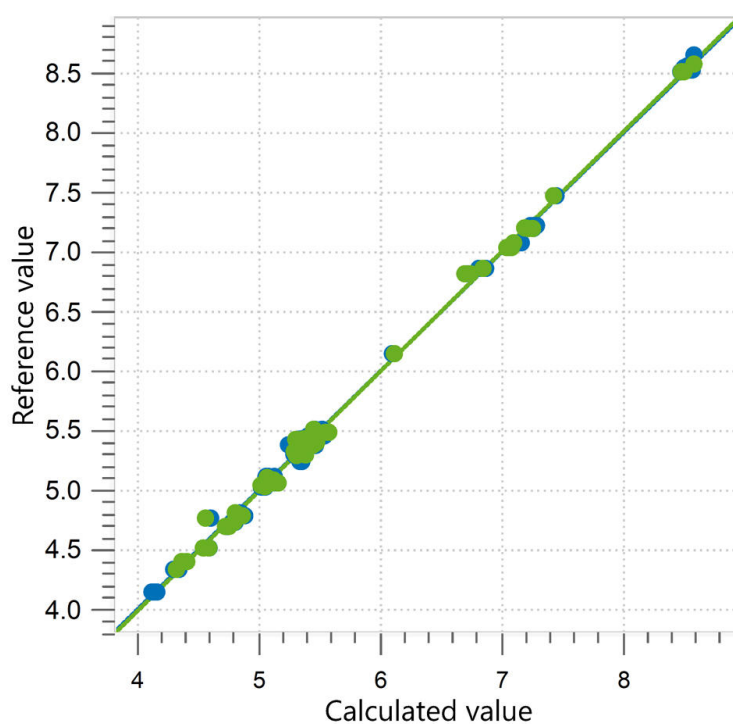


Figure 3. Correlation diagram and the respective FOMs for the prediction of Brix in coconut water using an OMNIS NIR Analyzer Liquid. The calibration dataset is shown in blue, and the external validation dataset is in green.

R ²	SEC (° Bx)	SECV (° Bx)	SEP (° Bx)
0.997	0.04	0.04	0.05

RESULT SALINITY

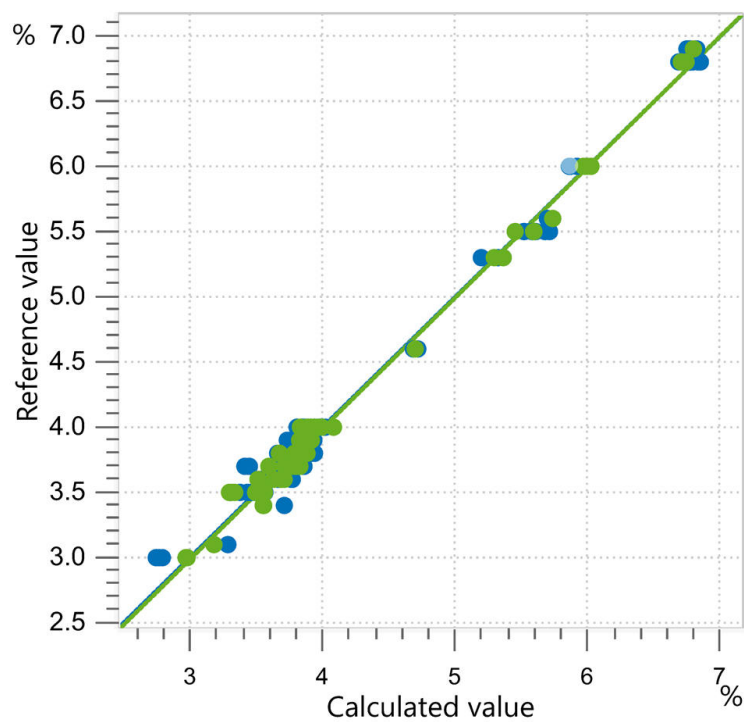


Figure 4. Correlation diagram and the respective FOMs for the prediction of coconut water salinity using an OMNIS NIR Analyzer Liquid. The calibration dataset is shown in blue, and the external validation dataset is in green.

R ²	SEC (%)	SECV (%)	SEP (%)
0.992	0.08	0.10	0.09

RESULT PH VALUE

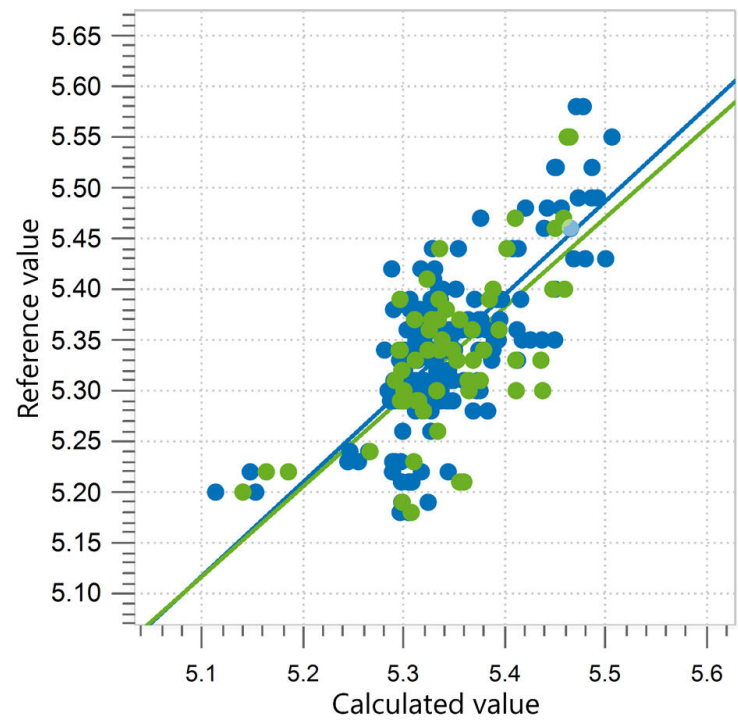


Figure 5. Correlation diagram and the respective FOMs for the prediction of coconut water pH value using an OMNIS NIR Analyzer Liquid. The calibration dataset is shown in blue, and the external validation dataset is in green.

R ²	SEC	SECV	SEP
0.658	0.05	0.05	0.06

RESULT CONDUCTIVITY

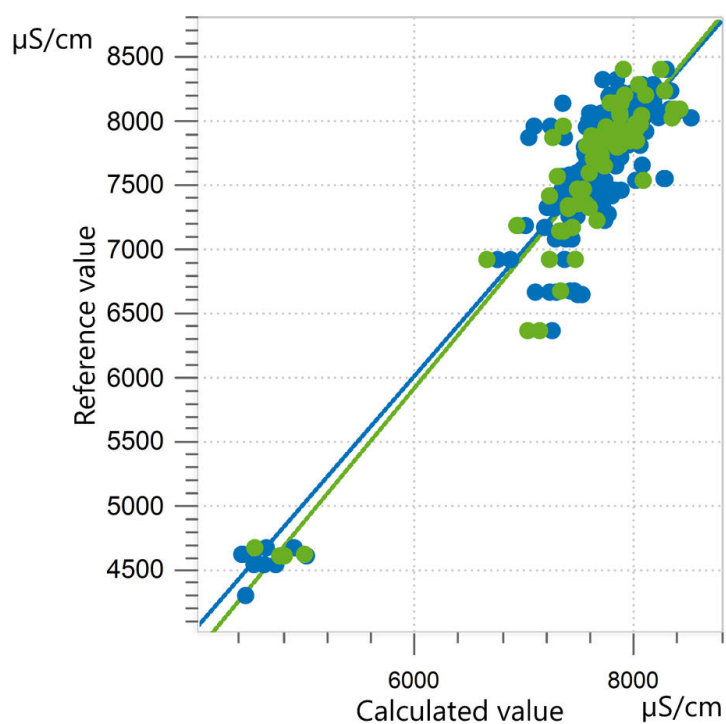


Figure 6. Correlation diagram and the respective FOMs for the prediction of coconut water conductivity using an OMNIS NIR Analyzer Liquid. The calibration dataset is shown in blue, and the external validation dataset is in green.

R^2	SEC ($\mu\text{S/cm}$)	SECV ($\mu\text{S/cm}$)	SEP ($\mu\text{S/cm}$)
0.892	250	286	285

RESULT TURBIDITY

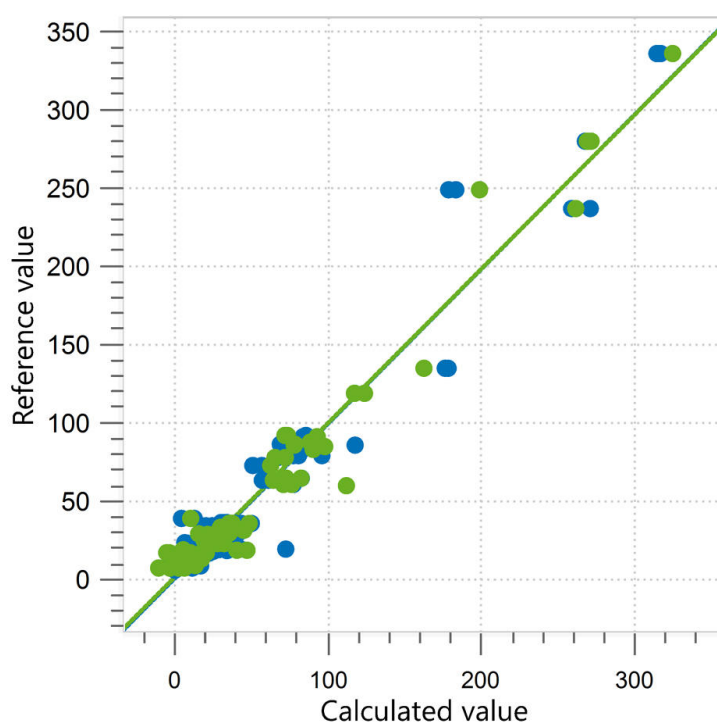


Figure 7. Correlation diagram and the respective FOMs for the prediction of coconut water turbidity using an OMNIS NIR Analyzer Liquid. The calibration dataset is shown in blue, and the external validation dataset is in green.

R ²	SEC (ppm)	SECV (ppm)	SEP (ppm)
0.956	10.05	13.04	14.90

CONCLUSION

This Application Note shows the feasibility of using NIR spectroscopy for the quality control of coconut water. The parameters Brix, conductivity, turbidity, pH value, and salinity can be monitored by NIRS in seconds without any sample preparation. The presented setup with a

flow-through cell not only simplifies sample handling but also allows full automation when using an OMNIS Sample Robot.

In addition to coconut water, the coconut fruit itself can also be analyzed using near-infrared spectroscopy.

CONTACT

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CONFIGURATION



OMNIS NIR Analyzer Liquid

液体サンプル用の近赤外スペクトロメーター。

スイスの品質規格に基づいて開発および製造された OMNIS NIR Analyzerは、生産工程全体にわたる日常的な分析に対応する近赤外分光法(NIRS)ソリューションです。最新技術のアプリケーションと、最新のOMNIS Softwareとの統合により、このNIR分光計は高速性、操作性、そして柔軟な活用が可能となっています。

OMNIS NIR Analyzer Liquidの利点の概要:

- 液体サンプルの測定を10秒未満で実施
- 25~80 ° Cの範囲でのサンプルの温度調節
- サンプル容器の挿入および取り外しの自動検出
- オートメーションシステムへの容易な統合、または追加の分析技術(滴定)との連携
- 異なる光路長を持つ多数のサンプル容器に対応

OMNIS NIR

Cuvette holder for the OMNIS NIR Analyzer for flow-through cells(6.7401.300; 6.7401.310; 6.7401.320; 6.7401.330; 6.7401.340).





OMNIS

A WHOLE NEW LEVEL OF PERFORMANCE

OMNIS

A WHOLE NEW LEVEL OF PERFORMANCE

1 mm

近赤外分光法 (NIRS) の分析に適した、光路長 1.0 mm のフロークォーツキューベットです。

次の製品と互換性があります:

- ホルダー OMNIS NIR、フローセル (6.07401.100)
- フローキューベット用 DS2500 ホルダー (6.7493.000)

OMNIS

Windows™コンピュータ上のOMNISソフトウェアをスタンドアロン操作することが可能になります。

特徴:

- ライセンスには、既に1つのOMNISデバイスライセンスが含まれています。
- メトローム・ライセンシングポータルにて、アクティブ化する必要があります。

Quant Development

Software license for the creation and editing of quantification models in a stand-alone OMNIS Software installation.