



Application Note AN-NIR-085

# Quality Control of Palm Oil

## Accurate and precise determination of the iodine value

Determination of key quality parameters of palm oil, such as the iodine value (IV), are typically performed using time consuming and costly wet chemical methods.

This application note demonstrates that the Metrohm DS2500 Liquid Analyzer operating in the visible and near infrared spectral region (Vis-

NIR) provides a **cost-efficient and fast solution** for the determination of these quality control parameters in palm oil. With **no sample preparation or chemicals needed**, Vis-NIR spectroscopy allows for the analysis of palm oil in **less than a minute** and **can be used by anyone**.



## EXPERIMENTAL EQUIPMENT

Palm oil samples which have been refined, bleached, and deodorized (RBD palm oil) were measured in transmission mode with a DS2500 Liquid Analyzer over the full wavelength range (400–2500 nm). The highly viscous samples were liquefied using the Vial Heater. Reproducible spectrum acquisition was achieved using the built-in temperature control (at 60 ° C) of the DS2500 Liquid Analyzer. For convenience, disposable vials with a path length of 8 mm were used, which made cleaning of the sample vessels unnecessary. The Metrohm software package Vision Air Complete was used for all data acquisition and prediction model development. The measurements were also conducted with a XDS RapidLiquid Analyzer to compare the analytical performance of both instruments.



**Figure 1.** DS2500 Liquid Analyzer and a palm oil sample present in an 8 mm disposable vial.

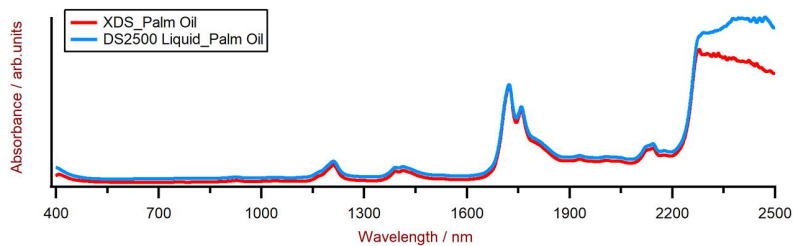
**Table 1.** Hardware and software equipment overview

Equipment	Metrohm number
DS2500 Liquid Analyzer	2.929.0010
XDS RapidLiquid Analyzer	2.921.1410
Vial Heater	2.921.9010
Disposable vials, 8 mm diameter, transmission	6.7402.000
Vision Air 2.0 Complete	6.6072.208

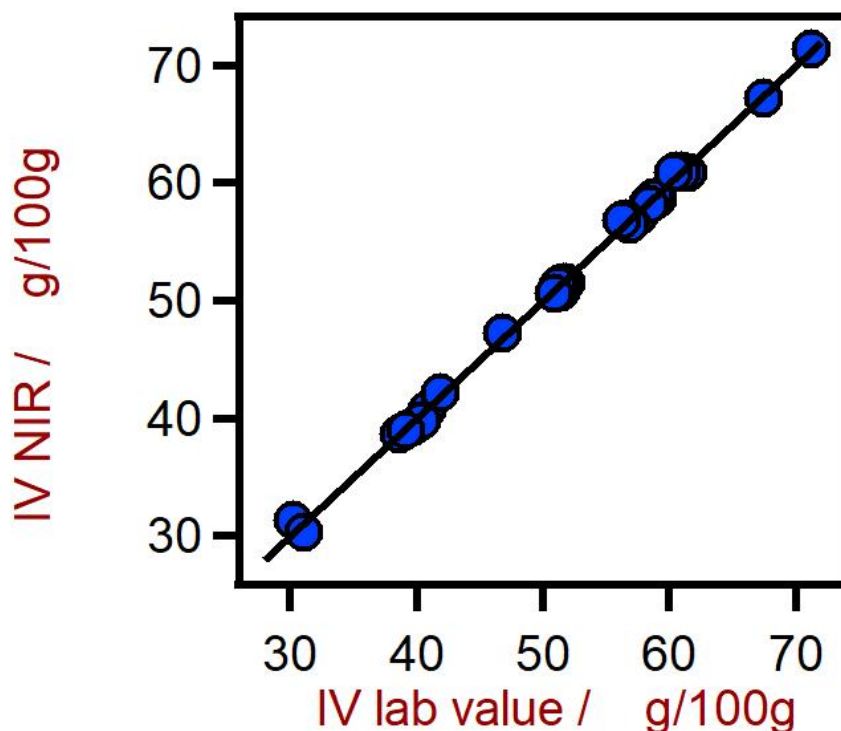
## RESULTS

The obtained Vis-NIR spectra (**Figure 2**) were used to create prediction models for quantification of the individual key parameters. The quality of the prediction models was evaluated using correlation diagrams, which

display the correlation between VisNIR prediction and primary method values. The respective figures of merit (FOM) display the expected precision of a prediction during routine analysis.



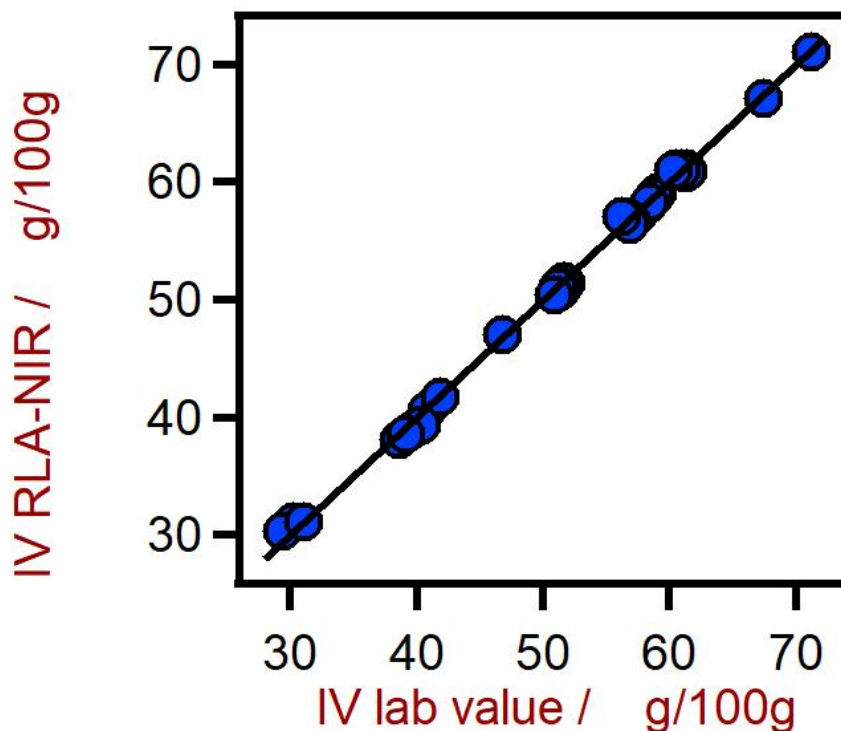
**Figure 2.** Vis-NIR spectra of palm oil obtained using a DS2500 Liquid Analyzer / XDS RLA and 8 mm disposable vials.



**Figure 3.** Correlation diagram for the prediction of the iodine value (IV) in palm oil using a DS2500 Liquid Analyzer. The iodine lab value was evaluated using titration.

**Table 2.** Figures of merit for the prediction of the iodine value (IV) in palm oil using a DS2500 Liquid Analyzer.

Figures of merit	Value
$R^2$	0.998
Standard error of calibration	0.49 g/100g
Standard error of cross-validation	0.49 g/100g



**Figure 4.** Correlation diagram for the prediction of the iodine value (IV) in palm oil using a XDS RapidLiquid Analyzer. The iodine lab value was evaluated using titration.

**Table 2.** Figures of merit for the prediction of the iodine value (IV) in palm oil using a XDS RapidLiquid Analyzer.

Figures of merit	Value
R <sup>2</sup>	0.998
Standard error of calibration	0.55 g/100g
Standard error of cross-validation	0.54 g/100g

## CONCLUSION

This application note demonstrates the feasibility of the DS2500 Liquid Analyzer for the analysis of the iodine value in palm oil. Compared to the older generation XDS RLA, the observed accuracy is slightly better, yet within statistical relevance.

In a previous application note ([AN-NIR-044](#)), the XDS RLA was used to determine **additional**

**quality parameters in palm oil, including free fatty acids, moisture content, and the deterioration of bleaching index (DOBI).** Due to the demonstrated comparability between the DS2500 Liquid Analyzer and XDS RapidLiquid Analyzer, it is clear that those parameters can also be determined with the DS2500 Liquid Analyzer.

The main advantages of NIR spectroscopy over wet chemical methods are that, **running costs are significantly lower and time-to-result is significantly reduced.**

Internal reference: AW NIR CH-0010-052020

[AN-NIR-044 - Quality Control of Palm Oil – Environmentally friendly determination of FFA content, iodine value, moisture, DOBI, and carotene content](#)

## CONTACT

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### DS2500 Liquid Analyzer

ラボおよび生産環境における品質管理用の堅牢な近赤外分光法。

NIRS DS2500 Liquid Analyzerは、生産チェーン全体に沿った液体のルーチン分析に実績のあるフレキシブルなソリューションです。頑丈な仕様により、NIRS DS2500 Liquid Analyzerは粉塵、湿気、および振動に強い為、過酷な生産環境での使用に理想的です。

DS2500 Liquid Analyzer は400~2500 nmのスペクトル範囲全体をカバーし、サンプルを80° Cまで加熱し、様々な使い捨てハイアルやクォーツキュベットとの互換性を有します。このようにして個々のサンプル要件に対応し得るDS2500 Liquid Analyzerは、1分未満で正確かつ再現性ある結果を得られるようサポートします。さらに一体型のサンプルホルダ検出、および説明不要のVision Airソフトウェアを用いることで、ユーザーが簡単かつ安全に操作できることが保証されます。

サンプル量が多い場合、Metrohmサンプルロケットと組み合わされたフローセルの導入によって、生産性を著しく向上させることができます。



### NIRS XDS RapidLiquid Analyzer

あらゆる種類の液体および懸濁液の迅速で正確な分析。

NIRS XDS RapidLiquid Analyzerは、液体製剤および物質の迅速で正確な分析を可能にします。ボタンを押すだけで正確な測定結果が得られるため、NIRS XDS RapidLiquid Analyzerはラボおよびプロセスにおける品質管理のための信頼性が高くシンプルなソリューションです。サンプルは、再使用可能な石英製キュベットまたは使い捨てガラス製ハイアルに置かれます。温度調整されたサンプルコンパートメントは、再現性のある分析条件、およびそれによる正確な測定結果を保証します。



### NIRS XDS Vial Heater including 250 vials

The NIRS XDS Vial Heater Module enables analyses of samples at temperatures of up to 200 ° C. The Vial Heater is used together with an NIRS XDS Transmission OptiProbe Analyzer. The Transmission Probes are fastened across from one another in the NIRS XDS Vial Heater. The NIRS disposable glass vials with 4 mm or 8 mm diameter are positioned between the two optical fibers in the heating block of the NIRS XDS Vial Heater. The temperature of the heating block can be regulated up to 200 ° C. The sample and the optical fiber can be protected against ambient light with a lid. The spectral measurement of the sample takes place in transmission.



## Vision Air 2.0 Complete

Vision Air - 汎用性に優れた分光法ソフトウェア。

Vision Air Complete は、規制環境下での使用のための、操作の容易な最新のソフトウェアソリューションです。

Vision Air の利点の概要:

- 調整済みのユーザーインターフェースを伴う個別のソフトウェアアプリケーションにより、直観的かつ容易な操作が保証されます。
- 作業手順の容易な作成およびメンテナンス
- 安全かつ容易なデータ管理のための SQL データベース

バージョン Vision Air Complete (66072208) には、可視近赤外分光法を用いた品質管理のための全てのアプリケーションが含まれています:

- 装置管理およびデータ管理のためのアプリケーション
- メソッド開発のためのアプリケーション
- ルーチン分析のためのアプリケーション

その他の Vision Air Complete ソリューション:

- 66072207 (Vision Air Network Complete)
- 66072209 (Vision Air Pharma Complete)
- 66072210 (Vision Air Pharma Network Complete)