

Application Note AN-NIR-126

Biodiesel content in diesel with near-infrared spectroscopy

Monitor the fuel blending process within seconds

The properties of biodiesel fuel, which is produced from vegetable oils or animal fat, are very similar to petroleum-derived diesel, but biodiesel pollutes less. In most countries the common biodiesel blend is B20, which ranges from 6% to 20% biodiesel content. Measuring the biodiesel content in diesel is important, as higher levels can cause deposits in older diesel engines, clogging the fuel filters and pumps. Fuels with high levels of biodiesel also tend to absorb more moisture compared to petroleum-derived fuels. With near-infrared spectroscopy (NIRS), the biodiesel content is determined in seconds without any sample preparation. Compared to other test methods like those used in ASTM D7467, biodiesel content analysis with NIR spectroscopy saves time and enables the implementation of online process monitoring with fiber optics.

EXPERIMENTAL EQUIPMENT

Twenty-one diesel samples with varying biodiesel content from 0% to 20% were measured on the OMNIS NIR Analyzer Liquid (Figure 1) in transmission mode (1000–2250 nm) using 8 mm disposable vials. The vial temperature was set and monitored at 30 °C with the built-in vial sensor to ensure consistent measurement performance.

OMNIS Software was used for all data acquisition and prediction model development.



Figure 1. OMNIS NIR Analyzer and a sample filled in a disposable vial.

Table 1. Hardware and software equipment overview.

Equipment	Article number
OMNIS NIR Analyzer Liquid	2.1070.0010
Holder OMNIS NIR, vial, 8 mm	6.07401.070
Disposable vial, 8mm, transmission	6.7402.240
OMNIS Stand-Alone license	6.06003.010
Software license Quant Development	6.06008.002

RESULT

The obtained NIR spectra (Figure 2) were used to create a prediction model for quantification of biodiesel content in diesel. The quality of the prediction model was evaluated using a correlation diagram (Figure 3) which displays a high correlation between the NIR prediction and the lab method. The respective figures of merit (FOM) confirm the feasibility during routine analysis.

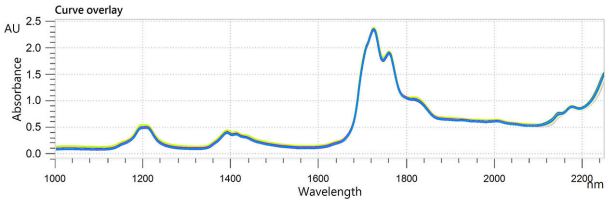


Figure 2. NIR spectra of biodiesel blends analyzed on an OMNIS NIR Analyzer Liquid with 8 mm vials.

Result biodiesel content

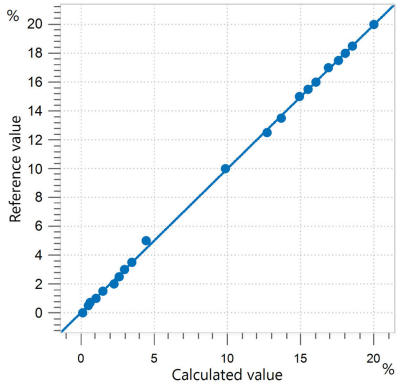


Figure 3. Correlation diagram and the respective FOMs for the prediction of biodiesel content in diesel. The reference value was determined by volumetric mixing of biodiesel and petroleum-derived diesel.

SEC (%)	SECV (%)	R^2CV
0.14	0.16	1.000

CONCLUSION

This Application Note shows the results of a biodiesel content analysis test without the need for any sample preparation, using near-infrared spectroscopy in place of other more time-intensive analytical techniques. This ultimately leads to a reduction in workload and the related costs. Alongside the biodiesel content test, additional fuel quality parameters like cetane number, moisture, or flash point can be determined with NIRS.

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CONFIGURATION



OMNIS NIR Analyzer Liquid
Nahinfrarot-Spektrometer für Flüssigproben.
Der OMNIS NIR Analyzer ist die nach Schweizer Qualitätsstandards entwickelte und produzierte Nahinfrarotspektroskopie(NIRS)-Lösung für die Routineanalytik entlang der gesamten Produktionskette. Die Nutzung neuester Technologien und die Einbindung in die moderne OMNIS Software spiegeln sich in der Geschwindigkeit, der Bedienbarkeit und dem flexiblen Einsatz dieser NIR-Spektrometer wider.
Die Vorteile des OMNIS NIR Analyzer Liquid im Überblick:

- Messungen von Flüssigproben in weniger als 10 Sekunden
- Temperaturregelung an der Probe von 25 °C – 80 °C
- Automatische Erkennung des Einsetzens und der Entnahme des Probengefässes
- Einfache Einbindung in ein Automationssystem oder Verknüpfung mit weiteren Analysentechniken (Titration)
- Unterstützung zahlreicher Probengefässe mit unterschiedlicher Pfadlänge



Halter OMNIS NIR, Vial, 8 mm
Vialhalter für den OMNIS NIR Analyzer für 8 mm Einwegvials (6.7402.240).



Einwegvial, 8 mm, Transmission, Anz. 100

100 Einwegvials aus Glas (Borosilikat) mit einer optischen Pfadlänge von 8 mm für Analysen von Flüssigkeiten in Transmission. Die Einwegvials werden mit den zugehörigen Verschlussstopfen (Stückzahl = 100) geliefert.

Kompatibel mit:

- Halter OMNIS NIR, Vial, 8 mm (6.07401.070)
- DS2500 Halter für 8 mm Einwegvials (6.7492.020)

OMNIS
A WHOLE NEW LEVEL OF PERFORMANCE

OMNIS Stand-Alone Lizenz

Ermöglicht den Stand-Alone Betrieb der OMNIS Software auf einem WindowsTM Computer.

Merkmale:

- Die Lizenz enthält bereits eine OMNIS Geräte Lizenz.
- Muss über das Metrohm Lizenzierungsportal aktiviert werden.

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Softwarelizenz Quant Development

Softwarelizenz für die Erstellung und Bearbeitung von Quantifizierungsmodellen in einer Stand-Alone OMNIS Software Installation.