

Application Note AN-NIR-155

Salt content in pickled vegetables by near-infrared spectroscopy (NIRS)

Determination of the salt content in food in a few seconds

The salt content is one of the most important quality and safety parameters to monitor during the manufacturing process of pickled vegetables. Salt content must be controlled during the production process as well as in the final product. Compared to conventional lengthy wet chemical methods, near-infrared (NIR) spectroscopy can be used for quickly analyzing the salt content in pickled foods.

While sodium chloride (NaCl) has no specific absorption band(s) in the NIR region, the presence of salt in a sample causes changes in the height, width, and position of the absorbance bands of water. For that reason, it is expected to find information about the changes in salt concentration in the NIR spectra. This Application Note demonstrates that NIRS is a good choice for the rapid quantification of salt content in ready-to-eat foods.

EXPERIMENTAL EQUIPMENT

This application studied 45 samples of pickled peppers and 107 samples of pickled olives. Samples with different concentrations of salt (sodium chloride) were ground and measured with an OMNIS NIR Analyzer Solid (Figure 1) in diffuse reflection mode (1000–2250 nm) using a small cup OMNIS NIR, 60 mm and small holder OMNIS NIR, 60 mm. To compensate for the inhomogeneity of the samples, rotating and multipoint measurement was used.



Figure 1. The OMNIS NIR Analyzer Solid.

RESULT

The NIR spectra (Figures 2–3), along with the corresponding reference values, were used to create prediction models for quantification of salt content.
The quality of the prediction models was evaluating using correlation diagrams (Figures 4–5) which display the relation between the NIR prediction and the reference values of salt content using a wet chemical method. Out of the total, 25% of the samples were selected as the validation set and the other 75% as a calibration set. The respective figures of merit (FOM) display the expected precision during routine analysis.

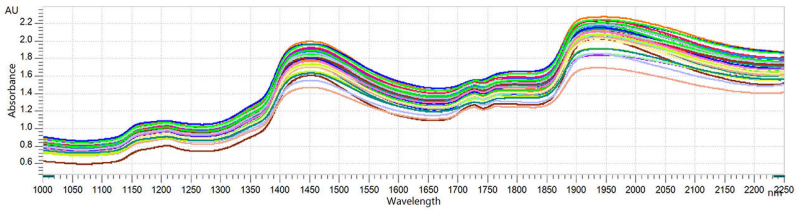


Figure 2. NIR spectra of different pickled olives measured on an OMNIS NIR Analyzer Solid.

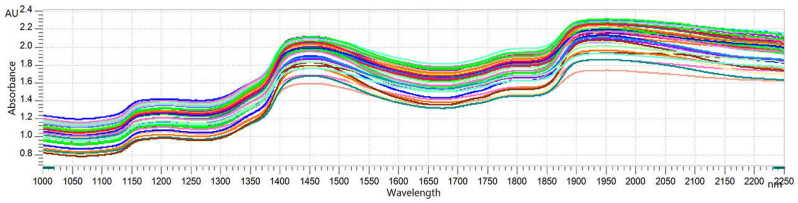
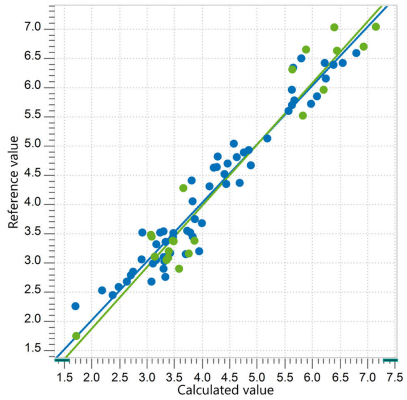


Figure 3. NIR spectra of different pickled peppers measured on an OMNIS NIR Analyzer Solid.

RESULT SALT CONTENT IN PICKLED OLIVES

Figure 4.

Correlation diagram and the respective FOMs for the prediction of salt in picked olives measured in an OMNIS NIR Analyzer Solid. Reference values were measured using potentiometric titration according to Metrohm Application Note AN-T-003.

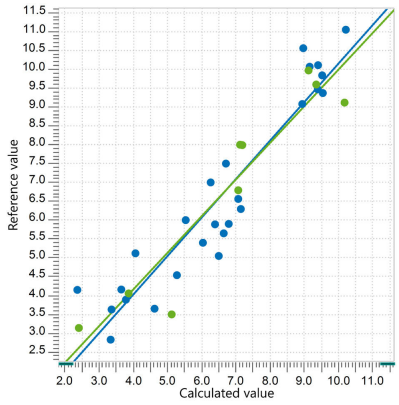


R^2P	SEC (%)	SECV (%)	SEP (%)
0.940	0.26	0.32	0.42

RESULT SALT CONTENT IN PICKLED PEPPERS

Figure 5.

Correlation diagram and the respective FOMs for the prediction of salt in picked peppers measured in an OMNIS NIR Analyzer Solid. Reference values were measured using potentiometric titration according to Metrohm Application Note AN-T-003.



R^2P	SEC (%)	SECV (%)	SEP (%)
0.885	0.59	0.83	0.86

CONCLUSION

This Application Note shows the feasibility of using NIR spectroscopy for the analysis of salt content in ready-to-eat food (i.e., pickled vegetables). By using NIRS, this measurement can be conducted in seconds without the use of chemicals.

CONTACT

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CONFIGURATION



OMNIS NIR Analyzer Solid

Nahinfrarotspektrometer für feste und viskose Proben.

Der OMNIS NIR Analyzer ist die nach Schweizer Qualitätsstandards entwickelte und produzierte Nahinfrarotspektroskopie(NIRS)-Lösung für die Routineanalyse entlang der gesamten Produktionskette. Die Anwendung neuester Technologien und die Integration 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 Solid im Überblick:

- Messungen von Feststoffen und viskosen Proben in weniger als 10 Sekunden
- Automatisierte Mehrpositionenmessungen für reproduzierbare Resultate auch bei inhomogenen Proben
- Einfache Integration in ein Automationssystem oder Verknüpfung mit weiteren Analysentechniken (Titration)
- Unterstützung zahlreicher Probengefässe



Kleiner Halter OMNIS NIR, 60 mm

Kleiner Halter für Kleines Probengefäss OMNIS NIR, 60 mm (6.07402.210).

Erlaubt eindeutige Positionierung des Probengefässes und die Rotation des Probengefässes.



Kleine Schale OMNIS NIR, 60 mm

Kleines Probengefäss für die Spektrenaufnahme von Pulvern und Granulaten in Reflexion an unterschiedlichen Probenstellen.

Der Glasboden besteht aus widerstandsfähigem Gorilla® Glass.

Kompatibel mit:

- Kleiner Halter OMNIS NIR, 60 mm (6.07402.200)

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.

OMNIS
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Softwarelizenz Quant Development

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