

Application Note AN-NIR-136

Analysis of fabric softeners and laundry perfumes with NIR spectroscopy

Determination of dry matter, pH, and viscosity in seconds

Fabric softeners and laundry perfumes (concentrated fragrances) are a category of personal care/laundry products used for their ability to make textiles softer, smoother, and more pleasantly scented after the washing cycle. A variety of raw materials is necessary to manufacture these products, and different analytical methods are often required before production can commence. Traditional analysis requires time-consuming methods. This Application Note describes how viscosity, dry matter content, and pH level of fabric softeners and laundry perfumes are measured with near-infrared spectroscopy. Near-infrared spectroscopy (NIRS) is a fast, chemical-free analysis technique for quality control of fabric softeners and laundry perfumes without sample preparation.

EXPERIMENTAL EQUIPMENT

Fabric softener and laundry perfume samples were measured with an OMNIS NIR Analyzer Solid (Figure 1) in transflection mode (1000–2250 nm) using a 1 mm gap size reflector and 28 mm disposable vials. Reference values of dry matter were measured by loss on drying, and pH and viscosity were determined with a pH meter and viscometer, respectively. OMNIS Software was used for all data acquisition and prediction model development



Figure 1. OMNIS NIR Analyzer Solid with transflection vessel and large reflector

RESULT

The obtained NIR spectra (Figure 2) were used to create prediction models for quantification of dry matter, pH value, and viscosity. The quality of the prediction models was evaluated using correlation diagrams (Figures 3–5) which display a very high correlation between the NIR prediction and the reference values. The respective figures of merit (FOM) display the expected precision of a prediction during routine analysis.

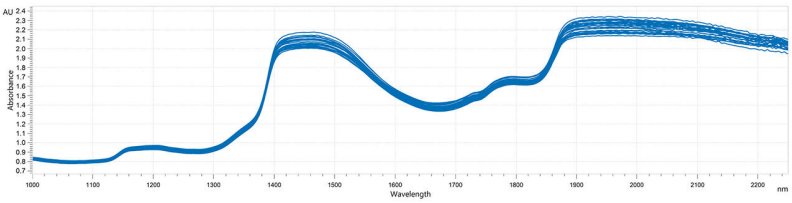


Figure 2. NIR spectra of fabric softeners and laundry perfumes analyzed on OMNIS NIR Analyzer Solid

Result pH in fabric softeners and laundry perfumes

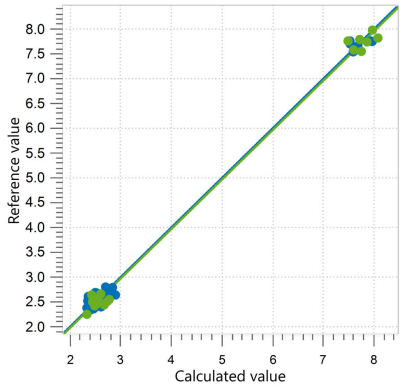


Figure 3. Correlation diagram and the respective FOMs for the prediction of pH value in fabric softeners and laundry perfumes using an OMNIS NIR Analyzer Solid. The correlation set is shown in blue, and the external validation set is in green.

R^2	SEC	SECV	SEP
0.997	0.11	0.14	0.15

Result dry matter in fabric softeners and laundry perfumes

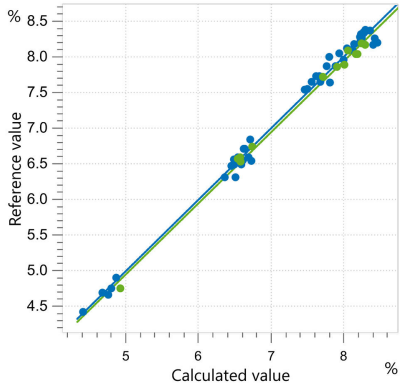


Figure 4. Correlation diagram and the respective FOMs for the prediction of dry matter in fabric softeners and laundry perfumes using an OMNIS NIR Analyzer Solid. The correlation set is shown in blue, and the external validation set is in green.

R^2	SEC (%)	SECV (%)	SEP (%)
0.995	0.09	0.10	0.09

Result viscosity in fabric softeners and laundry perfumes

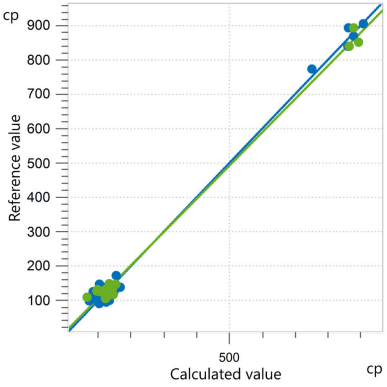


Figure 5. Correlation diagram and the respective FOMs for the prediction of viscosity in fabric softeners and laundry perfumes using an OMNIS NIR Analyzer Solid. The correlation set is shown in blue, and the external validation set is in green.

R^2	SEC (cp)	SECV (cp)	SEP (cp)
0.994	17.16	20.25	22.18

CONCLUSION

This Application Note shows the feasibility of the analysis of dry matter, pH, and viscosity in laundry perfumes and fabric softeners with near-infrared spectroscopy. Measurement of all three quality parameters can be conducted within seconds without using any chemicals.

NIRS can be used in several steps of the production chain or during quality control of the final product, saving manufacturers time and money. Additionally, with NIRS only one technology is required, compared to the standard analytical techniques often used for these determinations (Table 1).

Table 1. Overview of standard methods used for the determination of different reference values in fabric softeners and laundry perfumes.

Parameter	Method	Time to result
Dry matter	Loss on drying	30 min
pH	pH meter	5 min
Viscosity	Viscometer	15 min (sample preparation + measurement)

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CONFIGURATION



OMNIS NIR Analyzer Solid

Near-infrared spectrometer for solid and viscous samples.

Developed and produced in accordance with Swiss quality standards, the OMNIS NIR Analyzer is the near-infrared spectroscopy (NIRS) solution for routine analysis along the entire production chain. Its application of the latest technologies and its integration in the modern OMNIS Software are reflected in its speed, operability and flexible utilization of this NIR spectrometer.

Overview of the advantages of the OMNIS NIR Analyzer Solid:

- Measurements of solids and viscous samples in less than 10 seconds
- Automated multi-position measurements for reproducible results, even with nonhomogeneous samples
- Simple integration in an automation system or link with additional analysis technologies (titration)
- Supports numerous sample vessels



Small reflector OMNIS NIR, 1 mm

Reflector with a gap size of 1 mm (optical path length of 2 mm) for the transflection measurement of liquids.

Suitable for disposable 28 mm reflection vials (6.7402.140).



Disposable vials, 28 mm, reflection

216 lockable disposable glass vials with a diameter of 28 mm for analyses of solids in reflection. Suitable for the following analyzers:

- NIRS DS2500 Analyzer
- NIRS XDS RapidContent (Solid) Analyzer
- NIRS XDS MultiVial Analyzer
- NIRS XDS MasterLab Analyzer

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A WHOLE NEW LEVEL OF PERFORMANCE

OMNIS Stand-Alone license

Enables stand-alone operation of the OMNIS software on a WindowsTM computer.

Features:

- The license already includes one OMNIS instrument license.
- Must be activated via the Metrohm licensing portal.

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Software license Quant Development

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