



Application Note AN-NIR-087

Ethanol content in hand sanitizers

Fast and reagent-free ethanol content determination

In 2020, the demand for hand sanitizer skyrocketed due to the COVID-19 pandemic. Many companies shifted gears, streamlining their operations to produce hand sanitizer in large volumes. As in any product manufacturing process, accurate formulation enables good quality and minimizes waste. The alcohol content in hand sanitizers must be greater than 60% (v/v) to be an effective antiseptic. Reagents commonly used in these solutions are water,

alcohol (commonly ethanol or isopropanol), small amounts of emollient (skin softener, e.g. glycerol), and an oxidizing agent (e.g. hydrogen peroxide) to minimize microbial contamination. A safe and fast way to monitor ethanol content in these sanitizing solutions is with **reagent-free** near-infrared spectroscopy, which provides reliable **results in a few seconds**, quickly indicating when adjustments in formulation are necessary.

EXPERIMENTAL EQUIPMENT

Mixtures of ethanol/water standards with a range of ethanol content from 58% to 82% (v/v) were measured in transmission mode with a DS2500 Liquid Analyzer over the full wavelength range (400–2500 nm). Reproducible spectrum acquisition was achieved using the built-in temperature control at 40 ° C. 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.



Figure 1. DS2500 Liquid Analyzer and a sample filled in a disposable vial.

Table 1. Hardware and software equipment overview

Equipment	Metrohm number
DS2500 Liquid Analyzer	2.929.0010
DS2500 Holder 8 mm vials	6.7492.020
Disposable vials, 8 mm	6.7402.000
Vision Air 2.0 Complete	6.6072.208

RESULTS

All 13 measured Vis-NIR spectra (**Figure 2**) were used to create a prediction model for quantification of the ethanol content. The quality of the prediction models was evaluated using correlation diagrams, which display a very

high 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 hand sanitizers with varying ethanol content measured on a DS2500 Liquid Analyzer.

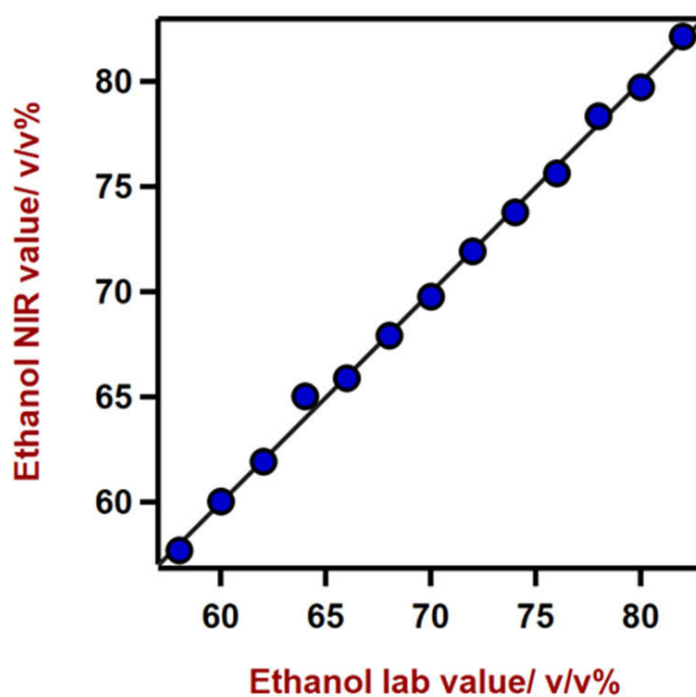


Figure 3. Correlation diagram and the respective figures of merit for the prediction of ethanol content in hand sanitizers using a DS2500 Liquid Analyzer.

Table 2. Figures of merit for the prediction of ethanol content in hand sanitizers using a DS2500 Liquid Analyzer.

Figures of merit	Value
R^2	0.9977
Standard error of calibration	0.41 v/v%
Standard error of cross-validation	0.56 v/v%

CONCLUSION

This application note demonstrates the feasibility of the DS2500 Liquid Analyzer for the determination of ethanol in hand sanitizer products. Vis-NIR spectroscopy enables a fast

determination with high accuracy, and therefore represents a suitable alternative to the standard method.

Table 3. Time to result for the ethanol content determination in hand sanitizers using gas chromatography

Parameter	Method	Time to result and workflow
Ethanol content	GC	~5 min (preparation) + ~5 min (GC)

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DS2500 Liquid Analyzer

Robust near-infrared spectroscopy for quality control, not only in laboratories but also in production environments. The DS2500 Liquid Analyzer is the tried and tested, flexible solution for routine analysis of liquids along the entire production chain. Its robust design makes the DS2500 Liquid Analyzer resistant to dust, moisture and vibrations, which means that it is eminently suited for use in harsh production environments. The DS2500 Liquid Analyzer covers the full spectral range from 400 to 2500 nm, heats samples up to 80° C and is compatible with various disposable vials and quartz cuvettes. The DS2500 Liquid Analyzer is thus adaptable to your individual sample requirements and helps you obtain accurate and reproducible results in less than one minute. The integrated sample holder detection and the self-explanatory Vision Air Software also ensure simple and safe operation by the user. In the case of larger-sized sample quantities, productivity can be considerably increased by using a flow-through cell in combination with a Metrohm sample robot.



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)



8mmDS2500

直径8 mmのガラス製使い捨てバイアル用インテリジェントホルダー