

Application Note AN-NIR-147

近红外光谱法测定葡萄酒中的乙醇含量

Rapid determination of alcohol levels in wine with NIRS

Ethanol content is an important parameter to determine in wine—during the fermentation process, for quality control, and for other legal requirements of alcoholic beverages. Traditional time-consuming methods like gas chromatography (GC) can be used for the determination of ethanol content in wine. However, measuring the alcohol content in wine can be done easily without sample preparation by using near-infrared spectroscopy (NIRS). NIRS is a fast, easy to use, and chemical-free analysis method. The NIRS solution can be used either atline during the wine fermentation process or in a quality control laboratory.

EXPERIMENTAL EQUIPMENT

Samples of red wine and white wine with varying alcohol content were measured on an OMNIS NIR Analyzer Liquid (1000–2250 nm). Measurements were performed in transmission mode with a 2 mm flow-through cell and corresponding holder for flow-through cells. The built-in peristaltic pump on the OMNIS Sample Robot S was used for liquid transfer (Figure 1). OMNIS Software was used for all data acquisition and prediction model development.



Figure 1. OMNIS NIR Analyzer Liquid and OMNIS Sample Robot S – WSM (1T/2P).

Table 1. Hardware and software equipment overview.

Equipment	Article number
OMNIS NIR Analyzer Liquid	2.1070.0010
NIRS 12.5 mm quartz cuvette flow 2 mm	6.7401.320
Holder OMNIS NIR, flow-through cells	6.07401.100
OMNIS Stand-Alone license	6.06003.010
OMNIS Stand-Alone: 1 instrument license	6.06002.010
Software license Quant Development	6.06008.002
OMNIS Sample Robot S – WSM (1T/2P)	2.1010.1120
OMNIS Sample rack, 25 x 75 mL (PP)	6.02041.040
Gripper fingers 28-48 mm	6.02601.040

RESULT

The obtained NIR spectra of wine (Figure 2) were used to create a prediction model for ethanol content. A leave one out validation procedure was applied. A correlation diagram showing the relation between the NIR prediction and the reference values is shown in Figure 3 together with the respective figures of merit (FOM).

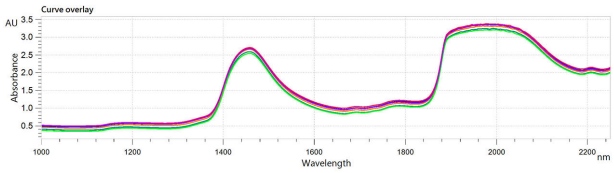


Figure 2. NIR spectra of different wine samples measured on an OMNIS NIR Analyzer Liquid with a 2 mm flow-through cell.

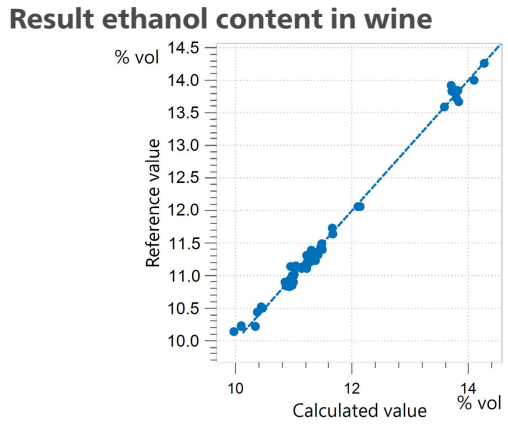


Figure 3. Correlation diagram and the respective figures of merit for the prediction of ethanol in wine. The determination of ethanol content in wine using gas chromatography was performed for reference values.

R^2	SEC (% vol)	SECV (% vol)
0.995	0.080	0.082

CONCLUSION

This Application Note shows the feasibility of using NIR spectroscopy for testing ethanol content in wine. The analysis can be conducted within seconds. No chemicals are used, saving costs. Automation possibilities with the OMNIS platform allow the unattended measurement of up to 175 samples.

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CONFIGURATION



OMNIS NIR Analyzer Liquid

用于液体样品的近红外光谱仪。

OMNIS NIR Analyzer 按照瑞士质量标准开发和制造,是用于整个生产链中常规分析的近红外光谱解决方案。最新技术的应用以及与现代 OMNIS Software 的集成,体现在这款 NIR 光谱仪的速度、操作性和灵活应用上。

OMNIS NIR Analyzer Liquid 的优势概览:

- 液体样品测量时间小于 10 秒
- 样品温度调节范围为 25–80 °C
- 自动检测样品容器的放入和移除
- 可轻松集成至自动系统,或与其它分析技术(滴定)联用。
- 支持多种不同路径长度的样品容器



NIRS 12.5 mm 2 mm

流通式石英比色皿可用于持续监控例如片剂溶解过程和反应动力学。其耐高压性和专有的防气泡性能使全部测量均十分方便。

由高纯度和均质的石英玻璃制成的窗口可确保在波长为 200 nm - 2500 nm 范围内具有超过 80% 的透射性能。

有不同的层厚可供选购:

0.5 mm 层厚,容积 = 175 µL(**订货号:67401300**)
1 mm 层厚,容积 = 350 µL(**订货号:67401310**)
2 mm 层厚,容积 = 700 µL(**订货号:67401320**)
5 mm 层厚,容积 = 1750 µL(**订货号:67401330**)
10 mm 层厚,容积 = 3500 µL(**订货号:67401340**)

尺寸:高 x 长 x 宽 = 35 mm x 12.5mm x 12.5 mm
窗口高度 = 8.5 -15 mm

和 XDS Rapidliquid Analyzer 的 NIRS 间距支架和 DS2500 Liquid Analyzer 的 DS2500 支架兼容。



OMNIS NIR

适合流通池的 OMNIS NIR Analyzer 的比色皿支架 (6.7401.300; 6.7401.310; 6.7401.320; 6.7401.330; 6.7401.340)。

OMNIS
A WHOLE NEW LEVEL OF PERFORMANCE

OMNIS

允许单机版 OMNIS 软件在一台 WindowsTM 计算机上运行。

特性:

- 该许可证已含有一份 OMNIS 设备许可证。
- 须通过万通许可授权平台进行激活。

OMNIS
A WHOLE NEW LEVEL OF PERFORMANCE

OMNIS Stand-Alone1

1 份仪器许可证,用于针对 OMNIS Stand-Alone 运行另外一台 OMNIS 仪器。

支持以下仪器:

- OMNIS 仪器
- Metrohm USB 设备
- RS-232 仪器(例如:天平)

OMNIS
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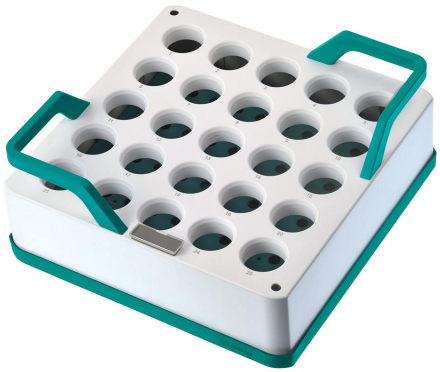
Quant Development

用于在独立 OMNIS Software 安装套件中编写和编辑量化模型的软件许可证。



OMNIS Sample Robot S – WSM (1T/2P)

OMNIS Sample Robot S – WSM 配备 1 个 OMNIS Workstation Module,包括 2 台用于清洁和抽吸传感器及样品容器的泵、1 个工作站、棒式搅拌器以及丰富的全自动滴定直接入门附件。该系统的 2 个样品架提供了容纳 32 只样品杯,每只 120 mL 的位置。这套模块化系统在完整安装状态下提供,因此可以在最短时间内启动。根据要求还可以为系统升级另外 2 台蠕动泵以及另一个工作站,以使吞吐量加倍。如果需要其它工作站,Sample Robot S 可升级为 L 尺寸的 OMNIS Sample Robot,这样可以在最多 4 个工作站上同时加工 7 个样品盘的样品,达到四倍样品吞吐量。



OMNIS 25 x 75 mLPP

OMNIS 样品架,用于 OMNIS Sample Robot Pick&Place,适配 25 个样品杯。以下样品杯均可使用:6.01402.000、6.01402.003、6.1459.400。

塑料:聚丙烯 (PP)



28-48 mm

OMNIS Sample Robot Pick&Place 的抓手夹指,用于抓取外直径 28-48 mm 的样品杯。