



Application Note AN-NIR-092

Quality Control of PVC foils

Easy and robust determination of PVDC layer thickness

PVC (polyvinyl chloride) foils with a PVDC (polyvinylidene chloride) coating are often used for high performance packaging films like pharmaceutical blister packs or in food packaging. In multi-layer blister films, the PVC serves as the thermoformable backbone structure, whereas the PVDC coating acts as a barrier against moisture and oxygen. The Water

Vapor Transmission Rate (WVTR) and Oxygen Transmission Rate (OTR) are influenced by the composition and the thickness of the coating.

A fast way to monitor PVDC coating thickness is with near-infrared spectroscopy. Results are provided **in a few seconds**, indicating when adjustments in the polymer production process are necessary.

EXPERIMENTAL EQUIPMENT

Several 250 μm PVC foils coated with a PVDC layer of varying thickness (40 g/m^2 , 60 g/m^2 , 90 g/m^2) were measured on the DS2500 Solid Analyzer. The measurements were carried out in transfection mode using the NIRS gold diffuse reflector with 1 mm pathlength. This ensures that the spectral pathlength is constant while enhancing the spectral signal. The Metrohm software package Vision Air Complete was used for all data acquisition and prediction model development.



Figure 1. DS2500 Solid Analyzer

Table 1. Hardware and software equipment overview

Equipment	Metrohm number
NIRS DS2500 Solid Analyzer	2.922.0010
Vision Air 2.0 Complete	6.6072.208
NIRS gold diffuse reflector, 1 mm	6.7420.000
NIRS mini sample cup	6.7402.030

RESULT

All 68 measured Vis-NIR spectra (**Figure 2**) were used to create a prediction model for quantification of PVDC layer thickness. The quality of the prediction model was evaluated using correlation diagrams, which display a very

high correlation between Vis-NIR prediction and the reference values. The respective figures of merit (FOM) display the expected precision of a prediction during routine analysis.

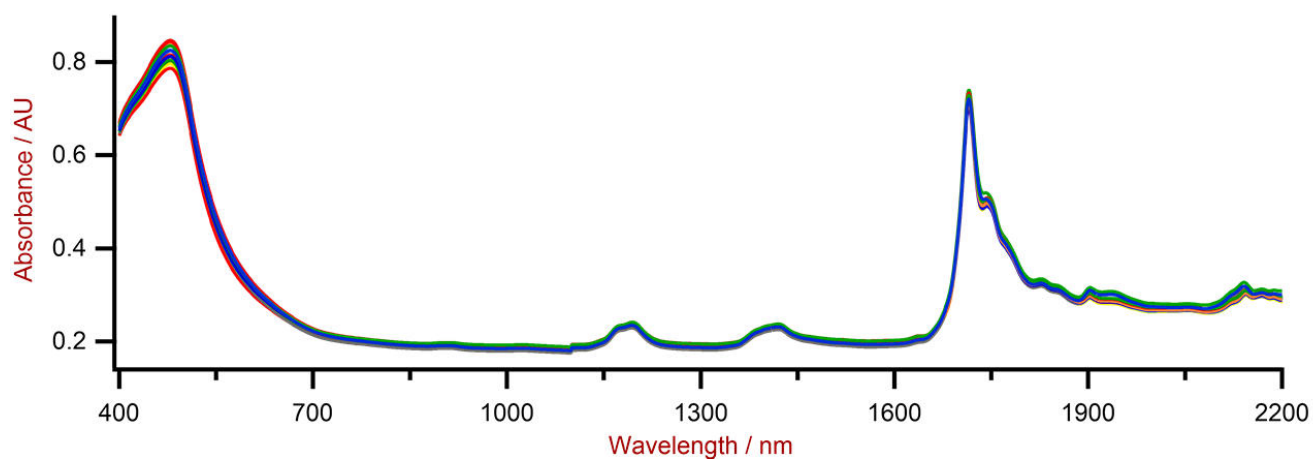


Figure 2. Vis-NIR spectra of PVC foils with different PVDC layer thicknesses measured on a DS2500 Solid Analyzer.

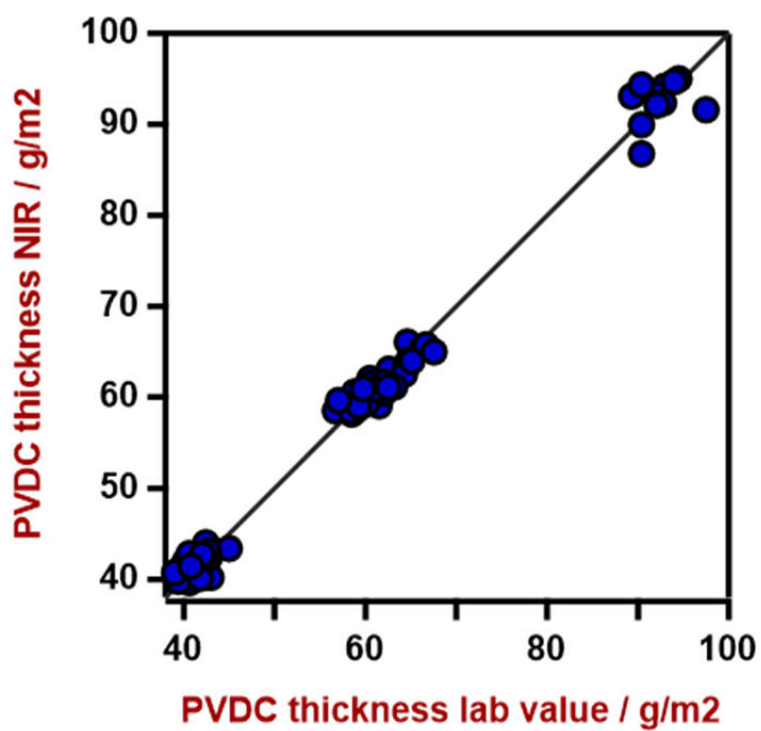


Figure 3. Correlation diagram for the prediction of PVDC layer thickness using a DS2500 Solid Analyzer.

Table 2. Figures of merit for the prediction of PVDC layer thickness using a DS2500 Solid Analyzer.

Figures of merit	Value
R^2	0.992
Standard error of calibration	1.7 g/m ²
Standard error of cross-validation	1.9 g/m ²

CONCLUSION

This application note demonstrates the feasibility of differentiating PVC foils coated with different PVDC layer thickness (40, 60, 90 g/m² PVDC on 250 µm PVC foils). The thickness of the PVDC layer could be successfully determined with NIR spectroscopy with an average

difference with respect to the reference data of 2%. Vis-NIR spectroscopy enables a fast determination without any sample preparation, and therefore represents a suitable method to measure PVDC layer thickness.

CONTACT

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DS2500 Solid Analyzer

坚固结实的近红外光谱仪,用于生产环境和试验室中的质量检查。

DS2500 分析仪是经过验证的灵活解决方案,用于对整个生产链过程中的固体、乳膏和液体进行常规分析。其坚固结实的设计使 DS2500 Analyzer 分析仪不受灰尘、湿度、振动和温度波动的影响,因此非常适用于在恶劣的生产环境中使用。

DS2500 涵盖了从 400 到 2500 nm 的整个光谱范围,并能在不到一分钟时间内提供准确和可再现的结果。

DS2500 Analyzer 满足制药行业的要求,并由于操作简便而能帮助用户完成其日常工作任务。

由于与设备匹配,附件可以承受任何具有挑战性的样品类型,例如:粒料之类的粗颗粒固体或乳膏之类的半固体样品,可获得结果。测量固体的时候,使用 MultiSample Cup 可以提高生产率,可以自动批量测量多 9 个样品。



Vision Air 2.0 Complete

Vision Air – 通用的光谱分析软件。

Vision Air Complete 是用于监管规范环境的先进易用的软件解决方案。

Vision Air 优点一览:

- 便捷的软件应用和经过适配的用户界面保证了直观简单的操作方式
- 操作过程的创建与维护方式简单
- SQL 数据库,可安全且简单地管理数据

Vision Air Complete (66072208) 版本包含所有用于可见近红外光谱分析质量保证过程的应用:

- 仪器和数据管理应用
- 方法开发应用
- 常规分析应用

其它 Vision Air Complete 解决方案:

- 66072207 (Vision Air Network Complete)
- 66072209 (Vision Air Pharma Complete)
- 66072210 (Vision Air Pharma Network Complete)



NIRS 1 mm

对液体进行透射反射测量的金反射器。可与下列设备组合使用:

- NIRS DS2500 Analyzer(订货号:2.922.0010)
- NIRS XDS MasterLab Analyzer(订货号:2.921.1310)
- NIRS XDS MultiVial Analyzer(订货号:2.921.1120)
- NIRS XDS RapidContent Analyzer(订货号:2.921.1110)
- NIRS XDS RapidContent Analyzer - Solids(订货号:2.921.1210)



NIRS 10 100

用于粉末和颗粒反射光谱采集的小号样品容器。该样品容器可用一次性盖封闭,可避免样品损失,并使粉末及颗粒在样品容器中均匀分布。

此样品瓶可与下列仪器一同使用:

- NIRS DS2500 Analyzer(订货号:2.922.0010)
- NIRS XDS MasterLab Analyzer(订货号:2.921.1310)
- NIRS XDS MultiVial Analyzer(订货号:2.921.1120)
- NIRS XDS RapidContent Analyzer(订货号:2.921.1110)
- NIRS XDS RapidContent Analyzer - Solids(订货号:2.921.1210)