



Application Note AN-NIR-083

Quality Control of HDPE, LDPE, and PP

Non-destructive determination of polymers within one minute with NIRS

Identification of individual polymers with FT-IR spectroscopy can be a challenge due to sample inhomogeneity especially when larger sample sizes need to be analyzed.

This application note demonstrates that the DS2500 Solid Analyzer operating in the visible and near infrared spectral region (Vis-NIR) provides a **reliable and fast solution** for the

identification of high-density polyethylene (HDPE), low-density polyethylene (LDPE), and polypropylene (PP). With **no sample preparation or chemicals needed**, Vis-NIR spectroscopy allows the identification of larger inhomogeneous sample amounts in **less than a minute**.

EXPERIMENTAL EQUIPMENT

HDPE, LDPE, and PP pellets were measured in reflection mode with a DS2500 Solid Analyzer over the full wavelength range (400–2500 nm). A rotating DS2500 Large Sample Cup was employed to overcome the distribution of varied particle sizes and chemical components. This allowed automated measurements at different sample locations for a reproducible spectrum acquisition. As displayed in **Figure 1**, samples were measured without any preparation. The Metrohm software package Vision Air Complete was used for all data acquisition and prediction model development.

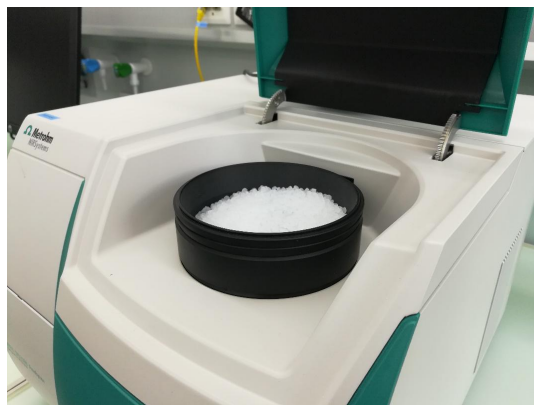


Figure 1. DS2500 Solid Analyzer and PE pellets present in the rotating DS2500 Large Sample Cup.

Table 1. Hardware and software equipment overview

Equipment	Metrohm number
DS2500 Analyzer	2.922.0010
DS2500 Large Sample Cup	6.7402.050
Vision Air 2.0 Complete	6.6072.208

RESULT

A correlation algorithm was applied to the measured Vis-NIR spectra (**Figure 2**) to create a prediction model for the identification of the individual polymer types. The quality of the prediction was evaluated using built-in statistical tools, which display the correlation value

distribution between Vis-NIR prediction and product class (**Figure 3**). The high correlation values of 0.985 and above, together with the fact that no polymer was misidentified, highlight the feasibility of NIR spectroscopy for identification of different polymer types.

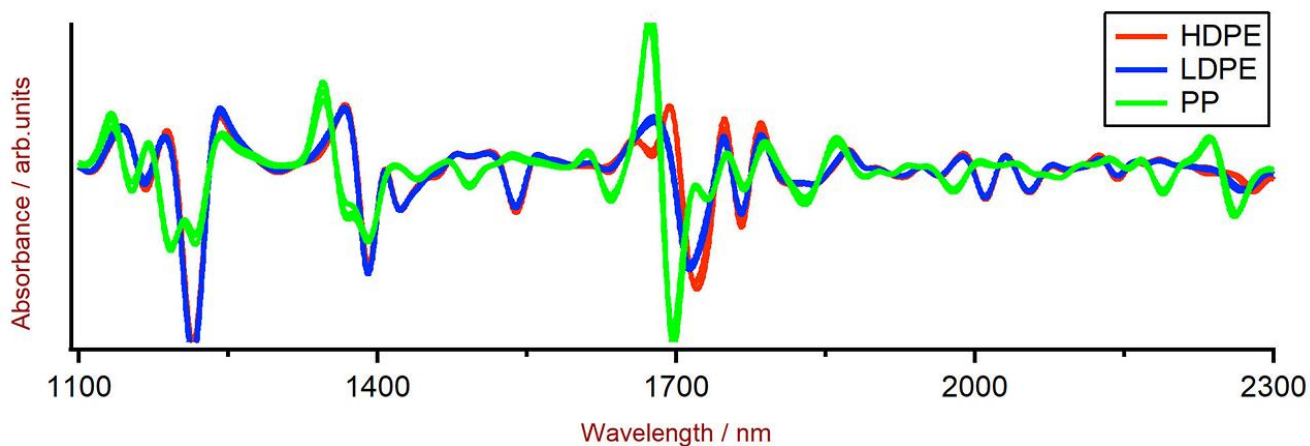


Figure 2. Selection of HDPE, LDPE, and PP NIR spectra (pre-treated with a 2nd derivative) obtained using a DS2500 Analyzer. Clear differences for the different polymer types are visible in the wavelength region around 1700 nm.

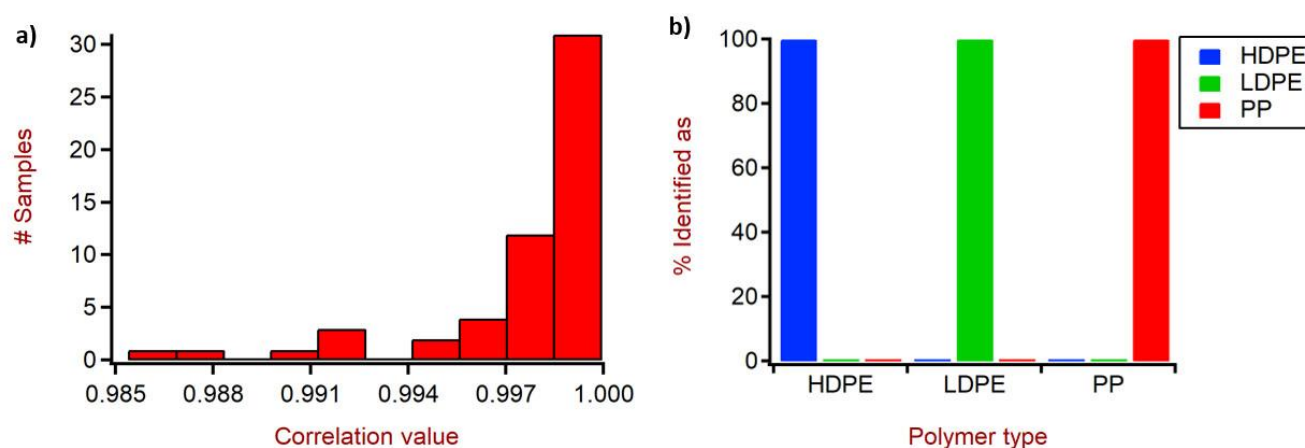


Figure 3. Correlation value histogram for the identification of the individual polymer types. (b) All polymer types in the sample set were identified correctly.

CONCLUSION

This application note demonstrates the feasibility of NIR spectroscopy to identify different types of polymers. In comparison to the FT-IR spectroscopy method, **no sample**

preparation is needed. Further, the rotating sample cup system allows also the **fast analysis** of large inhomogeneous sample sizes.

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DS2500 Solid Analyzer

固耐用的近外光,用于生境和室中的量。

DS2500 分析是的活解决方案,用于整个生程中的固体、乳膏和液体行常分析。其固耐用的使 DS2500 Analyzer 分析不受灰、湿度、振和温度波的影,因此非常用于在劣的生境中使用。

DS2500 涵盖了从 400 到 2500 nm 的整个光范,并能在不到一分内提供准和可再的果。DS2500 Analyzer 足制行的要求,并由于操作便而能助用完成其日常工作任。

由于与完美匹配,附件可以承受任何具有挑性的品型,例如:粒料之的粗粒固体或乳膏之的半固体品,可得最佳果。量固体的候,使用 MultiSample Cup 可以提高生率,可以自批量最多 9 个品。



DS2500

用于在不同品位置使用 NIRS DS2500 Analyzer 采集粉末和粒反射光的大号品容器。



Vision Air 2.0 Complete

Vision Air – 通用的光分析件。

Vision Air Complete 是用于管范境的先易用的件解决方案。

Vision Air 点一:

- 独特的件用和配的用界面保了直的操作方式
- 操作程的建与方式
- SQL 数据,可安全且地管理数据

Vision Air Complete (66072208) 版本包含所有用于可近外光分析量保程的用:

- 器和数据管理用
- 方法用
- 常分析用

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)