



Application Note AN-NIR-098

PVC 粒料的量控制

Determine molecular weight easily within seconds

PVC (polyvinyl chloride) has unique properties when compared to other olefin-derived plastics that only contain carbon and hydrogen atoms in their chemical structure. Some PVC features include increased chemical and mechanical stability as well as fire retardant properties. The molecular weight of the polymer has a significant influence on these properties. Molecular weight is defined here as the average weight of the molecules that make up a polymer, and this value gives an indication of the length of the polymer chains. To monitor the

PVC quality, it is important to measure the molecular weight during the production process. The standard method to determine PVC molecular weight is by size exclusion chromatography (SEC). This analytical method is time-intensive and requires trained personnel to perform.

Determining the molecular weight of PVC is easier with near-infrared spectroscopy (NIRS). NIRS provides results in **just a few seconds** and can quickly indicate when adjustments to the production process are necessary.

EXPERIMENTAL EQUIPMENT

33 PVC samples with varying molecular weights from 113000–192000 g/mol were measured on the DS2500 Solid Analyzer. 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 large sample cup	6.7402.050

All 33 measured Vis-NIR spectra (**Figure 2**) were used to create a prediction model for quantification of molecular weight. The quality of the prediction model was evaluated using the cross-validation algorithm which displays a very high correlation

between Vis-NIR prediction and the reference values. The respective figures of merit (FOM) display the expected precision of a NIRS prediction during routine analysis (**Table 2**).

RESULT

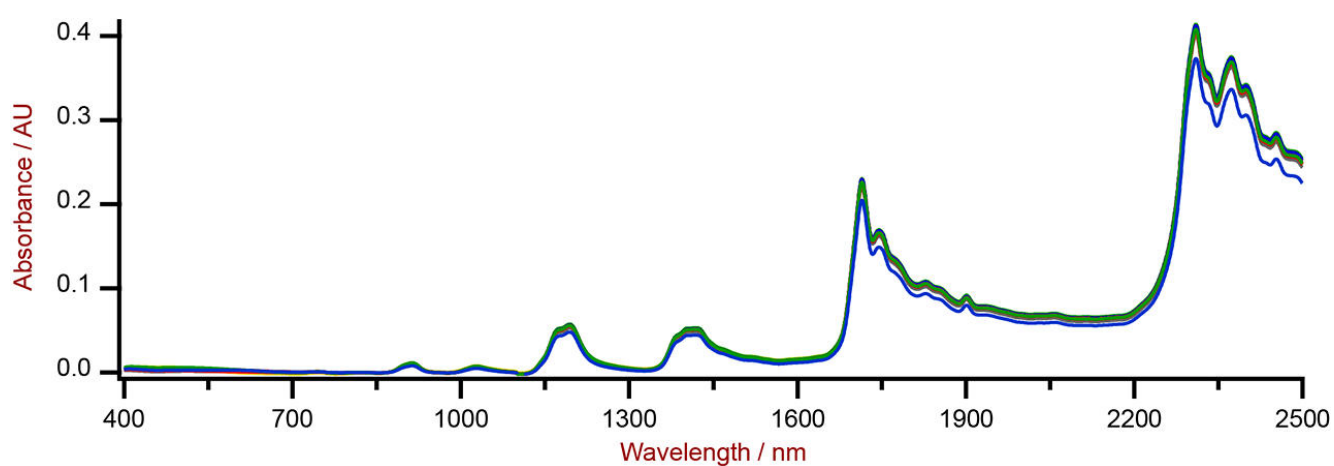


Figure 2. Vis-NIR spectra of PVC granulate samples with different molecular weights measured on a DS2500 Solid Analyzer.

RESULT

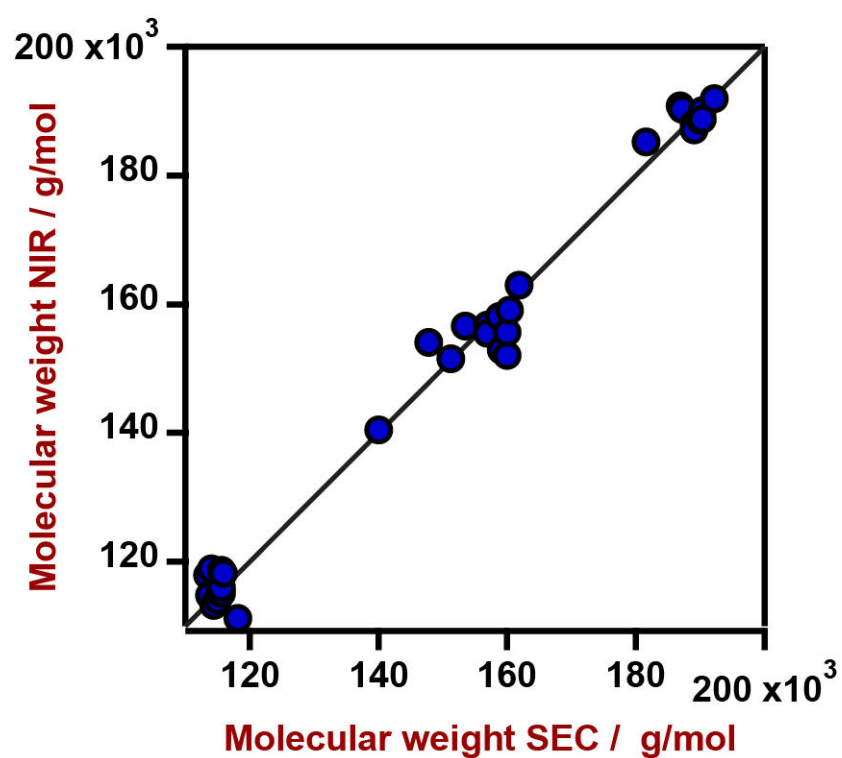


Figure 3. Correlation diagram for the prediction of PVC molecular weight using a DS2500 Solid Analyzer.

Table 2. Figures of merit for the prediction of the molecular weight of PVC granulate samples using a DS2500 Solid Analyzer.

Figures of merit	Value
R^2	0.988
Standard error of calibration	3640 g/mol
Standard error of cross-validation	5375 g/mol

CONCLUSION

This application note demonstrates the feasibility to determine the molecular weight in PVC granulate samples with NIR spectroscopy. The PVC molecular weight was successfully determined with NIRS only differing from the reference data with an average of

1.5%. Vis-NIR spectroscopy enables a fast determination with no sample preparation and has proven itself as a suitable method to measure PVC molecular weight.

CONTACT

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DS2500 Solid Analyzer

固的近外光,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,可得果。量固体的候,使用 MultiSample Cup 可以提高生率,可以自批批量多 9 个品。



Vision Air 2.0 Complete

Vision Air –

Vision Air Complete

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Vision Air Complete (66072208) :

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Vision Air Complete :

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



DS2500

NIRS DS2500 Analyzer