P-003: Development of an NIR method for the determination of essential oil in fresh sage leaves

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Today, near infrared spectroscopy (NIRS) is a widely accepted and implemented technology for fast and nondestructive plant and food analysis even allowing direct in-process application.

Various methods are described for qualitative estimations as well as quantification of essential content and composition in different plant organs (leaves, seeds, roots, flowers…). All these methods have in common the application on died material (drugs).

But especially for breeding, cultivation and processing analytical methods on fresh material are demanded allowing earlier and better growing control and optimization of farm management.

Routinely, gas chromatography is performed on essential oil (EO) obtained by hydro-distillation of the plant material.

This method efforts harvesting of plant material followed by energy intensive distillation and expensive, laborious chromatography. Besides destruction of the plant material, quality of the plants in the field may change drastically in the meantime. Hence, the informative value of GC data for assessing permanently changing field material looses with increasing time spent for analysis.

A recent publication describes quantification of EO in dried sage leaves by attenuated total reflectance infrared spectroscopy (ATR-IR) [1]. Again, the presented prediction models also require time for drying in which the field system may change again.

To improve the productivity and quality of EO in the plant during vegetation period for e.g. defining an optimal period for harvest, NIRS offers an elegant solution for fresh plant analysis. Exemplarily, a robust and fast method applied on fresh sage (*Salvia officinalis* L.) leaves for prediction of the final EO quality in the related drug material (for which quality standards are defined by different Pharmacopoeias) is presented.

Therefore, information about the water content in the fresh material is indispensible since it varies over season, plant development and even day time.

To consider moisture variation in fresh leaves for EO quantification, in a first step a NIRS prediction model for the water content was developed based on Karl-Fischer (KF) titration reference values. In the second step, a new sample set of fresh sage leaves was investigated by NIRS followed by extraction and GC analysis.

Based on the NIRS measurement now the moisture could be predicted based on the model developed in the first step. With that knowledge, the GC data could be referred to the dry matter content of the fresh leaves allowing comparison to related drug material. Figure 1 gives a working scheme about the strategy of analysis in fresh sage leaves for EO quantification referred to the dry drug.

A dataset of 50 fresh sage leaves has been used for development of prediction models for EO content (R2=0.873; RMSECV=0.278 ml/100 g) using the NIRS moisture correction for fresh sage leaves (R2=0.977, RMSEP=4.95%.).

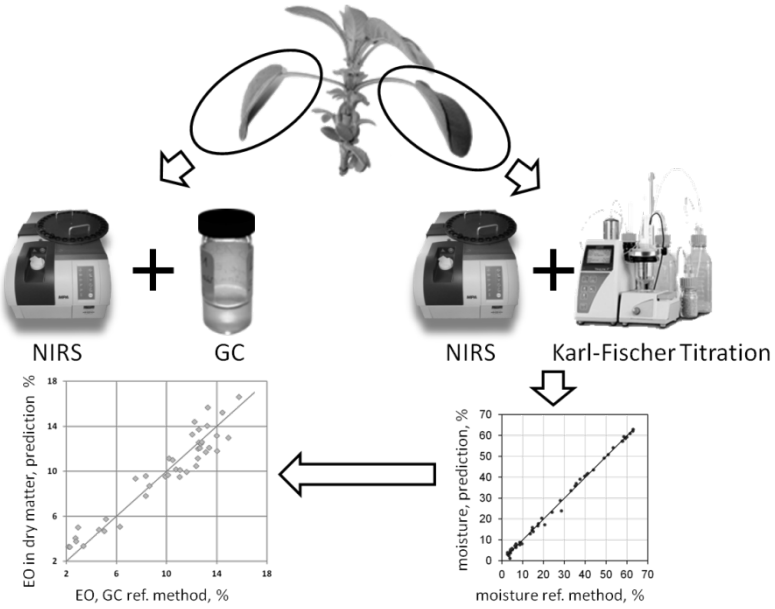

Figure 1: EO quantification in fresh sage leaves for quality estimation of related dry drug.

References

[1] GUDI, G., KRÄHMER, A., KRÜGER, H., and H. SCHULZ, 2015: J. Agric. Food Chem., **63**, pp 8743–8750. DOI: 10.1021/acs.jafc.5b03852