

Application Note AN-NIR-101

Quality control of dried cannabis

Chemical-free potency testing within one minute with NIRS

Cannabis has a long history as a recreational drug and medically as an analgesic and antispasmodic agent. Discovery of the major cannabinoids tetrahydrocannabinol, cannabidiol, and cannabigerol (THC, CBD, and CBG) has resulted in increased interest in their medical effects. While THC is psychoactive and classified as an illicit drug of abuse in most countries, CBD has a legally accepted status in many parts of the world for medicinal purposes. CBD is believed to relieve anxiety and stress and to promote better sleep. Because of the different effects and possible legal consequences, determining the cannabinoid profile of cannabis is of high interest.

Typically, cannabis potency testing is performed by HPLC analysis. While HPLC can detect low concentrations of less abundant cannabinoids, it requires chemical reagents and it is quite time-consuming. This Application Note explains why near-infrared spectroscopy (NIRS) is a superior method for the quantification of THC, CBD, and CBG in dried cannabis because it provides results in less than a minute and does not require any chemicals.

EXPERIMENTAL EQUIPMENT

A total of 702 dried cannabis samples with varying THC, CBD, and CBG concentrations were used for this study. The Vis-NIR spectra were acquired on a Metrohm DS2500 Solid Analyzer (Figure 1) equipped with the DS2500 Holder. A 400 mg portion of each sample was ground by hand using a grinder, then placed in a NIRS mini sample cup. Afterward, a 4 mm total pathlength diffuse gold reflector was positioned on top of the prepared cannabis sample. Data collection and model development were carried out with the Vision Air Complete software package.



Figure 1. Metrohm DS2500 Solid Analyzer with a NIRS transflection vessel shown instead of a mini sample cup.

Table 1. Hardware and software equipment overview

Equipment	Metrohm number
DS2500 Solid Analyzer	2.922.0010
DS2500 Holder	6.7430.040
Mini sample cups, 10 pcs incl. 100 disposable backs	6.7402.030
NIRS gold diffuse reflector, 4 mm total pathlength	6.7420.020
Vision Air 2.0 Complete	6.6072.208

RESULTS

The obtained Vis-NIR spectra (Figure 2) were used to create prediction models for THC, CBD, and CBG content in dried cannabis. To verify the quality of the prediction models, correlation diagrams were created which display a correlation value (R^2) between the Vis-NIR prediction and primary method (HPLC) values. The respective figures of merit (FOM) display the expected precision of a prediction during routine analysis (Figures 3–5).

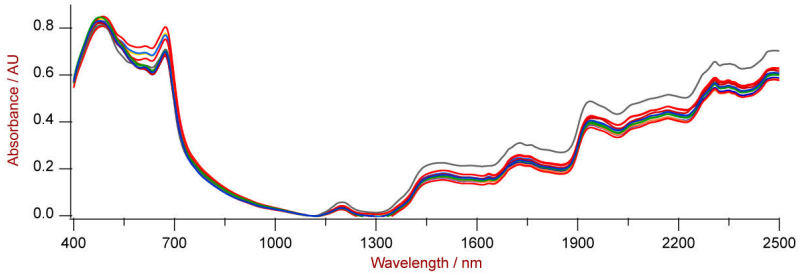


Figure 2. Selection of Vis-NIR spectra of different cannabis samples measured with a Metrohm DS2500 Solid Analyzer.

Result THC

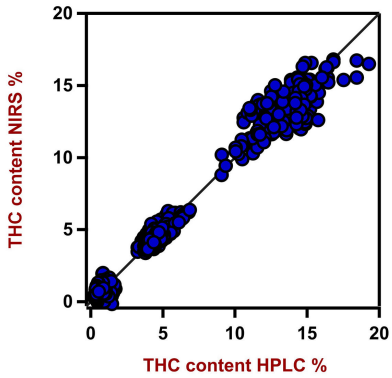


Figure 3. Correlation diagram and the respective figures of merit for the prediction of the THC content in dried cannabis using a DS2500 Solid Analyzer.

Result CBD

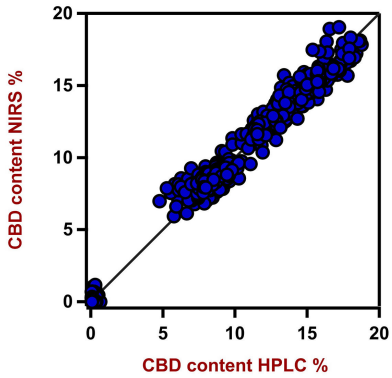


Figure 4. Correlation diagram and the respective figures of merit for the prediction of the CBD content in dried cannabis using a DS2500 Solid Analyzer.

Result CBG

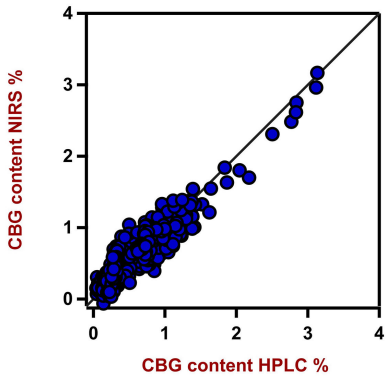


Figure 5. Correlation diagram and the respective figures of merit for the prediction of the CBG content in dried cannabis using a DS2500 Solid Analyzer.

CONCLUSION

This Application Note presents a Vis-NIR method that is excellently suited for the fast quantification of the three main cannabinoids in cannabis (i.e., THC, CBD, and CBG). Compared to the standard HPLC method (Table 2), cannabis analysis with near-infrared spectroscopy saves up to 30 minutes of time per analysis. Additionally, NIRS requires no chemical reagents and is a non-destructive analytical technique.

Table 2. Time to result with conventional HPLC method.

Parameter	Method	Time to result
THC, CBD, CBG	HPLC	10 min (preparation) + 20 min (HPLC)

CONTACT

Metrohm Central Africa
2 Almond Street, Accra,
Ghana
0000 Accra
info@metrohm.com.gh



DS2500 Solid Analyzer

Robust near-infrared spectroscopy for quality control, not only in laboratories but also in production environments.

The DS2500 Analyzer is the tried and tested, flexible solution for routine analysis of solids, creams, and optionally also liquids along the entire production chain. Its robust design makes the DS2500 Analyzer resistant to dust, moisture, vibrations, and temperature fluctuations, which means that it is eminently suited for use in harsh production environments.

The DS2500 covers the full spectral range from 400 to 2500 nm and delivers accurate, reproducible results in less than one minute. The DS2500 Analyzer meets the demands of the pharmaceutical industry and supports users in their day-to-day routine tasks thanks to its simple operation.

Thanks to accessories tailored perfectly to the instrument, optimum results are achieved with every sample type, no matter how challenging it is, e.g. coarse-grained solids such as granulates or semi-solid samples such as creams. The MultiSample Cup can help improve productivity when measuring solids, as it enables automated measurements of series containing up to 9 samples.



DS2500 Holder

Holder for use with:

- Small sample vessels (**6.7402.030**)
- DS2500 Iris (**6.7425.100**)



NIRS mini sample cups, 10 pcs. including 100 disposable backs

Mini sample cup for the spectral recording of powders and granulates in reflection. The sample cup can be sealed with disposable backs in order to avoid sample loss and for the uniform distribution of the powder or granulate in the sample cup.

The sample cups are used with the following instruments:

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



NIRS gold diffuse reflector, 4 mm total pathlength

Gold diffuse reflector for the transflection measurement of liquids. Can be used in combination with the following instruments:

NIRS DS2500 Analyzer (order number: 2.922.0010)
NIRS XDS MasterLab Analyzer (order number: 2.921.1310)
NIRS XDS MultiVial Analyzer (order number: 2.921.1120)
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