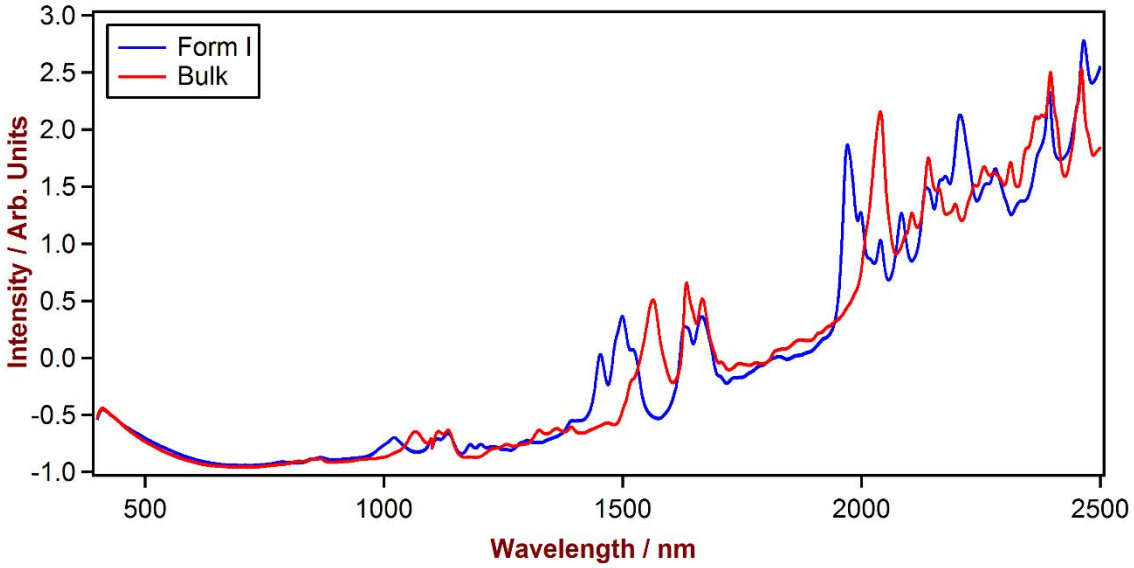
NIR Application Note NIR–37

Differentiation of polymorphs using near infrared spectroscopy (NIRS)



This Application Note shows that near-infrared spectroscopy (NIRS) differentiates between the sulfathiazole polymorphs form I and commercial sulfathiazole using the first overtones of the N-H stretching vibrations. Because form I is the least stable polymorph of the antibiotic sulfathiazole, crystallization monitoring and final product control are very important. NIR spectroscopy allows a faster differentiation than conventional lab methods.

Metrohm
NIRSystems

Method description

Introduction

Sulfathiazole is a sulfonamide antibiotic agent and is able to crystallize as various polymorphs.
Polymorphs are crystals that differ in their repeating pattern or crystal lattices. The bioavailability of crystalline actives can depend heavily on the crystallinity. Therefore, pharmaceutical industries have to meet regulatory requirements. A fast identification of polymorphs in terms of incoming goods inspection, such as in end products and under storage is very important. Analyses are routinely performed to insure that samples meet specified release parameters. For process development, such analyses are also necessary for the determination, under which circumstances recrystallization to other forms occur. Traditionally, X-ray diffraction (XRD) is used for the identification of the lattice structure. Near infrared spectroscopy (NIRS) can be used likewise as a secondary method. The differentiation between bulk material and different polymorphs via NIRS is a fast alternative to conventional lab methods.

Experimental

From commercial sulfathiazole, sulfathiazole form I was synthesized. The NIR instrument used in the study was Metrohm NIRS DS2500 Analyzer which was operated in stationary diffuse reflectance mode (Fig. 1). The samples were filled in disposable glass vials. The vials were centered on the sampling window using the NIRS DS2500 Iris (Tab. 1). Absorbance spectra were obtained using 32 co-added scans.

Tab. 1: Used equipment for this application.

Equipment	Metrohm code
NIRS DS2500 Analyzer	2.922.0010
NIRS Mini Sample Cup Holder for DS2500	6.7430.040
NIRS DS2500 Iris	6.7425.100
NIRS XDS SmartProbe Analyzer (2m Fiber)	2.9211.610
Probe Assy, interchangeable	6.7430.080
Vision Pharma 4.1	6.6069.413

In Vision (Metrohm chemometric software), using the algorithm of Correlation in Wavelength Space with a threshold of 0.9, a library for the named substances was developed. The data were pretreated using Standard Normal Variate (SNV) as to reduce scatter effects. The wavelength range of biggest spectral differences was used (Fig. 2). Internal cross-validation was applied to verify the performance of the derived library.

Fig. 1: The NIRS DS2500 Analyzer was used with the Mini Sample Cup Holder and the NIRS DS2500 Iris in diffuse reflection mode over the full wavelength range (400 – 2500 nm).

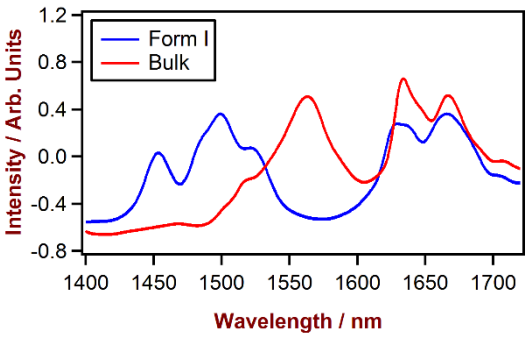


Fig. 2: Standard Normal Variate (SNV) was applied on the raw spectra. The wavelength region of the first overtones for the N-H stretching vibrations (1400–1720 nm) is displayed, where sulfathiazole form I shows the biggest differences from the commercial product.

The developed identification method was successfully applied on a NIRS XDS SmartProbe with ReflectionProbe (Fig. 3).

Fig. 3: The NIRS XDS SmartProbe Analyzer was used for raw material identification, such as for the identification of the final product.

Conclusion

NIR spectra of commercial sulfathiazole and form I can be used in material identification.