

Uses of near infrared spectroscopy

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Near-infrared spectroscopy, known as NIR spectroscopy or NIRS, is a long-established analytical technique. For over 30 years, it has proven to be a fast and reliable method for measuring chemical and physical properties in solids and liquids.

This article introduces how NIR spectroscopy works alongside a presentation of the technique's advantages and versatility.

NIR spectroscopy analyzes how light and matter interact, generating a spectrum. Generally, light is described by wavelength rather than applied energy when spectroscopic methods are applied.

NIR spectroscopy functions in the wavelength range of 780 to 2500 nm, which is the near-infrared region of the electromagnetic spectrum. Simply put, a NIR spectrometer measures how much light is absorbed at various wavelengths in the NIR region.

It should be noted that near-infrared and mid-infrared are two different wavelength ranges.

NIRS is a secondary technique, meaning a prediction model is required before performing the technique. This is comparable with HPLC. To detect or quantify a substance using HPLC, standard solutions of the substance should be prepared and measured to create a calibration curve.

Similarly, with NIRS, a number of spectra with known concentrations or known parameter values that were acquired using a primary method, such as titration, must be measured. From this spectra, a prediction model is created using chemometric software (e.g., the Metrohm Vision software).

Once the prediction model has been generated, routine analysis of unknown samples can be initiated.

There are a number of functional groups, including -CH, -NH, -OH, and -SH to which NIR spectroscopy is particularly sensitive. Therefore, first quantifying the sample's chemical parameters, such as water content (moisture), hydroxyl value, acid number, and amine content, to name a few, is an ideal approach.

The interaction between light and matter depends upon the matrix of the sample itself, facilitating the identification of physical and rheological parameters, including density, intrinsic viscosity, melt flow rate, and particle sizing.

To understand the advantages of NIR technology, understanding how NIR spectra is measured is key. NIR spectroscopy facilitates the analysis of a wide variety of different samples. Accordingly, the sample type determines what instrument will need to be used.

There are a number of measurement methods available for the different sample types, ranging from clear liquids to opaque pastes and powders. Knowing which measurement method, sampling module, and what accessories to use is essential when developing effective NIR methods. 

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