

What is NIR

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NIR is an acronym for Near InfraRed spectroscopy, and it refers to the analytical technique of using near-infrared radiation to analyze samples for compositional or characteristic traits. NIR has also been used to describe Near-Infrared Reflectance. Other similar terms include NIRS (Near Infrared Spectroscopy) and NIT (Near Infrared Transmission spectroscopy). All of these techniques are related and rely on near-infrared light being used to characterize materials.

How does NIR Work?

NIR is a region of the electromagnetic spectrum that has unique properties which make it very useful for characterizing materials. The NIR region is from 700 to 2500 nm. This area of the electromagnetic spectrum has the best combination of attributes for the analysis of most solid, slurry and liquid samples.

Light in this region interacts with OH, NH and CH bonds and certain wavelengths (frequencies) are associated with each bond type. When NIR light is presented to samples high in chemical compounds containing these bonds, some of energy is absorbed by the sample in these specific wavelengths, and thus the reflected light has less intensity in these regions. The differences in the reflected signal (spectrum) can be correlated to chemical concentration differences, and this forms the basis of an NIR calibration. Once this calibration is established, it can be used to predict the chemical concentration of unknown samples.

As an example, proteins are characterized by the presence of NH bonds found in the individual amino acids. The NH bonds absorb NIR radiation in multiple regions across the NIR spectrum at various levels. The more protein in the sample, the more energy that is absorbed in these region and the reflected energy has less intensity in this region.

Benefits

NIR has become a popular and widespread analytical technique for the analysis of

food, agricultural, pharmaceutical and chemical products. NIR analyzers have the following benefits:

- Easy to use – normal operation consists of loading a sample cell and starting the instrument.
- Little sample preparation – most samples can be analyzed as-is or with simple grinding or particle size reduction.
- No hazardous chemical waste – no chemicals are used at all.
- Fast analysis – typical analysis times are 10 seconds – 2 minutes.
- Simultaneous results for multiple parameters – multiple constituent are predicted with one sample analysis.
- Reliable results – for most analyses, NIR instruments have a prediction accuracy within 1.5 times of the reference method error with much better precision.
- Cost effective – one analyst can typically analyze several hundred samples in a day with no consumable costs.