

NIR measurements with a fiber-optic probe

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When several near-infrared instruments are used in a network and a common chemometric model is applied for spectra processing, the instruments comparison is indispensable. Direct transferability often claimed by the producers should be treated with caution. It has been found experimentally that when measurements are performed with the help of a fiber-optic probe, the main source of spectra discrepancy is probes' sensitivity to contactless measurements. Here the influence of the probe-to-object distance on the acquired spectra is analyzed in detail. Special experimental set-ups are proposed to isolate various strongly influencing factors and to maintain stable measurement conditions. The application of an artificial standard instead of real-world objects helps to focus on the instrument/accessory characteristics.

It has been shown that a substantial impact on spectra quality is caused by the gap between the probe tip and the object. Spectra distortions include signal attenuation, low frequency effect, such as nonlinear baseline shift, and high frequency noise, mostly noticeable in the range where absorption is low. In some cases even a loss of peaks is observed (when object and reference have low intensity). Such spectra discrepancy is hardly compensated by common spectroscopic preprocessing methods. The performance of just two FT-NIR spectrometers equipped with fiber probes was analyzed in detail. However the experiments conducted with six other instruments from NIR network have revealed similar problems. Hence, the detected FPs differences are not attributable to the specific properties of the two tested probes. The problem is of a general nature.

As a rule, the producers of modern FT-NIR instruments claim high compatibility of the instruments of the same product line. However, the general instrument consistency does not guarantee the accessories' compatibility in various experimental set-ups. This issue should be taken into account when several FT-NIR spectrometers are consolidated in one network.

References

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