SPECTRAL ENGINES

APPLICATION NOTE

PORTABLE DEVICES

Portable NIR sensors enable fast and accurate material detection in safety and security applications.

Background

Infrared spectroscopic measurements are used for material identification in safety and security applications, but are still used mainly in laboratories. Portability and connectivity would help officials and other inspectors to use powerful Near-Infrared (NIR) also in many field applications. NIR is a fast and accurate method that does not require any sample preparation.

There are several portable spectrometers already on the market. The main challenges with these devices relate to their still rather large size, which makes them cumbersome to use or carry as out-of-lab applications, but also their price, which limits their use to specific cases. Spectral Engines has overcome these challenges by developing a lightweight, wireless, portable NIR device platform that combines powerful NIR spectroscopy and advanced cloud-computing techniques to increase the performance and quality of the measurements. The price point of this device is remarkably lower than existing state-of-art portable spectrometers. This makes it a very attractive option for field measurement applications, such as the drug screening of unknown street samples, counterfeit inspection, and explosives detection.

Near-Infrared (NIR) spectroscopy is proven technology for the identification of unknown materials. Most laboratory techniques are slow and they require expensive instruments and also highly educated laboratory personnel. NIR is a practical option for when a similar analysis needs to be carried out in the field. NIR offers a cost-efficient but accurate and reliable method to analyze many samples in a short time frame and without any sample preparation. These are important features when an analysis should be done out-of-lab. The added value is created by the attractive price point of the instrument, which is only a small fraction of instruments widely used in central laboratories.

Spectral Engines' technology offering

Spectral Engines technology platform is based on MEMS-fabricated FPI sensors. The MEMS fabrication decreases the price point of sensors dramatically and reduces the size of devices. Though the size of the instrument is small, the performance, by way of sensitivity, is adequately comparable to laboratory instrument performance. One valuable benefit of our technology is also its connectivity. Portable sensors can be connected to the cloud and to advanced machine-learning algorithms for identifications that can be run from the cloud. This makes it easy to update the spectral signature libraries with new materials later but also it offers possibility to cost-efficiently test new computing algorithms based on the data of hundreds or even thousands of sensors.

Spectral Engines wireless portable NIR analyzer is very well suited to field inspection applications.

- Fast and reliable detection of counterfeits, illegal drugs, and explosives
- Rapid, non-destructive measurement, without a need for sample preparation
- Affordable
- Connectivity and portability
- Easy-to-upgrade libraries via cloud-based tools

USE CASE

Counterfeit detection using a portable NIR sensor

Counterfeits are a huge problem, specifically in the pharmaceutical and food industries. This is a serious global problem for which better and more efficient tools should be developed. It has been reported that 10–30% of pharmaceutical products are counterfeits. Counterfeits are estimated to cost legitimate businesses USD 200–350 billion per year and it is difficult to fight against such a vast counterfeit market without having rapid screening devices. Based on some reports, from 30–50% of these counterfeits include no active ingredient at all. Consequently, the detection limit of sensors does not need to be very high to find most counterfeits easily.

NIR technology has been reported many times in scientific publications as being a suitable technology for the reliable and accurate detection of fake medicines. Their portability and connectivity combined with an affordable price point expand the opportunities of wireless NIR technology in out-of-lab applications for counterfeit inspection.

USE CASE

Fast narcotics screening of street samples by police officers

Illegal narcotics pose an ever-rising global problem. It is estimated that 1 in 20 adults, or a quarter of a billion people aged 15–64 years, used at least one drug in 2014. Current funds and resources are insufficient to manage the reduction of both demand and supply and therefore new, more efficient methods are needed. Illegal narcotics are a huge global problem. In 2005, the global illicit drug trade was worth $13 billion at production level, $94 billion at wholesale level, and $332 billion at retail level.

Current portable hand-held analyzers cost EUR 20-40 000, which are deployed for analyzing illegal narcotics. Spectral Engines' MEMS-spectral sensor technology enables this to be done at a fraction of the existing cost. Affordable sensors combined with 'big data' management and next generation machine learning algorithms will be game changers in the development of intelligent sensing applications for the narcotics screening market. The benefit of Spectral Engines' solution is that it is non-destructive and non-contact. It is ideal for the rapid screening of drugs in field conditions, with minimal technical expertise required.

Conclusion

Spectral Engines' portable sensors offer small, robust and fast measurement technology for field measurements. Technology is based on the so-called true NIR region (1350-2450 nm), which gives very high accuracy and reliability in analyses. Safety and security applications require a convenient way to update spectral libraries following the emergence of dangerous or illegal new substances. This is possible using cloud-based data management tools for the maintenance of sensors, coupled with a user-friendly platform for updating on new substances whenever needed.

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