SPECTRAL ENGINES

APPLICATION NOTE

PORTABLE DEVICES

Fast and accurate material detection in safety and security applications

Background

Near-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) spectroscopy also in many field applications. NIR spectroscopy 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 size and price. Large analyzers are cumbersome to use or carry in the field and high price limits their use in specific cases. Spectral Engines has overcome these challenges by developing the NIRONE™ Scanner that combines powerful NIR spectroscopy and advanced machine learning algorithms. It is the world's smartest, fastest and easiest way to create your unique material sensing solution. This makes it a very useful option for field measurement applications, such as drug screening of unknown street samples, counterfeit inspection and explosives detection.

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 spectroscopy is a practical option when a similar analysis needs to be carried out in the field. It offers a cost-efficient, accurate and reliable method to analyze many samples in a short time 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 price point of the device which is only a small fraction of the cost of instruments widely used in central laboratories.

Spectral Engines' solutions

Spectral Engines technology is based on a MEMS Fabry-Perot interferometer. The MEMS fabrication decreases the price point of the sensors dramatically and reduces the size of devices. Even though the devices are small, their performance is comparable to laboratory instruments.

Portable material scanners can be connected to the cloud and advanced algorithms for identifications can be run from the cloud. This makes it easy to update the spectral signature libraries with new materials and cost-efficiently test new algorithms based on the data of hundreds or even thousands of sensors.

The key benefits of Spectral Engines' solutions are:

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

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.

Spectral Engines' own portable narcotics scanner TactiScan is a highly accurate unit bringing new levels of safety and efficiency to police fieldwork. It is the world's first portable drug screening device, designed to detect illicit narcotics onsite with no officer exposure.

USE CASE

Counterfeit detection using a portable material scanner

Counterfeits are a huge problem, specifically in the pharmaceutical and food industries. This is a serious global problem and for that reason 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 does not need to be very high to find most counterfeits easily with sensors.

NIR spectrocopy 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 NIR spectroscopy in out-of-lab applications for counterfeit inspection.

Conclusion

Spectral Engines' technology makes it possible to develop compact, robust and fast portable scanners for field measurements. Technology is based on the so-called true NIR region (1350-2150 nm), which means better sensitivity and specificity in material sensing applications. Cloud-based data management tools coupled with a user-friendly platform offer a convenient way to update the spectral libraries of safety and security applications whenever needed as new substances emerge.

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