Raman Spectroscopy Measurement of Pharmaceutical Active Ingredients and Excipients.

Raman spectroscopy is quickly gaining renown as an extremely useful technique for chemical analysis. Raman analysis is nondestructive, requires very limited sample preparation, and allows for sample volumes in the micro liter range. In fact, Raman techniques can be used to acquire data through vial walls, pill pack windows and bags -- packaging forms that are frequently used in the biomedical and pharmaceutical industries.

Ocean Optics offer different Raman Spectroscopy options for their customers. Our approach to this market is based on OOI sales philosophy of applications customization sales and service. Some of the available Raman analysis options include Ocean Optics spectrometer based systems (modular) using the QE65000 as the detector platform with accessories (lasers and probes) provided by partner companies. Turnkey Raman Systems which uses OOI spectrometers as their detection devices provide the next option. These ready to use systems offer different resolution, sensitivity and laser wavelength options, including a low-resolution hand held device and desktop units. The main advantage of these instruments is their software, which better focuses on applications and includes the capability of creating and maintaining a spectral library.

A typical **application for the pharmaceutical** market illustrates the capability of discerning pharmaceutical raw materials such as active ingredients, binders, fillers, lubricants and other excipients commonly used by this industry.

To illustrate the capabilities of our systems we analyzed the following pharmaceutical active ingredients (Paracetamol and Carbamazepine) as well as two commonly used excipients (alpha and beta Lactose).

The samples studied consisted of simple organic compounds including excipients and active pharmaceutical ingredients. They were contained in standard, clear borosilicate scintillation vials with no additional preparation applied. Most samples were purchased from Sigma-Aldrich or were obtained from a major pharmaceutical company.

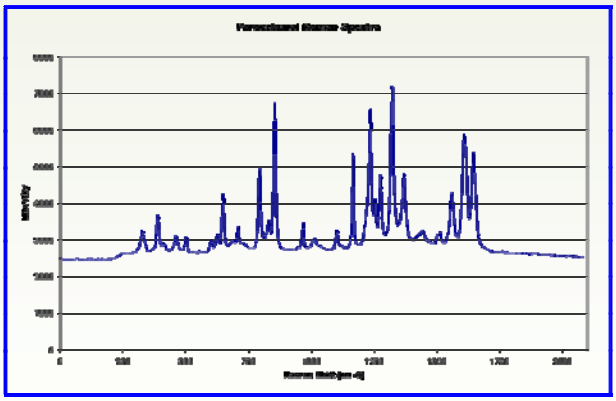
The samples were analyzed using an Ocean Optics **QE65000** Raman configured spectrometer (with a 50 um slit, grating # H6 starting at 780 nm and SAG mirrors); a 785 nm laser with 500 mW output and a fiber optic probe specifically designed to work at the laser wavelength for this experiment. In order to take the measurements we placed the

tip of the probe at the bottom of the glass vials containing the samples. We measured the samples using an integration time of 8 seconds and averaging three readings.

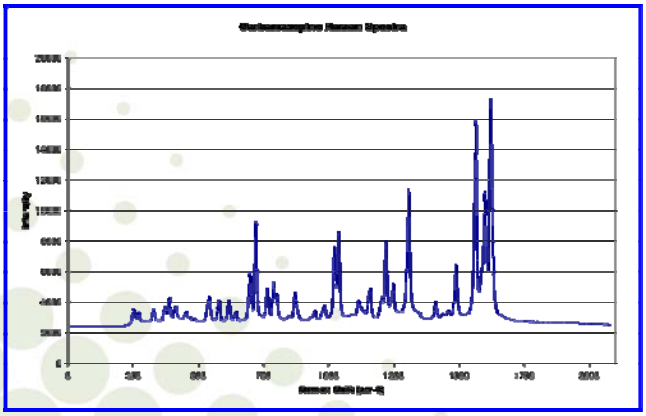
The above picture illustrates the overall modular set-up, including the QE65000 spectrometer (black) a 785 nm laser (white) and the fiber optic Raman probe.

Results

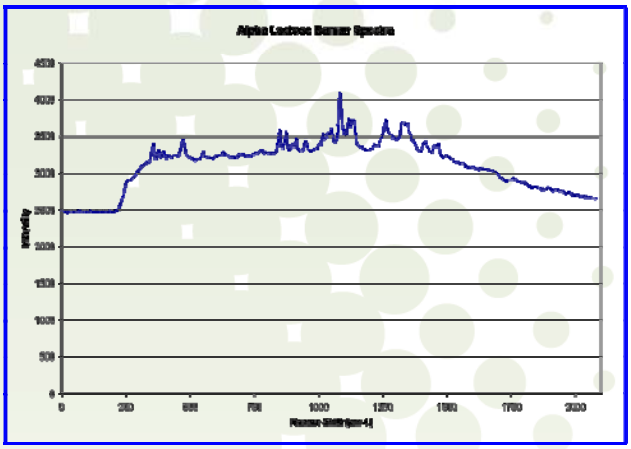
The results of the Raman measurements of the four samples are illustrated in the following graphs:



Paracetamol Spectra



Carbamazepine Spectra



α-Lactose Spectra

Conclusions

The obtained data shows that the used instrumental set-up can detect the sample's main Raman features although there is Fluorescence showing in the Lactose samples. Fluorescence is a common phenomenon in Raman measurements of some organic compounds and depends on the wavelength of the utilized laser.

This simple study shows that the utilized Raman configuration for this application can differentiate the different raw materials based on their spectral fingerprint. Furthermore it also demonstrated that it can help obtain semi-quantitative data of the active ingredients content in a pharmaceutical mixture with proper method development and chemometric techniques.

Featured System	Turn-key system	Hand-held option
The **QE65000** is the most sensitive spectrometer we have ever developed. The Hamamatsu FFT-CCD detector used in the QE65000 provides 90% quantum efficiency (defined as how efficiently a photon is converted to a photoelectron). The **Laser-785** is a 500-milliwatt, continuous-wave laser specifically developed for Raman spectroscopy. The high-power excitation source has an integrated laser driver, and a thermoelectric cooler. The RIP-RPB Raman Probe Laboratory probe for use with lasers up to 3 mm from specified operating wavelength; comes with 7.5-mm focal length	The **Raman Systems R-3000** are a fully integrated Raman analyzers for real-time qualitative and quantitative spectral analysis of aqueous solutions, powders, tablets, gels and surface media from ~200-2700 cm-1. Special configurations are available for all budgets and applications with options for resolution, sensitivity and 532 nm or 785 nm lasers. The systems include a choice of 785 nm or 532 nm solid-state diode laser; a fiber optic spectrometer with optional TE cooling; an "all-in-one" fiber optic probe for liquids, solids and powders; focusing and calibration caps; a software-controlled laser shutter and operating software and a sample holder.	The **RSL-1 Handheld Raman Spectrometer** from Raman Systems is a fully integrated system (spectrometer , laser and probe)that's just 12" x 6", making it ideal for on-site materials analysis.The RSL-Plus is self-calibrating and has automated validation features. Its operating software is compliant with the FDA's 21-CFR-11, and includes features such as audit logging, spectral matching, database creation, and automatic detection of data tampering.
		
	http://www.oceanoptics.com/products/r3000.asp	http://www.oceanoptics.com/products/rsl1.asp

References

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