Not Your Father's Raman Spectrometer
New Handheld Brings Lab Power to Field Petrochemical Applications

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Handheld Raman spectrometers have gained wide acceptance in recent years for identifying unknowns in field applications. They have proven to be especially effective in raw materials inspection for petrochemical, chemical, pharmaceutical, and electronic industries. Raman spectroscopy is a non-invasive, non-destructive analytical technique. Unlike the more popular and closely related technique FTIR, it requires no sample preparation and is insensitive to interference from water or moisture.

In the petroleum industry, these spectrometers help to identify and quantify pure materials and mixtures in liquid and solid forms.

This non-destructive technique offers analytical information previously not available in a handheld system.

The handheld Raman has application to refined oil products, such as methanol content in gasoline, and with a new 1064 nm laser excitation source it is particularly useful for crude and biofuels testing. Engine oil wear analysis has also proven to be an application that the 1064 nm wavelength is most suited to analyse effectively.

As impressive as these applications are, they are qualitative in nature. An example of the use of handheld Raman spectrometer for quantitative work, namely measuring methanol component in blended gasoline, is presented below.

Quantitative results are presented in Figure 4, which covers the entire blending range: from neat gasoline to pure methanol. By choosing appropriate spectral features, a simple linear correlation can be found between methanol percentage and the spectral quantity. With the established equation, the percentage of methanol of known samples is predicted to be within ±2% of their actual values; for example, 8.3% was predicted for a 10% sample and 51% was predicted for a 50% sample from our own experiments.

In conclusion, although it is widely accepted that handheld Raman can identify a wide range of molecular species, we have demonstrated that an ultra-compact, field deployable Raman spectrometer can also be reliably used to measure quantitatively the methanol content in pre-blended gasoline samples.

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Raman Spectra

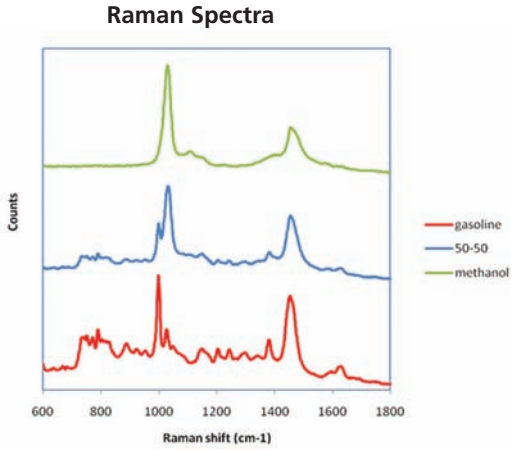

Figure 3. Typical Raman spectra taken with Rigaku's Handheld. Integration time: 4 seconds.

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Figure 1. The "experimental setup." The experiment consists of holding the laser power button for a few seconds to shine laser light on the sample vial. In this case is the experiment takes approximately four seconds.

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Figure 2. An alternate configuration with improved ergonomics for point and shoot applications.

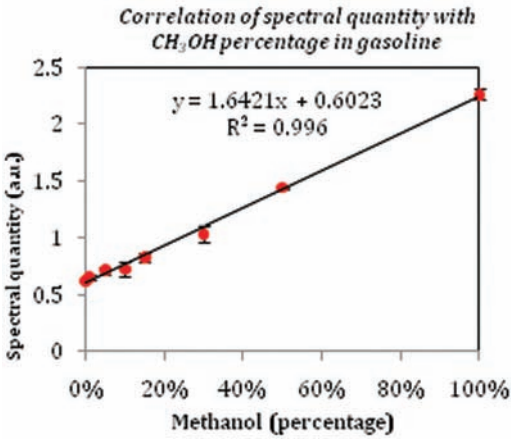

Figure 4. Correlation of a spetral quantity with the methanol percentage in blended gasoline. Data were fit with linear regression. Error bars represent ±3 .

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