



Raman Concatenation

Extended Raman detection
range covering
 65 cm^{-1} to 4000 cm^{-1}

What is Raman Concatenation?

Raman Concatenation is an exciting new technique, and it involves sequentially collecting Raman spectra from two NIR lasers with one Raman spectrometer and one Raman probe. It enables fluorescence free spectra of the fingerprint and stretching region with increased sensitivity and discrimination.

- Enables fluorescence free spectrum collection of the fingerprint and stretching region in the SWIR
- Concatenation has the benefit of using «one» dispersive spectrometer and «one» probe.
- Capturing all regions at 1.4 μm has SNR advantage over FT-Raman (high integration times) and detector expansion

Why using Raman Concatenation?

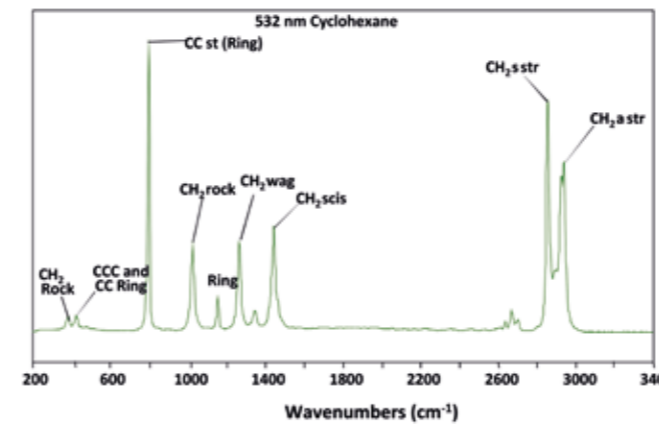


Figure 2a Cyclohexane extended range

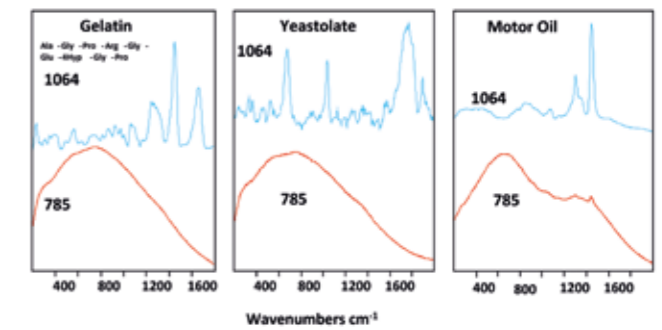
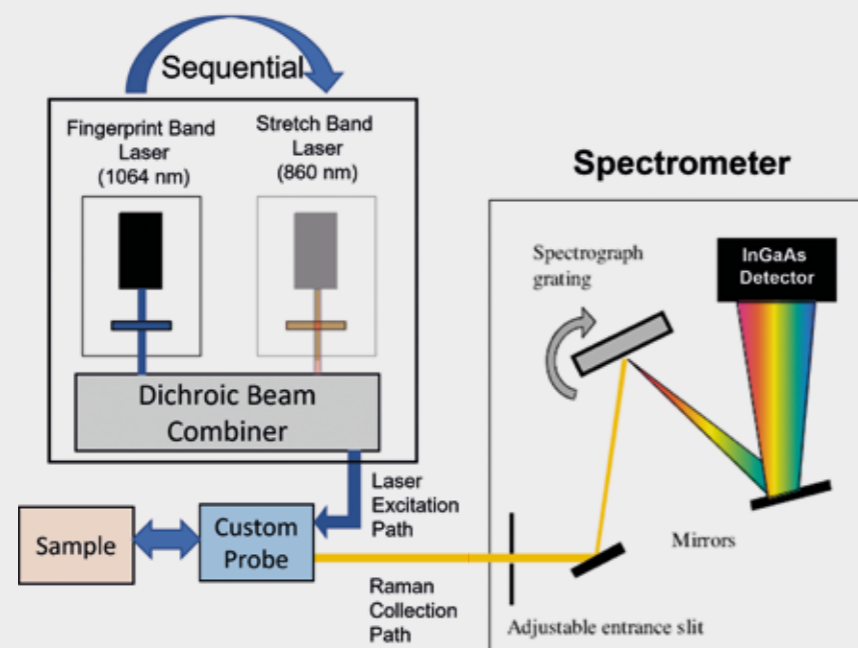


Figure 2b 785nm / 1064nm excitation

How Raman Concatenation works



- Full range but sensitive to background fluorescence for complex samples and mixtures

- Enhanced signal-to-noise ratio & peak discrimination within the stretch band (2000–4000 cm^{-1})

Stretch bands of Interest

C=C (2080–2260 cm^{-1})	Strong
S-H (2550–2600 cm^{-1})	Strong
C-H (2800–3000 cm^{-1})	Strong
N-H (3300–3500 cm^{-1})	Medium
O-H (3100–3700 cm^{-1})	Weak

Molecules of interest

Alkyne, (Alkyne tags for cancer research)
 Lipid, Proteins, Water (Bio-Medical)
 Carbohydrates, Water, Alcohol (Process)

Where to use Raman Concatenation?

BIODIESEL/PETROCHEMICAL

Raman concatenation has been applied to biodiesel fuels and petrochemical applications in cases where visible and NIR Raman spectra are overwhelmed by fluorescence.

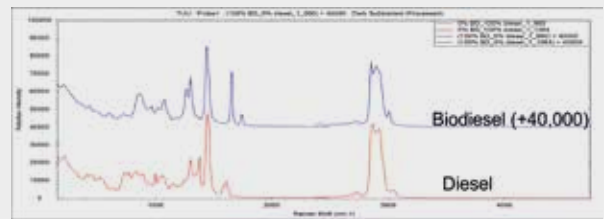


Figure 3 Compare biodiesel vs diesel

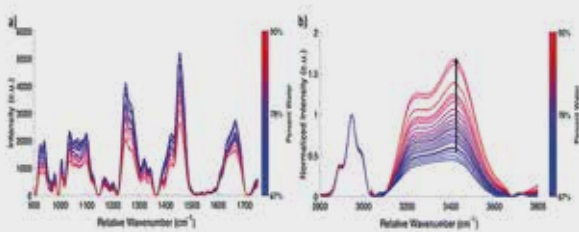


Figure 4 (Gelatin) demonstrates the uptake of water into a hydrogel using visible 685 nm (a) and 785 nm (b)

MOISTURE INFORMATION

Raman Concatenation expands the number of samples identified and provides enhanced information about the sample. Specifically, water information from the stretching region is now available for moisture analysis and referencing. Water band information can be used to calculate loss-on-drying for lyophilization and determine the expansion and contraction properties of hydrogels.

FOOD/DAIRY/BEVERAGE

Numerous types of dyes and pigments can overwhelm the Raman spectrum in sweets and baked items. Fluorescence can overwhelm the spectrum in dairy products and prohibit moisture analysis in items such as milk and cheese. Sodas are typically overwhelmed by fluorescence due to the base molasses flavoring extract, and the water band information is pronounced with Raman concatenation.

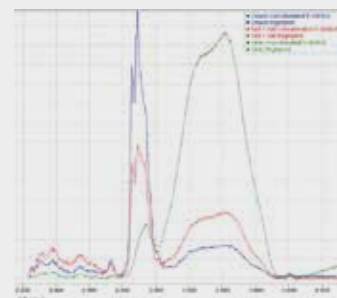


Figure 5 Water and fat content of skim milk (green), cream (blue) and half&half (red)