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Lab 4

Introduction to Raman Spectroscopy

Purpose

In this experiment Raman spectra will be acquired from several common solvents. Once analyzed, those spectra can then be used to determine the components of an unknown sample.

References

1 Ferraro, J.R.; Nakamoto, K. *Introductory Raman Spectroscopy.* Academic Press Inc.: San Diego, CA, 1994.
2 Dollish, F.R.; Fateley, W.G.; Bentley, F.F. *Characteristic Raman Frequencies of Organic Compounds;* John Wiley & Sons: New York, NY, 1974.

Apparatus

Delta Nu Raman Spectrometer and accessories
1 mL glass vials
Pipettes

Chemicals

Acetone
Dichloromethane
Ethanol
Methanol
Ethyl Acetate

Theory

Raman spectroscopy is inelastic scattering of light. This means that a photon of a fixed energy can hit a molecule and bounce off with a loss of energy. The lost energy goes into making the molecule vibrate. When you observe the light emitted by a sample irradiated with a laser, there are very weak bands that correspond to Raman scattering. These are so weak that they cannot be seen with the naked eye, but can be observed with very sensitive cameras. The Advantage 200A uses a digital camera to take a picture of the Raman spectrum and a computer is used to digitize the picture to produce a spectrum. The laser in the Advantage 200A is a HeNe laser that emits light at 632.8 nm and the Raman scattering is observed at longer wavelengths.

Procedure

Take Raman spectra of neat ethyl acetate, acetone, methanol, ethanol, and dichloromethane. Acquire a reference spectrum (no laser hitting the sample) and then acquire spectra for the above compounds. 10 seconds integration should produce a high quality Raman spectrum from these samples. Run the unknown given to you be your instructor.

Treatment of Data

Fill in the table below noting the wavenumbers of up to six of the most prominent peaks in each spectrum.

	Peak #1 (cm^{-1})	Peak #2 (cm^{-1})	Peak #3 (cm^{-1})	Peak #4 (cm^{-1})	Peak #5 (cm^{-1})	Peak #6 (cm^{-1})
Acetone						
Ethyl Acetate						
Methanol						
Ethanol						
Dichloromethane						

Using the information in the above chart, determine the components of the unknown solution.

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Questions

1) What component(s) were in the unknown solution?

2) Below is a chart listing a specific characteristic of each of the solvents studied in this experiment. Fill in the chart with the vibrational frequency (cm^{-1}) of the peak that appropriately corresponds to the characteristic indicated. It may be helpful to consult a book in the library on Raman spectroscopy.

	C=O stretch	Symmetric CCO stretch	Symmetric CCl_2 stretch
Acetone		X	X
Ethyl Acetate		X	X
Dichloromethane	X	X	
Ethanol	X		X
Methanol	X		X