

CHEMICAL IMAGE ANALYSIS

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Course Summary

The combination of spectroscopy and imaging, known as Spectral (or Hyperspectral) Imaging, is a rapidly emerging area of analytical science. Because the additional spectral information often permits one to chemically identify specific locations in a two-dimensional image, the approach is often referred to as Chemical Imaging. It is now possible to perform spectral imaging measurements from the ultra-violet region all the way into the far-infrared (terahertz) region of the electromagnetic spectrum. Chemical Imaging throughout all of these spectral ranges will be addressed in the course. An important concept is the representation of spectral imaging data as a cube: x and y directions being spatial coordinates, with the wavelength of light absorbed being represented along the z direction of the cube. Current array detectors used in spectral imaging applications can contain up to 80,000 pixels, or more, presenting a tremendous data analysis challenge. A number of approaches for extracting useful chemical information from these massive data sets will be discussed, including chemometric techniques. Spectral imaging using fluorescence, reflectance, transmission, attenuated total reflectance (ATR), and Raman will be discussed. Chemical Imaging using the near-infrared (NIR) spectral region will be emphasized in the course. Many industrial, pharmaceutical, and agricultural examples of spectral imaging will be used for illustration.

Course Outline:

- I. Introduction to spectral imaging
- II. Imaging of water in the near-infrared (NIR) spectral region
- III. Fluorescence and reflectance imaging in the uv/visible spectral region
- IV. Fourier transform infrared (FT-IR) microspectroscopic imaging
- V. FT-IR spectral imaging using attenuated total reflectance (ATR)
- VI. NIR spectral imaging
- VII. Approaches for extracting more chemical information from spectral imaging data cubes
- VIII. Spectral image analysis software packages
- IX. Quantitative spectral imaging
- X. Raman spectral imaging
- XI. Far-infrared (terahertz) spectral imaging
- XII. Spectral imaging using a tunable laser source

Who Should Attend?

This course is geared toward chemists or engineers who are interested in learning about spectral imaging and applying it in an effective manner to industrial, pharmaceutical, or agricultural problems. It will provide a general overview of spectral imaging and chemical image analysis with useful information on how to choose the best approach for the specific project or problem.