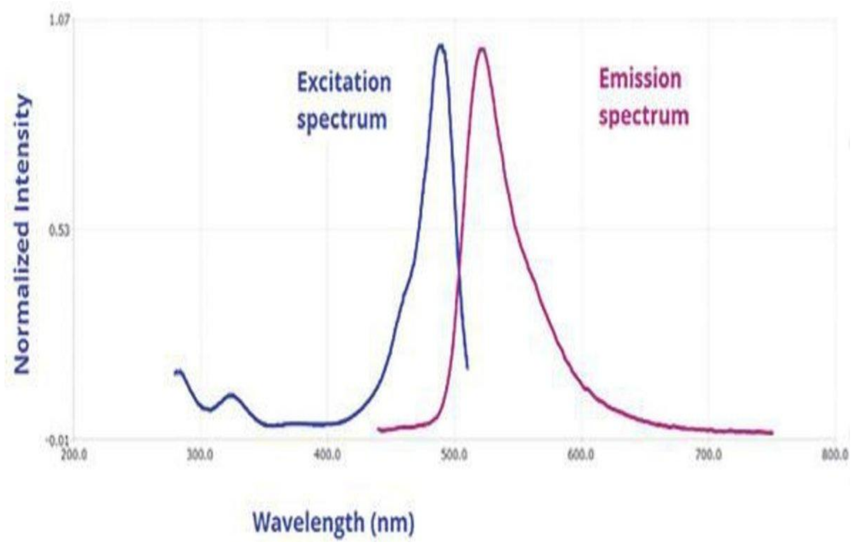
Fluorescence spectroscopy

Fluorescence spectroscopy is an investigative method based on the fluorescence properties of the sample under study, and is used for quantitative measurements of chemical products.

Fluorescence spectroscopy analyzes fluorescence from a molecule based on its fluorescent properties.

Fluorescence is a type of luminescence caused by photons exciting a molecule, raising it to an electronic excited state.

Fluorescence spectroscopy uses a beam of light that excites the electrons in molecules of certain compounds, and causes them to emit light. That light is directed towards a filter and onto a detector for measurement and identification of the molecule or changes in the molecule



FLUORESCENCE SPECTRUM

Steady state fluorescence spectra are when molecules, excited by a constant source of light, emit fluorescence, and the emitted photons, or intensity, are detected as a function of wavelength. A fluorescence emission spectrum is when the excitation wavelength is fixed and the emission wavelength is scanned to get a plot of intensity vs. emission wavelength.

A fluorescence excitation spectrum is when the emission wavelength is fixed and the excitation monochromator wavelength is scanned. In this way, the spectrum gives information about the wavelengths at which a sample will absorb so as to emit at the single emission wavelength chosen for observation. It is analogous to absorbance spectrum, but is a much more sensitive technique in terms of limits of detection and molecular specificity. Excitation spectra are specific to a single emitting wavelength/species as opposed to an absorbance spectrum, which measures all absorbing species in a solution or sample. The emission and excitation spectra for a given fluorophore are mirror images of each other. Typically, the emission spectrum occurs at higher wavelengths (lower energy) than the excitation or absorbance spectrum.

These two spectral types (emission and excitation) are used to see how a sample is changing. The spectral intensity and or peak wavelength may change with variants such as temperature, concentration, or interactions with other molecules around it. This includes quencher molecules and molecules or materials that involve energy transfer. Some fluorophores are also sensitive to solvent environment properties such as pH, polarity, and certain ion concentrations.

A few of the categories of fluorescent molecules and materials are:

- Amino acids (Trp, Phe, Tyr)
- Base pair derivatives (2-AP, 3-MI, 6-MI, 6-MAP, pyrrolo-C, tC)
- Chlorophylls
- Fluorescent Proteins (FPs)
- Organic dyes (fluorescein, rhodamine, N-aminocoumarins and derivatives of these)
- Rare earth elements (lanthanides)
- Semiconductors
- Quantum dots

Common Sampling Techniques of FTIR Spectroscopy

Fourier Transform Infrared (FTIR) Spectroscopy is the most commonly used form of IR spectroscopy and an extremely powerful tool in analytical, industrial, and academic laboratories. There are several FTIR sampling techniques available, with the most common being transmission, attenuated total reflectance (ATR), specular reflectance and diffuse reflectance. The design of an FTIR spectrometer also lends itself to Fourier transform photoluminescence (FT-PL) measurements in the mid-IR (MIR) spectral range broadening the analysis possible with an FTIR spectrometer.

Introduction to NIR

Near-infrared (NIR) spectroscopy is a highly flexible form of analysis, which can be applied to a broad range of research and industrial process applications. Long a staple technology in remote sensing, NIR spectroscopy has become popular within industrial markets as a cost-effective tool for measuring materials to optimize processes and manage costs.

What is NIR and how does it work?

NIR spectroscopy is a method that makes use of the near-infrared region of the electromagnetic spectrum (from about 700 to 2500 nanometers). By measuring light scattered off of and through a sample, NIR reflectance spectra can be used to quickly determine a material's properties without altering the sample.

NIR converts measured data into actionable information to help optimize processes or improve research. Capable of examining irregular surfaces with the same ease as a carefully prepared sample, NIR is non-destructive, and requires little or no sample preparation. It can also be used to analyze multiple constituents in a single scan.

Advantages of near infrared spectroscopy

- Highly flexible form of analysis

- Cost-effective
- Capable of examining irregular surfaces
- Non-destructive
- Requires little or no sample preparation