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Introduction to FTIR spectroscopy

Fourier Transform Infrared Spectroscopy, also known as FTIR Analysis or FTIR Spectroscopy, is an analytical technique used to identify organic, polymeric, and, in some cases, inorganic materials. The FTIR analysis method uses infrared light to scan test samples and observe chemical properties.

Fig(1) FT-IR Scanning Microscope

<u>FT-IR</u>

Fourier transform infrared spectroscopy (FTIR) is a technique used to obtain an infrared spectrum of absorption or emission of a solid, liquid, or gas.

An FTIR spectrometer simultaneously collects high-resolution spectral data over a wide spectral range.

This confers a significant advantage over a dispersive spectrometer, which measures intensity over a narrow range of wavelengths at a time.

The term Fourier transform infrared spectroscopy originates from the fact that a Fourier transform (a mathematical process) is required to convert the raw data into the actual spectrum.



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Fig(2) FT-IR

The goal of absorption spectroscopy techniques (FTIR, visible) spectroscopy, etc.) is to measure how much light a sample absorbs at each wavelength.

The most straightforward way to do this, the dispersive spectroscopy technique, is to shine a monochromatic light beam at a sample, measure how much of the light is absorbed, and repeat for each different wavelength.

Fourier transform spectroscopy is a less intuitive way to obtain the same information. Rather than shining a monochromatic beam of light (a beam composed of only a single wavelength) at the sample, this technique shines a beam containing many frequencies of light at once and measures how much of that beam is absorbed by the sample.

Next, the beam is modified to contain a different combination of frequencies, giving a second data point. This process is rapidly repeated many times over a short time span. Afterwards, a computer takes all this data and works backward to infer what the absorption is at each wavelength.



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zeta potential

Zeta potential is a physical property which is exhibited by any particle in suspension, macromolecule or material surface.

It can be used to optimize the formulations of suspensions, emulsions and protein solutions, predict interactions with surfaces, and optimise the formation of films and coatings.

Zeta potential is the charge that develops at the interface between a solid surface and its liquid medium.

Simply put, the surface charge of nanoparticles in solution.

It is an important tool for understanding the state of the nanoparticle surface and predicting the long-term stability of a colloidal dispersion.



Fig(3) Zeta potential



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Zeta potential (or Electro kinetic potential) is the potential difference between the surface of a solid particle and the surrounding liquid the particles are dispersed in.

The potential difference between the particle surface and surrounding liquid media is due to the presence of charges species at the interface.

Zeta potential can be influenced by the dielectric constant of a particle and the ionic strength of the surrounding media.

Therefore, when measuring the zeta potential of particles the choice of the dispersing media should be carefully considered where possible.

Zeta Potential Measurement

Measuring the zeta potential of particles can give valuable information on the stability of particles in solution and the potential of aggregation of particles. For biological samples zeta potential analysis can provide an insight into the cellular uptake of particles and the presence of biomarkers.

A net electric charge is often present on the surface of biological particles like cells and extracellular vesicles due to their ability to absorb ions or molecules. The surface charge creates an electrical double layer around the particle which consists of a tightly bound inner layer of ions (the Stern layer) and an outer diffused layer of ions (the Gouy-Chapman layer).



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UV-Vis Spectroscopy

Ultraviolet-visible (UV-Vis) spectroscopy is a widely used technique in many areas of science ranging from bacterial culturing, drug identification and nucleic acid purity checks and quantitation, to quality control in the beverage industry and chemical research. This article will describe how UV-Vis spectroscopy works, how to analyze the output data, the technique's strengths and limitations and some of its applications.

What is UV-Vis spectroscopy:

UV-Vi's spectroscopy is an analytical technique that measures the amount of discrete wavelengths of UV or visible light that are absorbed by or transmitted through a sample in comparison to a reference or blank sample.

Fig(4) UV-Vis

This property is influenced by the sample composition, potentially providing information on what is in the sample and at what concentration. Since this spectroscopy technique relies on the use of light, let's first consider the properties of light.



Figure5: A simplified schematic of the main components in a UV-Vis spectrophotometer