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A Detailed and Systematic Study of the Applications of Raman Spectroscopy in the Agricultural Products World.

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Abstract: *This article addresses some aspects of Raman microscopy and highlights development of an instrument for Raman spectroscopy. Raman spectroscopy has become more popular, in part, because of advances in Raman specotrometry technology and the increased power of personal computers. Raman spectroscopy can detect chemical and physical information about samples without destructively analysing them and helps in analysis based on rapid on-line analysis. This article briefly discusses the application of Raman spectroscopy. Raman spectroscopic techniques are promising for various applications in agriculture, food, and/or meat products research.*

***Keywords:** Raman spectroscopy, surface-enhanced Raman spectroscopy, Raman spectrometry*

1. Introduction

Raman spectroscopy is based on an inelastic light scattering method that was first reported by Chandrashekhara Venkata Raman and Krishnan which originates from an inelastic scattering of light known as the Raman effect. Diffusion is the essential mechanism of material waves.

1.1 Basic principles: Mechanism and Instrumentation

As a result of a process involving irradiation, a molecule will be broken apart, and in doing so will produce light in the form of "scattering" in the form of "elastic scattering". Electromagnetic scattering doesn't alter the atomic structure of photons, and no changes are made in wavelength and energy. Diffusion of light is also another form of light scattering, but diffusive diffusers like ice crystals need to be put as out. The Raman shift that results from the scattering of the Stokes scattered light by the sample is called the Dv cm. Stokes scattering is stronger than anti-Stokes scattering because of the higher pressures involved, and Raman spectroscopy is also used in food science.

2. Theoretical Basis of Raman Spectroscopy

The rays emitted by the X-ray tube are made up of photons of different wavelengths, but are clearly polarised in one direction or another. Some of those photons are absorbed by the sample. After being struck by the incident photon, the molecule makes a slight inelastic collision that allows the extra energy of the photon to be absorbed by the molecule. As a consequence of the motion of molecules and how the light is dispersed, the energy of vibrational particles is changed and the light is changed to a different wavelength. If the radio waves go between two pieces of glass, then we obtain a Raman change in the reflected radiowaves. If the electron gains energy, it can be transferred to wavelengths longer than one would expect based on the classical wave-length model, or it can be shifted to shorter wavelengths where the quantized energy of the electron is captured in the electron-nucleus scattering range, such as those wavelengths where the state vector has an all-zero distribution. Figure 1 indicates the energy of the Raman scattering process occurred from 0.02 to 10 nm.

By the way, radiation waves are the way of determining the chemical composition of molecules that are the source of scattering. Fourier-transform Raman spectroscopy utilises scattered light to obtain information about molecular vibrations which can provide information about the structure, symmetry, electronic environment, and bonding of molecules; thus, Fourier-transform Raman spectroscopy's quantitative and qualitative analysis allows for the quantitative and qualitative analysis of molecules; subsequently, Fourier-transform Raman spectroscopy can also be used to provide quantitative and qualitative analyses of molecules, since concentrations of bands are proportional to the analyse concentrations, which can be explained with the following equation.

Iv = I0KvC (11)

where I v is the estimated Raman intensity, I 0 is the excitation intensity, and K v is the constant.

And the C is the concentration of the analyte.

Raman spectroscopy has unique advantages that are important in food analysis. For example, it has high precision, strong compatibility with aqueous systems, no special sample preparation, and short timescale.

1. The Raman spectrum has a strong threshold of determination for what a sample is and is not overlapping which allows for Raman spectroscopy to be used to capture the fingerprint of samples to do the real analysis.

2. When in aqueous solutions, Raman spectroscopy has the ability to work in an atmosphere which can be excessively