Short Communication

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Nuclear Magnetic Resonance Spectroscopy NMR

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Abstract

Nuclear magnetic resonance is a type of spectroscopy. It is necessary to know for which atom it is active and for which atom it is inactive. Nuclear magnetic resonance spectroscopy is used to clarify the composition of carbon atoms, crystals and non-crystals. Nuclear magnetic resonance spectroscopy can be applied to clinical diagnostic imaging. In this paper we have presented detailed information on nuclear magnetic resonance spectroscopy. Before taking the information of nuclear magnetic resonance spectroscopy

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Description

Spectroscopy

When white light is given to the surface of an atom, molecule, or other object, spectrum is seen from it which is called spectroscopy [1]. The spectrum that is found depends entirely on the determined atom, molecule, or other substance. Spectroscopy is also used in physics, chemistry, and biology. The red wavelength is the highest and the frequency is the lowest. While violet have the shortest wavelength and the highest frequency [2]. There are many types of electromagnetic radiation like

- Gamma radiation
- X-ray radiation
- Ultraviolet radiation
- Visible light
- Infrared radiation

When it comes from the sun's rays it is an ultraviolet wave. The shortest wavelength from above is that of gamma radiation. A total of 22 types of spectroscopy are found [3,4].

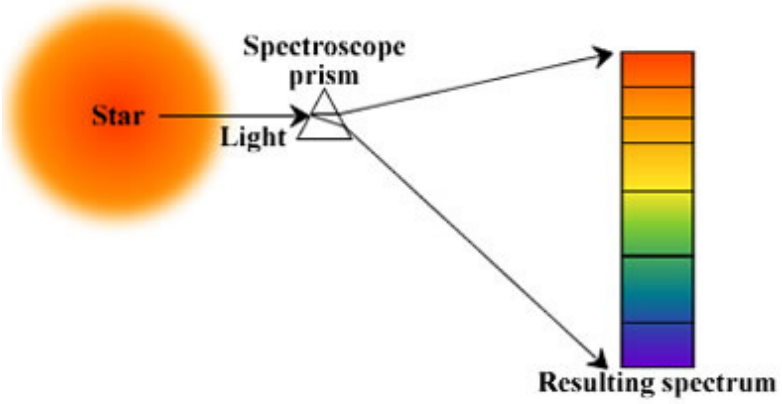

Figure 1: Spectroscopy of resulting spectrum.

Information

First of all, we will learn what nuclear magnetic resonance is and how it works. Nuclear magnetic resonance is a type of spectroscopy **(Figure 1)**.

Suppose there is a nucleus in which a proton is present while the proton represents the spin moment. This causes the proton to act as a small magnet. So the nuclear magnetic resonance will be active only if the spin quantum number of an atom is greater than zero. Therefore, it can be said that nuclear magnetic resonance will be activated only when the atomic number and the atomic mass are not equal [5]. Nuclear magnetic resonance is made up of three words which are nuclear, magnetic and resonance. This suggests that the nucleus should contain all the information pertaining to the nucleus that has protons and neutrons in which the proton has a positive charge and the neutron does not have a charge. The electron itself can be clockwise or anti-clockwise spin moment. And when the nucleus also orbits in its place, the orbit is also clockwise or anti-clockwise [6].

Type of NMR:

• 1H NMR: Used to determine the type and number of H atoms in a molecule.

• 13 C NMR: Used to determine the type of carbon atoms in the molecule.

Atoms are tested on the basis of hydrogen atoms in hydrogen nuclear magnetic resonance. Nuclear magnetic resonance is techniques that determine the structure of various compounds [7].

Principle: When energy in the form of radio frequency is applied when applied frequency is equal to processional frequency absorption of energy occurs nucleus is in resonance and nuclear magnetic resonance signal is recorded.

• Sample holder

• Permanent magnet

• Sweep generator

• Radio frequency transmitter

• Radio frequency receiver

• Read out system

Calibration is performed by adding an empty NMR tube to ensure no background signals from the tube or the instrument is present. The sample is then placed in the NMR tube and the NMR spectrum is measured. Nuclear magnetic resonance machines are available in small and large sizes. How this machine works is shown below. A nuclear magnetic resonance machine has two large magnets [8]. These samples can be in liquid or solid form. In which a radio wave is generated. And the hydrogen atoms in the sample absorb the energy of the radio wave. Only when the spin of an atom is greater than zero does clear magnetic resonance become active in the atom. Therefore, clear magnetic resonance will be activated only on an atom whose spin is greater than zero. Thus when a sample is placed between two magnets and if the sample is of hydrogen atom then it will have hydrogen so it will have a positive charge. Its direction is from north to south.

Advantages of NMR:

• With a suitable computer apparatus we can calculate the whole 3D structure of proteins and enzymes.

• This method is able to lead us for the observation of chemical kinetics.

• We can investigate the dielectric constant the polarity and any other properties of the solvent.

Disadvantages of NMR:

• This is good for more accurate determination of the structure but not for the availability of higher molecular weight.

• The cost of the experiment implementation increasing with the higher strength and the complexity of determination.

Application of NMR: Nuclear magnetic resonance is used as quality control of atoms, molecules or other surfaces. Nuclear magnetic resonance is also used to test the purity of a sample as well as its proportions and the structure of the root. Solid state nuclear magnetic spectroscopy is performed to determine the molecular structure of solid [9,10]. It can also be used for the determination of protein structure. NMR can be used to determine molecular conformation in solutions as well as to study physical properties at the molecular level such as conformational exchange, solubility and diffusion NMR spectroscopy is a spectroscopy technique used by chemists and biochemists to investigate the properties of organic molecules, although it applies to any type of sample that contains spin-containing nuclei **(Figure 2)**.

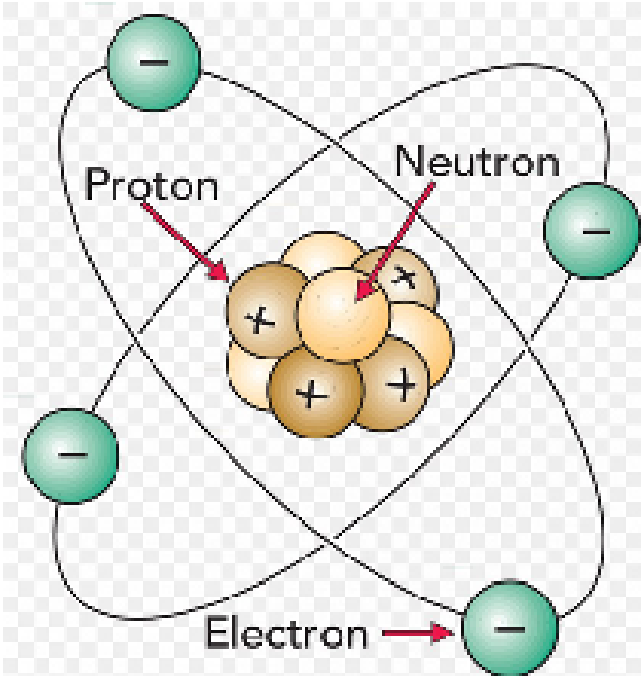

Figure 2: Nuclei with electron and proton.

NMR can be used to either match spectral libraries or to apply the basic structure directly to unfamiliar combinations **(Figure 3)**.

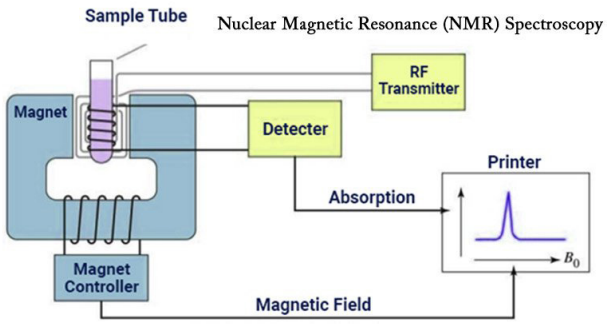

Figure 3: NMR spectroscopy instrumentation.

Conclusion

Nuclear magnetic resonance is a most powerful analytical technique in terms of the range of system that can be studied and the nature of information and can be obtained regarding the system of interest. Provide qualitative and quantitative data. Only require few milligram samples. Able to detect very fine structural components.

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