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A BRIEF REVIEW ON NUCLEAR MAGNETIC RESONANCE

Yashashree K. Dhekale* , Sanskruti S.Yele , Parimal M.Bedagnur ,

Anjali R. Shinde,Vijaysinh U. Sable

Department of Pharmaceutical Quality Assurance , Lokmangal College Of Pharmacy, Wadala, Solapur, Maharashtra, India .

ABSTRACT

To study the NMR spectroscopy the NMR spectroscopy is nuclear magnetic spectroscopy which is widely used in these years. Because of it gives the accurate measurements and graphical notation.

NMR (NEUCLEAR MAGNETIC RESONANCE) neuclear spectroscopy is use of NMR phenomenon to study the physical, chemical and biological properties of matter.[4]

The basic components in the NMR spectroscopy is atom and it's proton number. The proton give the magnetic movement to the compound. hence its summarized that it is useful in structure identification.

In the pharmaceutical analysis the NMR spectroscopy used in identification and frequency testing of carbamazepine.The carbamazepine and frequency testing is done with H1 NMR spectrum

KEYWORDS: NMR, Radio Frequency Magnetic Fild, Neucler Shielding , Spin

INTRODUCTION

Bloch, Hansen, and Packard of Stanford University and Purcell, Pound, and Torrey of Harvard University jointly discovered NMR in 1946[4]. The initial observation that magnetic nuclei, like protons and phosphorus 31 (1H and 31P, respectively),[7] could absorb radio frequency energy in a nucleus-specific magnetic field of a certain strength led to the discovery. Different atoms within a molecule resonated at different frequencies upon absorption, causing the nuclei to start resonating. This finding made it possible to examine a molecule's structure in great detail. Since then, kinetic and structural studies, solids, liquids, and gases have *all* been studied using NMR, leading to the awarding of six Nobel prizes in the field of NMR.[11]

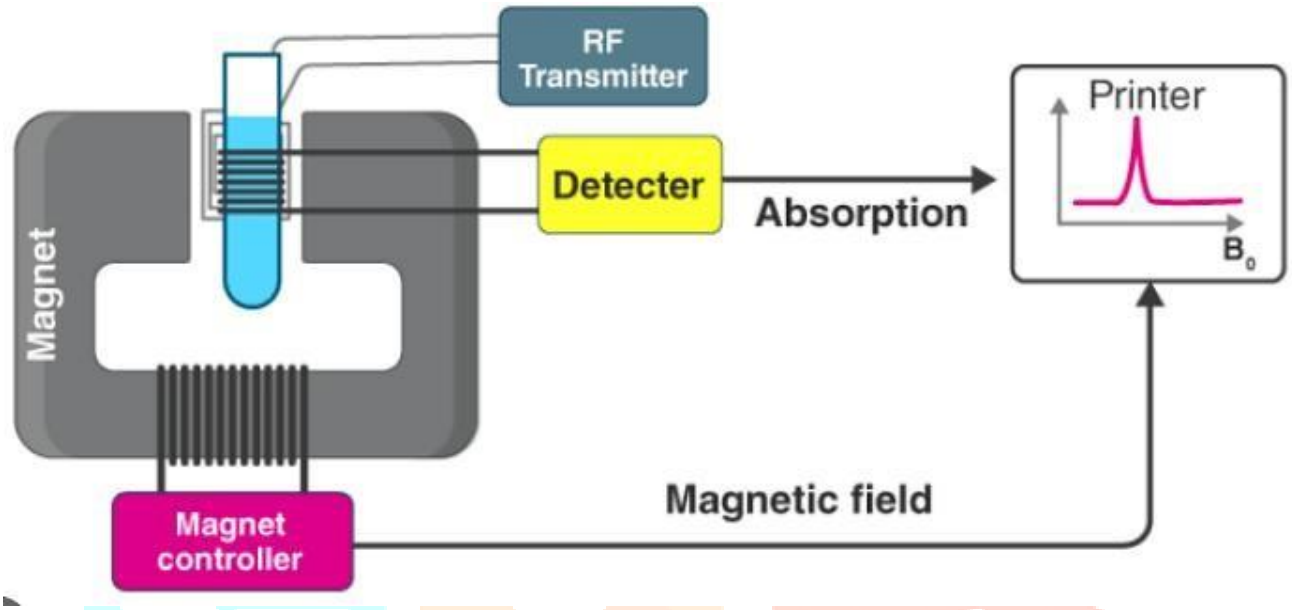
PRINCIPLE OF NMR SPECTROSCOPY

It is predicated on the facts that all nuclei have an electrical charge and that the majority of atoms' nuclei exhibit spin. The foundation of NMR spectroscopy is the absorption of electromagnetic radiation in the 3 kHz–300 GHz radiofrequency band. [8]Because atoms' nuclei are electrically charged and have spin, they produce magnetic fields. Atomic nuclei can align themselves either in the direction of an external magnetic field or in the opposite direction when such a field is present. Energy moves from the ground state to the excited state when there is an external magnetic field present. At a wavelength that coincides with radio frequencies, it occurs when an electron transitions from an excited to a ground state.

7CONCEPT OF NMR SPECTROSCOPY.

CONCEPT OF NMR SPECTROSCOPY

INSTRUMENTATION OF NMR SPECTROSCOPY



WORKING

1.NMR Spectroscopy's Operation

2.The steps listed below demonstrate how NMR spectroscopy operates:

3.The provided sample must first be placed in a magnetic field.

4.The nuclei sample must then be excited into nuclear magnetic resonance with the aid of radio waves in order to generate NMR signals.

5.Sensitive radio receivers are then used to detect these generated NMR signals.

6.The intramolecular magnetic field surrounding an atom in a molecule alters its resonance frequency.

7.This then provides comprehensive details regarding the electronic structure and functional group of a molecule.

8.A reliable technique for identifying monomolecular organic compounds is nuclear magnetic resonance (NMR) spectroscopy, which also yields comprehensive details about the structure, dynamics, and reaction of the structure dynamics, and reaction of compound.[4]

CONSTRUCTION

There are eight main components to the NMR spectroscopy instrumentation, which are described below:

1.**Sample Holder:** Usually made of glass, this tube measures 0.3 cm in diameter and 8 cm in length.

2.**Magnetic coils:** When current passes through them, they produce a magnetic field.

3.A permanent magnet is employed to create a uniform magnetic field.

4.**Sweep generator:** This device adjusts the magnetic field's intensity.

5.**Radiofrequency transmitter:** It aids in creating a brief but potent radio wave pulse.

6.An aid for identifying or receiving radio frequency signals is a radiofrequency receiver.

7.An RF detector is a device that detects and receives radio frequency signals that have not been absorbed.

8.**Recorder:** This device aids in capturing the NMR signals that the RF receives.[4]

Spin and magnetic Properties

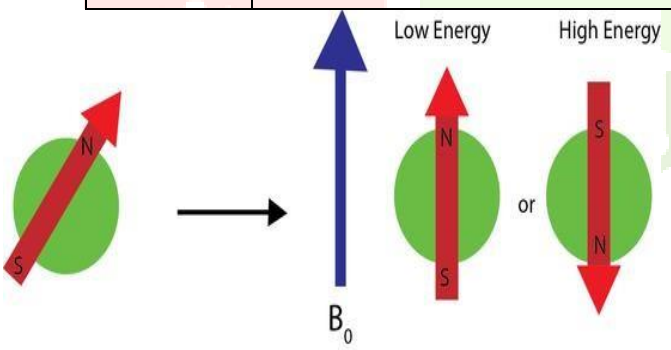
Protons and neutrons, two basic particles with the intrinsic quality of spin, make up the nucleus. Similar to electrons, a nucleus's spin can be expressed in terms of quantum numbers: I for spin and m for spin in a magnetic field. All other atoms with odd numbers of protons and neutrons have non-zero spin, while atomic nuclei with even numbers of protons and neutrons have zero spin. Moreover, the magnetic moment, μμ, of every molecule with a non-zero spin is given by

$\mu=\gamma I(1)(1)\mu=\gamma I$

where γγ is the nucleus-specific gyromagnetic ratio, which is a proportionality constant between the angular momentum and the magnetic dipole moment.[10]

The nucleus behaves like a tiny bar magnet due to its magnetic moment. Every magnet is oriented randomly when there's no external magnetic field present. The sample is subjected to the external magnetic field B0B0 during the NMR experiment, which forces the bar magnets to align either high energy or low energy with the B0B0. The magnets undergo a spin flip during the NMR experiment, which calls for a precise quanta of energy. It is helpful to think about the NMR experiment using the nuclear energy levels in order to comprehend this rather abstract idea.[11]

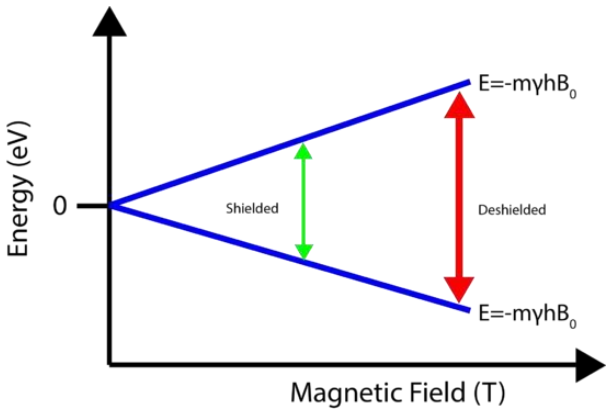
SR.NO	NUCLUI	SPIN	Frequency
1.	1H	½	250
2.	13C	½	62.88
3.	31P	½	101.2



NUCLEAR SHEILDING

Nuclear Defence

The idea of nuclear shielding, which permits structural assignments, is the foundation of NMR's power. Electrons orbit the nucleus and encircle every atom. The nucleus senses a magnetic field created by charged particles traveling in a loop. Consequently, the magnetic field that the nucleus experiences will be slightly altered by the local electronic environment surrounding it, which will then result in slightly altered energy levels! We call this shielding. Inequivalent nuclei are those that, as a result of local electronic interactions, experience varying magnetic fields. As can be seen below, the spin flip is excited by a different frequency due to the change in energy levels, which results in the creation of a new peak in the NMR.[1]



The effect that shielding from electrons has on the splitting of the nuclear energy levels. Electrons impart their own magnetic field which shields the nucleus from the externally applied magnetic field. This effect is greatly exaggerated in this illustration.[1]

APPLICATION

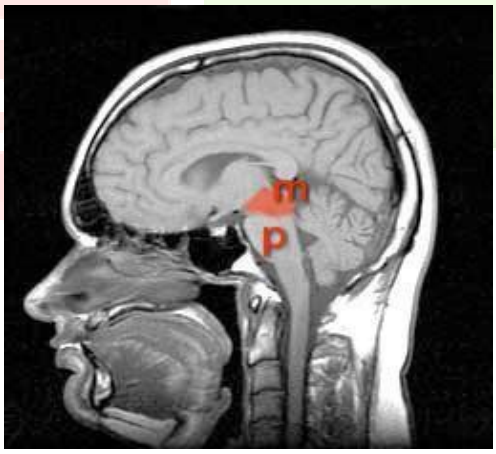
NMR has shown to be extremely important in two main domains: chemistry and medicine, where new applications are being created on a daily basis.

Medicinal Device

Magnetic resonance imaging (MRI), sometimes referred to as nuclear magnetic resonance imaging (NMRI), is a crucial medical diagnostic technique used to examine the anatomy and physiology of the human body. It can provide fine-grained images of any part of the body, particularly soft tissue, in every conceivable plane. It has been applied to imaging related to the nervous system, musculoskeletal system, chest, and cancer. It is much safer to use than other options, like computed tomography (CT), because it doesn't use ionized radiation.[11]

In Biology

NMR spectroscopy biologically applied in protein structure identification and their folding strength .



NMR spectroscopy in chemical laboratories applied as determination of organic compound structures

In Chemistry

Today, nuclear magnetic resonance is a common tool used by chemists in many labs to determine the structures of significant chemical and biological compounds. Different peaks in an NMR spectrum provide information about the various atoms within a molecule based on their specific chemical environments and atomic bonding. While many other isotopes, including 2H, 3He, 15N, 19F, and so on, are also employed, the most frequently used ones for detecting NMR signals are 1H and 13C.[11]

Additionally, NMR has shown to be extremely helpful in a variety of other fields, including process control, environmental testing, petroleum industry, earth's field NMR, and magnetometers. When it comes to costly

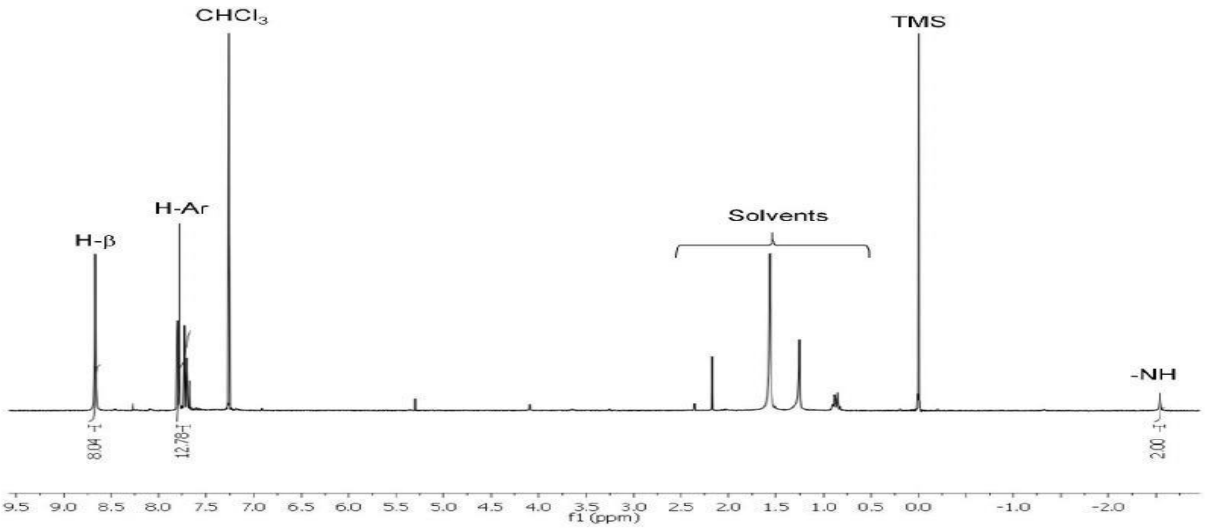
biological samples, non-destructive testing is much more cost-effective and can be recycled if additional trials are required. NMR equipment is used by the petroleum industry to measure porosity.

Basic interpretation of drug analysis by NMR spectroscopy

There are two different kinds of spectra in NMR spectroscopy: h1 and c13.the h1 The idea behind NMR spectroscopy is that when an external magnetic field is applied, energy can be transferred from base levels to higher ones. This process is known as the chemical shift, which is the atomic nucleus's resonant frequency in relation to a standard in a magnetic field.

Now, let's look at an example of how to interpret a carbamazepine examination using NMR spectroscopy.[12]

1	Compound	Carbamazepine
2	Spectrum type	1H NMR spectrum
3	Solvent	CDcl3
4	Instrument type	JEOL
5	Nucleus	1H
6	Frequency	400 MHZ
7	Chemical shift reference	TQM



Spectrum view of carbamazepine

The structure of carbemazepine consists c15 h12 n2o .it consist c15 having odd number of electrons hence it is shows the non zero state and h12 hydrogen froms the h3 grouping like h3 and working like a magnetic field means the protons are spin and produce energy On graph hydrogen molecule give the intermediate graph and c gives the high graph.

CONCLUSION

Upto this information It is authoritative to conclude that this technique has gained popularity for use in diagnosis, treatment planning, treatment maintenance, and observing the interactions between foreign materials and the human body. Since NMR technology is still developing, some discoveries are expected to be made in the near future.

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