Magnetic Resonance Now Also Comes In Tiny Quantities

September 29 2009

(PhysOrg.com) -- It is now possible to analyse very small samples using Nuclear Magnetic Resonance. Thanks to a specially constructed detector, a 'stripline', greater sensitivity can be achieved while maintaining the same level of resolution.

This means that this analytical technique is also suitable for measuring fluids which are only available in very small quantities such as plant extracts or fluid samples from extremely small organisms. The new technique has been developed by Jacob Bart, a PhD candidate from the University of Twente, The Netherlands.

The technique of Nuclear Magnetic Resonance (NMR) makes it possible to unravel the three-dimensional structure of a molecule. Using this method, doctors can diagnose diseases and chemists can develop new medicines for example. Until now, NMR was only sufficiently sensitive when applied to volumes of greater than 500 microlitres. Researchers would also like to apply the technique to smaller quantities such as fluid samples from small organisms, and to chemicals which are highly toxic, scarce or expensive. Until now, the technique was not sensitive enough for these purposes.

Nuclear Magnetic Resonance, the same technology which is used in MRI-scanners in hospitals, makes use of the 'spin' which every atom has. This spin is a magnetic phenomenon which becomes measurable when the atom is located in a strong magnetic field. If a small oscillating magnetic field is introduced, in addition to the strong magnetic field, the spin

changes in character and a small amount of energy is released. This energy can be measured and provides information about the composition and structure of the molecule in which the atom is located.

Using smaller volumes, measuring the signal from the spin of the atom without distorting it at the same time becomes a problem. Simply making the required detector coil smaller does not work. However, using a differently shaped coil does, as Jacob Bart found out. His 'stripline' is a flat strip which is positioned parallel to the magnetic field. An electric current through the stripline generates the small oscillating magnetic field. Due to its special shape, there are no distortions in the magnetic field and so the resolution can be maintained.

The stripline design has other advantages over the standard method. In a standard NMR system, a new sample must be put into position by hand every time. The new stripline can be connected up to a pump which can change samples quickly. This makes the system work more quickly and chemical reactions can even be followed in real time.

Provided by University of Twente (news : web)