Title:

Developments in Time Domain and Single Sided NMR

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Abstract:

Time-domain NMR (TD-NMR) has been applied in food science both for Quality Control and research for years. This presentation will provide an overview ranging from routine to research applications including the latest trends and developments in TD-NMR.
There is certainly a trend enlarging the possibility of TD-NMR towards, more generally, low field NMR (LF-NMR) with ^{1}H-Larmor frequencies in the range of 2-60 MHz. This field range is provided by permanent magnet systems almost exclusively. Developments focussed on magnetic field design with respect to sample shape and size and, on the other hand, to the improvement in homogeneity, even in case of single-sided NMR.
Especially the last point, aiming for a limited chemical shift resolution, allows and requires developments of new pulse sequences and data analysis strategies. With the help of statistical data processing tools, new application fields open up. These tools are well known in other analytical disciplines; in high field NMR one example is fruit juice characterization.
The achievements of TD-NMR developments will be highlighted by key examples found in process analysis, where the limited chemical shift resolution in LF-NMR is used for concentration mapping. Online weighing of liquids and solids within pharmaceutical environments allows fast 100% quality control.
Another example relying on a rather sophisticated pulse sequences and statistical data processing is the “body composition analysis” of small animals. The principle behind this LF-NMR application is the contrast generation between fat and water by measuring a combined T_1 and T_2 relaxation pattern, leading to a sufficiently good contrast for application of partial least squares regression (PLS). The principle works also in case of foods as well as in the inhomogeneous magnetic fields of single-sided NMR.
Several groups work on magnetic resonance imaging and investigations of diffusion properties of diverse materials in LF-NMR. An example is the development in droplet size determination.