The development of HR-MAS NMR towards microgramm biospecimens

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The development of HR-MAS NMR towards μg biospecimens

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Abstract

NMR has already proven to be a tremendous spectroscopic tool in the field of metabolomics in living specimens. Its major weakness is the low detection sensitivity that renders the analysis of microscopic quantities (< 1mg-scale) impractical, time consuming and often impossible. The use of micro-size NMR detection coils is consider a cost effective approach; however, implementing a microcoil for heterogeneous biospecimens such as tissues, cells and organisms is a challenging task. This is because of the necessity of rapid sample rotation of the specimens at a specific angle, 54.74o, to the magnetic field. The technique denotes as Magic-Angle Spinning (MAS) NMR. It is commonly applied to solid materials. Depending on the diameter of the MAS detection coil, MAS can be applied to a wide range of sample mass from 500 mg with a large coil diameter 7-mm probe, to < 1mg with μ-size diameter MAS probe (1-mm and 0.7-mm). However, these μMAS probes are not applicable to metabolomic studies due to the inadequate spectral resolution (0.02 ppm). For this reason, there are no suitable μMAS probes for metabolomic studies prior to 2014. This talk will present the 'progress' of the MAS developments towards metabolomics of μg specimens. It will briefly outline (i.e. sensitivity, resolution and practicality) two different μMAS approaches: (i) using a μ-size inductively coupled resonator, High-Resolution Magic Angle Coil Spinning (HRMACS); and (ii) the use of a specially designed standalone μMAS probe, High-Resolution micro-Magic Angle Spinning (HRμMAS).

Keywords: HRMAS, μMAS

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