

Flat RF coil for ^{14}N NQR monitoring of packed tablets – paracetamol example

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When the quality of formally declared pharmaceutical sample packed in a parcel wrapping is examined by NQR, there is a stack of equal sample boxes in question. Our aim is to test them simultaneously, nondestructively, unremoved from the larger container. The sensing NQR planar RF coil («pancake») with suitable large surface can be inserted into the rift made by pushing apart the layers of the packed tablet-boxes.

Multipulse NQR technique is used for the detection. In this experiment the most sensitive region of the flat coil space is in the vicinity of the coil windings, where the excitation RF field and detection of the resonant RF response are most efficient. Tablet boxes with paracetamol as active pharmaceutical ingredient (Lek, Ljubljana: Lekadol 500 in blisters) were used as an ^{14}N NQR probe.

A planar coil consists of a series of insulated spiral windings inside a ring of width $2w$ (Figure 1). Near the windings the excitation magnetic field B_1 points in radial direction, parallel to the coil plane. For small distances ($z \ll w$) normal to the coil plane B_1 magnitude decreases linearly, for large distances its axial dependence approaches $\sim 1/z^2$. In our case, in spite of inhomogeneous RF field around the flat coil, only the NQR

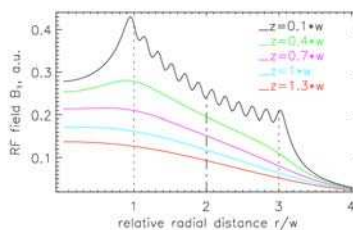
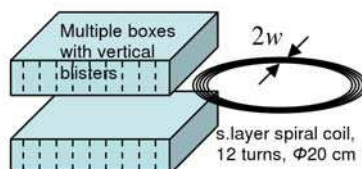


Figure 1. top panel: planar coil in a rift between two layers of tablet boxes (blisters orthog. to the coil plane). Bottom panel: example (model study) of radial dependence of RF magnetic field B_1 above 12 concentric equidistant circular loops for different heights above the planar coil.

signal from a layer of constant B_1 magnitude near the windings is relevant for the ^{14}N NQR signal provided that the correct multipulse-spin-lock condition is fulfilled.

Four cases were studied: a single planar coil case and three systems of coil pairs: coaxial-co-oriented pair, coaxial-anti-oriented pair (axial gradiometer) and coplanar-anti-oriented pair (planar gradiometer). Better rejection of environmental disturbances and better signal-to-noise ratio were achieved with gradiometers, the best performance was found with the planar gradiometer. However, modest shielding like phosphor-bronze wire mesh in a form of a tunnel, extending well beyond the coil system area, is needed for attenuation of incoming and outgoing RF disturbances.