

## Correlated $T_1$ - $T_2$ MRI for multi-component analysis in single voxels: water and fat gradients in cheese

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There is a strong need for non-destructive analytical methods to characterise complex biopolymer food systems. Important parameters to be obtained are: composition (e.g. water, fat, protein content) and structure. NMR and MRI methods can fulfil (at least part of) this need.

$T_1$ - $T_2$  correlation spectroscopy has the potential to resolve  $T_1$  and  $T_2$  in situations where these cannot be resolved in 1D distributions. Such situation is frequently met in complex multi-component biopolymer systems. Recent progress in fitting procedures based on fast 2D Laplace inversion routines makes it possible to perform continuous correlation analyses between NMR parameters (Song et al., 2002; Hürlimann et al., 2002). Up to now this method has not been combined with imaging.

Here, we present as a proof of principle correlated  $T_1$ - $T_2$  MRI on cheese (Brie). FLI is applied per voxel resulting in a separate 2D correlation plot for each position in the sample. Analysis of such plots yields the separated signals of water and fluid fat. There is a good agreement between the experimental results and expected water and fat gradients inside the cheese. A strong correlation is observed between the  $T_2$  of water and fat and the structure of the cheese on mesoscopic to macroscopic length scales. Amplitude images of fat (left) and water (right) as observed in Brie are presented below. The images show a clear increase in fat amplitude and decrease in water amplitude in the vicinity of the rind of the cheese.

These results show that it is possible to apply 2D correlated  $T_1$ - $T_2$  in NMR imaging experiments.

