Title:

Investigation of Sodium Ions in Food Models by ^{23}Na NMR Spectroscopy

Authors & affiliations:

M. Gobet[a], L. Foucat[b], C. Moreau[a]

a) INRA-ENESAD-University of Burgundy, UMR1129 FLAVIC F-21000 Dijon, France
b) INRA, UR370 QuaPA F-63122 Saint Genès Champanelle, France

The excessive consumption of sodium is a serious sanitary concern. The reducing of salt content without affecting technological and sensorial properties of foodstuffs is currently a challenge for the food industry[1]. There is a need to investigate the effect of sodium ions in food products at molecular level. In this context, methods for the absolute quantification of the bound fraction were developped, using ^{23}Na NMR single-quantum (SQ) and double-quantum-filtered (DQF) sequences. [2]

We adapted these methods on two kinds of samples:
- 1% (w/w) iota-carrageenan systems with increasing NaCl content: 0 to 3% (w/w). This polysaccharidic polymer, currently used as thickener in food industry, is known for its cation-sensitive gelling properties.
- semi-hard cheeses with various compositions (water, fat and calcium ion contents) and NaCl contents ranging from 0.7 to 2.5%. The high consumption and salt content of cheeses make them special targets for investigations on reducing sodium intake.

^{23}Na relaxation, single-quantum (SQ) and double-quantum-filtered (DQF) NMR experiments were performed on these systems using Bruker DRX-400 or Avance-500 spectrometers equiped with 10 mm probes.

We achieved through ^{23}Na NMR the quantification of the entire sodium content for the two studied systems. In *iota*-carrageenan system, the evolutions of ^{23}Na T_1 and of the 'bound' sodium proportion are in accordance with the gel strengthening. It confirms the direct involvement of "bound" Na+ ions in the gelation mechanism. Results lead us to propose a schematic model of carrageenan gelation mechanism within the studied range of sodium concentration. [3] In cheeses, the ^{23}Na relaxation measurements and the DQF parameters highlight the impact of the composition (water, fat and calcium ions contents) on the interactions of sodium with the food matrices.

This study highlights the usefulness of ^{23}Na NMR for investigating 'bound' sodium and understanding the role of sodium in foodstuffs.

References

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