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FIELD-CYCLING NMR RELAXOMETRY MEASUREMENTS OF HYDROCOLLOIDAL SYSTEMS

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Hydrocolloids are polymers of biological or synthetic origin with of a large number of hydroxyl groups, widely used in food processing technologies as gelling agents, thickeners or fat and saccharose replacers. Water binding affects texture and processing characteristics, which is why knowledge of the state of water in such biopolymer suspensions is essential to understand and predict their behaviour during production, storage and thermal processing. A useful technique to study the state of water in foods is nuclear magnetic resonance (NMR); the usual way of probing the dynamics using NMR is to examine relaxation at different temperatures and assume a function for the temperature dependence of the correlation times. However, in such a way large temperature range needs to be covered, which can be problematic in foods, as its structure and properties are temperature dependent. The alternative is to determine spectral density function of the substance by measuring spin-lattice relaxation time, T_1, over a wide range of Larmor frequencies; by using field-cycling technique one can probe the dynamical processes in the system (Kruk, Meier & Rössler, 2011).

The aim of the study was to acquire Nuclear Magnetic Relaxation Dispersion (NMRD) profiles of several binary systems based on agar, gelatin and carrageenan varying in concentration, and temperature. The shape of NMRD profiles revealed dramatic changes in dynamics caused by slight modifications of the content of hydrocolloidal system. An effect of hysteresis during heating – cooling cycles was observed for agar-based gels. Analysis of the data allowed to determine the rotational and translational correlation times of components within the system, i.e. biopolymer chain and water fractions differing in mobility.

REFERENCES

[1] Kruk, D., Meier, R. & Rössler, E.A. (2011) Translational and rotational diffusion of glycerol by means of field cycling ^{1}H NMR relaxometry. *The journal of physical chemistry. B*, 115, 951–7.

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