Title:

Effect of Fat Crystal Network Organization on Time Domain NMR Parameters

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The knowledge of the physical properties of the triacylglycerol crystal network in fats is a real challenge for food industry, as the crystal network organization has an impact on many food properties such as texture, sensory taste and extended shelf life. Although Time Domain NMR (TD-NMR) is now the reference technique to assess the solid fat index in food, all the possibilities of this technique are not fully exploited. Several NMR studies have been performed in order to evaluate its efficiency for the determination of polymorphism and have shown some interesting results about the capacities of the technique. Indeed, the distinction has been possible through second dipolar moment (M_2) and spin-lattice relaxation time (T_1) measurements. However, properties of fat crystal network also depend on size aspects, at crystal level as well as at network level.

We performed ^1H T_1 relaxation time and M_2 measurements of triglycerides at low field NMR (0.47 Tesla) to get more information on the fat crystal network, and specifically on crystal sizes. The first step was a study based on pure triglycerides where the influence of supercooling was probed. It has been shown that T_1 was sensitive to the nucleation and crystal growth processes. The next step was a study on a mixture of a low melting temperature triglyceride and a high melting temperature triglyceride. It has been highlighted differences in crystallization and polymorphism behavior between the two compounds. NMR measurements of a solid-liquid system as a function of storage time have shown an increase in the T_1 of the fat crystals in the network, whereas the M_2 values remained constant. This was related to the increase of cluster sizes in the fat crystal network during aging. All these results had shown that the T_1 relaxation measurement was more related to the crystal network organization than to the polymorphism.