Numerical approach for NMR-based analysis of water mobility in wheat flour dough

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The understanding of the breadmaking process requires to understand the changes in water mobility of dough. The dough ingredients as well as the processing conditions determine the structure of baked products which in turn is responsible for their apparence, texture, taste and stability. The transition from wheat flour to dough is a complex process in which several transformations take place, including those associated with changes in water distribution [1]. The molecular mobility of water in foods can be studied with proton nuclear magnetic resonance (1H NMR). Low-resolution (LR) 1H NMR has been mainly used to measure the transverse relaxation times (T2) in dough and bread [2]. In this study, the measured T2 was used to investigate wheat dough development during mixing. The interactions of the flour polymers with water during mixing reduce water mobility and result in different molecular mobilities in dough. The molecular dynamics in heterogeneous systems are very complex. From a mathematical point of view the NMR relaxation decay is generally medelled by the linear superposition of a few exponential functions of the relaxation times. This could be a too rough model and the classical fitting approaches could fail to describe physical reality. A more appealing procedure consists in describing the NMR relaxation decay in integral form [3] by the Laplace transform (LT). In this work an algorithm for the LT inversion is considered and compared with other classical numerical techniques.

References

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