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Microstructure and texture evolution of foods during cooking is difficult to characterize, because conventional techniques cannot analyze the internal structure, while preserving product's integrity. For apple, one of the most processed fruits, understanding thermal degradations in essential. Such phenomena was thus approached with *in-situ* quantitative NMR during the cooking process.

Five Golden Delicious apples were sampled in four 10 mm long and 5 mm diameter cylinders. Each of the twenty samples was sealed in parafilm. The thermal treatments were performed *in situ* at 9.4 T using a 5-mm diameter microimaging RF coil. A controlled hot air flow cooked the sample from 20 to 60°C, 2°C-step. After 6 min for stabilization at each temperature plateau, T2 measurement were performed with a CPMG pulse sequence (τ=125µs, TR=5s, 256 echoes, acquisition duration=2min30s).
All the echo decay curves were analyzed using non-negative least squares algorithm [1]. An insight to the evolution of the internal structure was gained by studying the resulting T2 distribution.

The T2 distributions displayed two distinct patterns before and after 53°C. Indeed, the T2 of vacuolar, cytoplasmic and cell wall compartments evolved little before 53°C with a marked shift in the T2 value of the vacuolar fraction at 53°C (from 270 ms to 200 ms) along with the disappearance of the cytoplasmic fraction. This critical temperature is in accordance with firmness changes measured on samples cooked at various temperature.

This study points out the powerful of multiexponential T2 analysis in resolving subcellular changes during apple *in situ* cooking at high magnetic field. It provides longitudinal information about structure change, probably attributable to the membrane degradation [2], during the whole process.

[1] Istratov, A. A. and O. F. Vyvenko, Rev. Sci. Instrum. (1999).
[2] Gonzalez, M. E., et al, J. Food Sci. (2010).