
Assessing changes in lentils texture during hydrothermal treatment.

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The changes of lentils texture during cooking obey different mechanisms, increase of water content in the seed, starch melting, cell-walls disrupting, the complexity of which is increased by the heterogeneity of the seeds, their genetic and environmental diversity. The aim of this work is to develop a method for measuring texture in order to tackle these mechanisms, by testing different lentil batches.

Three lentils batches, with different canning behaviors (A= conform, B, C = non conform, nc) were provided by Cofigeo (F12-Capdenac). Their compositions, especially in cell wall polysaccharides (CWP), was determined by chromatography and spectrophotometry. Hydration kinetics were determined by soaking at 25 and 95°C and fitted by Peleg's model. Cooking time distribution was measured using a specific device recently developed in our laboratory, inspired from Mattson cooker. Cooking time distributions, fitted by a Gompertz model, showed that both nc batches (B, C) display shorter characteristic cooking time ($t_c < 10\text{mn}$) than conform batch (A) ($t_c > 10\text{mn}$). Moreover, hydration kinetics showed that, at 95°C, the water content MC (dry basis) =1.3 was reached after 25mn, 15 and 12 mn for A, B and C, respectively. These differences may be attributed to the larger content of A in CWP (14%db) than of B and C (8.2 and 11.5 resp.), since CWP are supposed to act as water barriers. Texture was assessed by compression test using disk ($\varnothing 10\text{ mm}$) applied to one lentil, the most repeatable from the systems tested. From the linear part of the stress/strain curve, apparent modulus E_a value was derived. Surprisingly, for the same MC value (=1.3) and for the three batches, E_a values of cooked lentils at 95°C (2.7 to 4 MPa) were about twice larger than those of the lentils soaked at 25°C ($E_a = 1.7$ to 2 MPa). This result might be explained by two mechanisms: first, the strengthening effect of starch swelling at large temperature, and second, the hydrolysis of CWP by endogenous enzymes that were (re-)activated at low temperature (25°C). Whatever the mechanism, the implementation of biochemical and physical methods allowed us to explain the difference of behaviors of lentils during industrial processing.