Understanding the physicochemical processes involved in cooking legumes to drive water transfer

BOHUON P. (1,2), LEFRE C. (2), MESTRES C. (3)
1 Institut Agro, Montpellier, France
2 Qualisud, Univ Montpellier, Cirad, Institut Agro, Avignon Universit Universitde La Rnion, , Montpellier, France
3 Cirad, UMR Qualisud, Montpellier, France

The cooking quality of pulses depends essentially on water transfers; they are thermally thin objects. These water transfers are driven by multiple thermal events related to starch (gelatinization, melting) and proteins (denaturations). The objective of this study was to understand the physicochemical processes involved in the cooking of legumes in order to propose technological ways of innovation (facilitating their preparation mode, ready to use...). This study identified, at steady state, the phase changes of starch and protein macronutrients of legumes (lentil, chickpea, bean), using differential scanning calorimetry (DSC) for the separation of thermal events (starch/protein). Modeling by de-summarization of DSC peaks and representation of binary water/starch and water/protein phase diagrams was developed. The combination of these two phase diagrams has made it possible, by adjustment, to represent the behaviour of the ternary water/starch/protein system and to propose a distribution of water between starch/proteins. For example, for chickpeas and beans, the amount of water attributed to the starch increases from less than 10% of the total water to about 35-45% at the end of cooking. The results of this work were able to model the water/starch/protein equilibrium states and will facilitate the representation of dynamic water transfer model in legumes during pre-soaking and cooking.