

## **Characterization of methods to better understand the parameters influencing the Hard To Cook phenomenon**

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In addition to the environmental benefits of restoring nitrogen to the soil without adding fertilizer, legumes offer significant nutritional benefits. However, one of the difficulties encountered in the processing of legumes in industry is the so-called "Hard to Cook" phenomenon.

This study aims to remove the scientific barriers to understanding the Hard to Cook phenomenon. The "red bean" matrix is chosen as a model for this study.

In order to maximize the reliability of the analytical results, the study was carried out on 4 selected red bean batches: 1 control batch from France with Easy To Cook propensity and 3 batches with Hard To Cook propensity.

These batches of kidney beans were also stored under temperature and humidity conditions that favored the development of the Hard to Cook phenomenon. This was done in order to have the most contrasted batches possible.

During this project, the modeling of hydration kinetics, the analysis of mass densities, the porosity of seed structures, the composition of layers within the seeds, the fraction of soluble pectins were carried out and allowed to correlate the Hard to Cook phenomenon to the beans composition and especially its structure.

These analyses on the biochemical mechanisms and on the determination of the hydration and water diffusion kinetics, allowed to contribute to a better understanding and to orientate towards detection and sorting methods of Hard To Cook beans

Data analysis on the spectral part seems promising. The PCAs of the hyperspectral images show that the control batch seem to imbibe more rapidly than the Hard To Cook batches. This is consistent with observations of DCS and sigmoid hydration curves.

A portable infrared spectrometer (MicroNIR) was tested to study the Hard To Cook criterion.

The study of the results by Principal Component Analyses showed that this equipment seems able to differentiate Hard To Cook seeds incorporated among control seeds.

However, further studies are needed to validate the ability of this equipment to classify Hard To Cook or Easy To Cook seeds with sufficient robustness.