A NMR contribute to understand fresh-cut melon behaviour during storage

Joana F. Fundo[1], Alexandra Carvalho[2], Gabriel Feio[2], Cristina L.M. Silva[1], Mafalda A.C. Quintas[1,3]

1. CBQF, Escola Superior de Biotecnologia, Universidade Católica Portuguesa, Porto, Portugal
2. CENIMAT-I3N, Departamento de Ciência dos Materiais, Lisboa, Portugal

3 - IBB, Centre of Biological Engineering, Universidade do Minho, Braga, Portugal

Introduction

Solid-state wideline NMR spectroscopy is a useful technique in predicting physicochemical changes and understanding structures and dynamics of complex macromolecular systems. **The purpose of this work was to use NMR methodology as a tool to evaluate fresh-cut melon during storage period.** Melon, as the most of biological materials, consists largely of water and macromolecules rich in protons, and since water protons are major contributors to the proton relaxation, the interactions between water and macromolecules represent the most important factors affecting the proton relaxation process. Moreover, NMR could also be used for monitoring fruit quality during storage, due to the existence of water interactions degradation, and structure and chemical compounds changes.

Materials and Methods

Washed in running cold water

Dipped in hypochlorite solution

Placental tissues / seeds removed

Mesocarp prepared in 2.5 cm^3 cubes

Randomly placed in clamshells ~175g

Stored at 5ºC / during 7 days

3 replicates (clamshells) / experiment

Experimental trial carried out twice

Fresh-cut melon analysis during storage

Total colour difference

- CIE L* a* b* colour space / with a Konica-Minolta CR-400 chromameter
- surface colour / 5 cubes from each three replicate clamshells

Firmness

- TA-XT2 Plus texture analyser
- maximum force/ 5mm diameter probe to perforate 5mm into tissue (lateral surfaces)

Water activity

- dew point hygrometer / 3 measurements for each replicate

Microstructure observation

- optical and scanning electron techniques / photos of 3 sections from each fruit

NMR determination

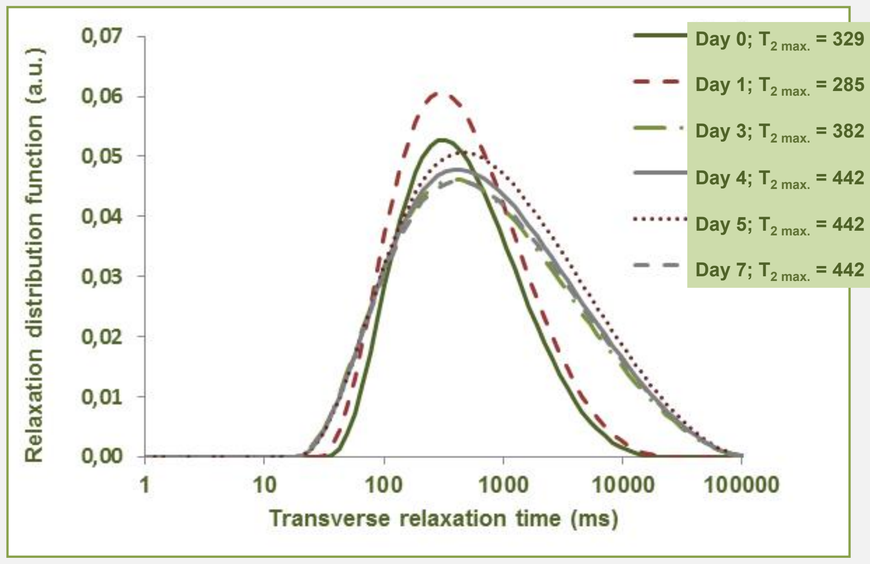
Free Induction Decay and Spin Spin Relaxation

Bruker AVANCE III 300 MHz

sample water transverse relaxation time was determined (T_2) as a continuous distribution

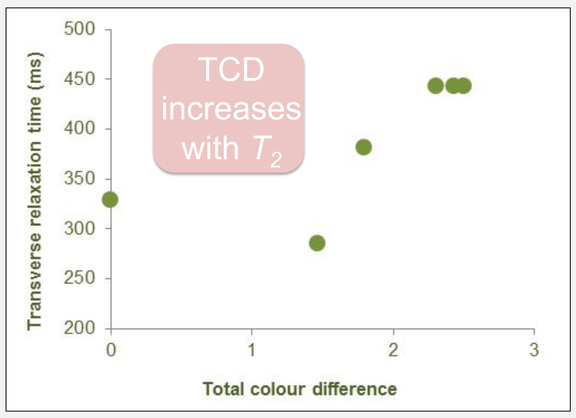
Results and Discussion

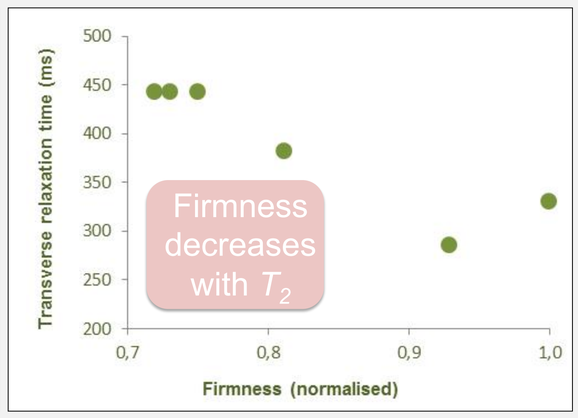
Distribution of water proton relaxation times

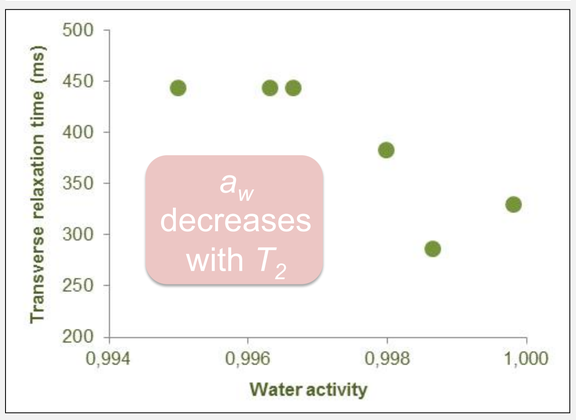


One class of water fluidity → The one present in cells after processing → Affected by processing and storage

Transverse relaxation time as function of quality parameters



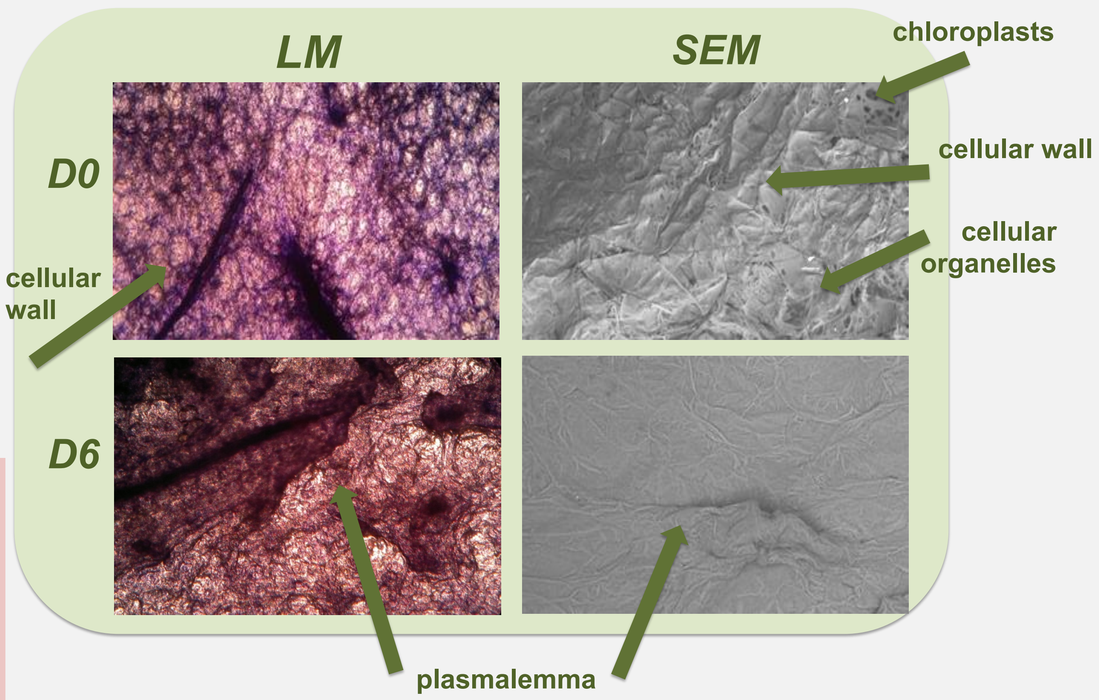




<u>TCD:</u> translucency/ water-soaking symptoms - disruption of cellular structures ⟷ <u>Firmness</u>: cell wall degradation - leakage of cellular osmotic solutes

a_w: the thermodynamics activity of water is far less relevant for processing and storage than structure related properties

Light and scanning electron microscopic images



Conclusions

- ✓ T_2 distribution function presents one peak corresponding to cells total water, that modifies with storage;
- ✓ Preliminary analysis fitted NMR results using a multi-exponential model, which revealed weaknesses;
- ✓ Quality parameters analysed demonstrated a relationship with the value of T_2 where the distribution function is maxima, and microscope images support results;
- ✓ Results show the usefulness of NMR concept for food science, and particularly for studies on degradation reactions and stability in complex food systems.

Acknowledgements

Authors Joana F. Fundo acknowledges Fundacão para a Ciência e a Tecnologia grant SFRH/ BD / 62176 / 2009.
This work was supported by National Funds from FCT through project PEst-OE/EQB/LA0016/2011.