HAL
open science

Protein Thermal Denaturation of Beef Muscle: Neutron Imaging and spectroscopies

Simone Scussat, Elias Bou-Maroun, Christine Fant, Philippe Cayot, Camille Loupiac

To cite this version:

Simone Scussat, Elias Bou-Maroun, Christine Fant, Philippe Cayot, Camille Loupiac. Protein Thermal Denaturation of Beef Muscle: Neutron Imaging and spectroscopies. Neutrons and food, Jul 2014, Paris, France. hal-02359464

HAL Id: hal-02359464

https://institut-agro-dijon.hal.science/hal-02359464

Submitted on 12 Nov 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Protein Thermal Denaturation of Beef Muscle: Neutron Imaging and Spectroscopies

Scussat S.[1,2], Bou-Maroun E.[1], Fant C.[3], Cayot P.[1], Loupiac C.[1,2]
[1] Équipe PAPC, UMR PAM, Université de Bourgogne – AgroSup Dijon, Dijon, France.
[2] Laboratoire Léon Brillouin, CEA – CNRS, CEA Saclay, Gif-sur-Yvette, France.
[3] Groupe EMN 3A, AgroSup Dijon, Dijon, France.

Neutrons and Food
Paris - France
9 to 11 of July 2014

Context of Project

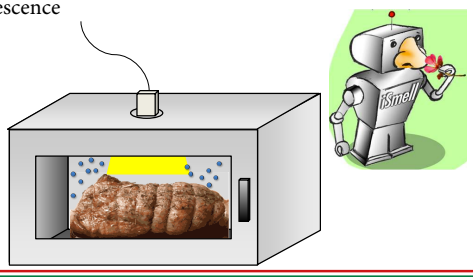
Open Food System is an academic and industrial projet with the purpose to follow meat cooking without any intrusion.

It concerns two main parts

1) Sensor Development

a) Spectroscopic Sensor
- Visible / InfraRed
- Fluorescence

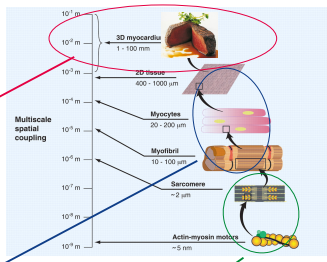
b) Olfactometer Sensor



2) Biochemistry of Muscle Cooking

Food Science Approach:

Macroscopic scale
Sensory Analysis
- Colour
- Texture
- Flavour



Our Approach:

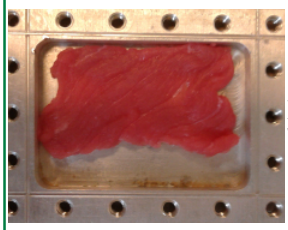
Microscopic scale (Neutron Imaging)

Molecular scale (Spectroscopies)

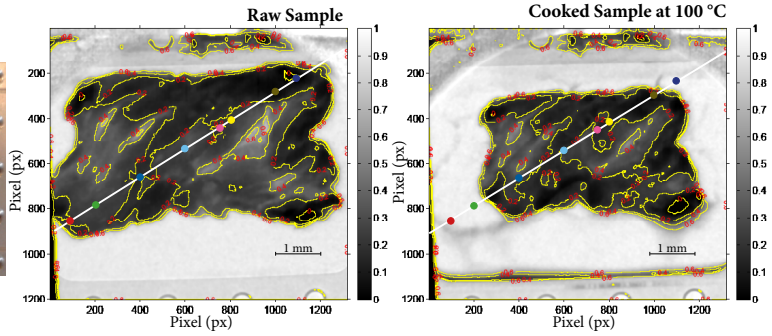
Neutron Imaging during Cooking

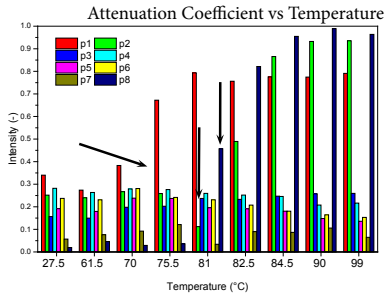
Neutron Imaging was used to follow muscle **morphology** changes (protein contraction) and **juice migration** inside the sample (through the evolution of Attenuation Coefficient)

Optical Image of Muscle
Raw Sample
Thickness: 2 mm



Superposition of Contour Plots on Neutron Images



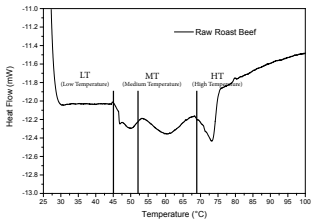


Main changes of attenuation coefficient take place at the **edge** of the sample

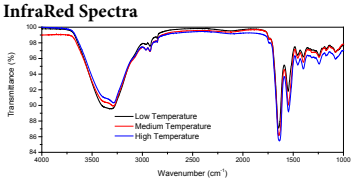
Spectroscopies: IR and Fluorescence

InfraRed and Fluorescence were carried out on **muscle** samples with the purpose to detect the **spectroscopic signature** of **proteins at a particular cooking degree**

Calorimetry
Used to determine the cooking temperature parameters for the samples

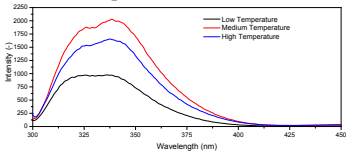


InfraRed Spectra



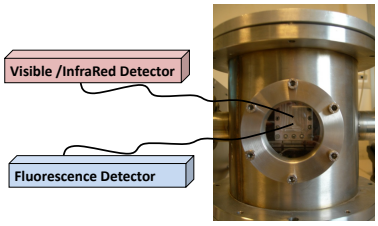
Principal Component Analysis - InfraRed
Separation on Cooking Degree:
- Beef: LT ≠ MT and HT

Fluorescence Spectra (ex. 291 nm)



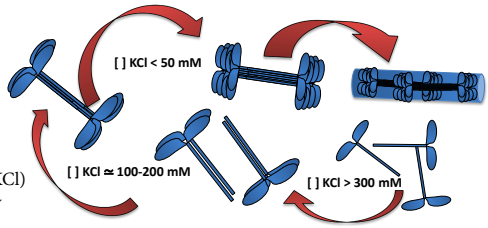
Principal Component Analysis - Fluorescence
Separation on Cooking Degree:
- Beef: LT ≠ MT and HT

Future



Microscopic Scale on Neutron Imaging:
- Coupling Neutron Imaging with Surface Spectroscopies (IR and Fluorescence) during heating Process

Molecular Scale:
- Myosin Thermal Denaturation depending on ionic strength (KCl)
- Structural Studies by IR, Fluorescence and SANS spectroscopy



Acknowledgement:
Open Food System is a research project supported by Vitagora, Cap Digital, Imaginove, Aquimer, Microtechnique and Agrimip, financed by the French State and the Franche-Comté Region as part of The Investments for the Future Programme managed by Bpifrance.
www.openfoodsystem.fr

References:
Chien et al., 322 (5907), 1494-1497 (Science)

View publication stats