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:


HAL Id: hal-02359464
https://hal-agrosup-dijon.archives-ouvertes.fr/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-Maroune E.1, Fant C.1, Cayot P.1, Loupiac C.1,2

1Laboratoire Léon Brillouin, CEA – CNRS, CEA Saclay, Gif-sur-Yvette, France.
2 Équipe PAPC, UMR PAM, Université de Bourgogne – AgroSup Dijon, Dijon, France.

Context of Project
Open Food System is an academic and industrial project with the purpose to follow meat cooking without any intrusion. It concerns two main parts:

1) Sensor Development
   - Spectroscopic Sensor
     - Visible / InfraRed
     - Fluorescence
   - 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).

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:
Chen et al., 322 (5907), 1494–1497 (Science)