Intelligent food packaging: RFID bio-based sensing label to monitor food shelf life
Jean Clency Fabien Bibi, Nathalie Gontard, Carole Guillaume, Brice Sorli

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Intelligent food packaging
RFID bio-based sensing label to monitor food shelf life

ECOBIOCAP
Ecoefficient Biodegradable Composite Advanced Packaging

Fabien BIBI – PhD Student (2012 – 2015)
Director: Nathalie GONTARD
Co-directors: Carole GUILLAUME, Brice SORLI
Objective

Development of the sensing bio-material

Food quality indicator via sensor

Detection

Threshold concentration in volatile markers of food degradation

Coupling of RFID (Radio Frequency IDentification) tag with the sensor

RFID: Wireless system for transferring data from a tag attached to an object
Vegetal protein: Wheat Gluten

• “bio” material and can be coated onto a substrate.
• displays sensitivity to gases and vapors (considered as food quality markers).
• exhibits electrical properties and dielectric properties (Dipoles, charges, charged molecular chains).
Effects of electric field on Wheat Gluten

- Alternating electric field impacts:
  - Movement of molecular chain,
  - Rotation of dipoles,
  - Movement of charge.

Energy induced in the wheat gluten material.

Energy stored (dipoles, polarization): rep. by permittivity ($\varepsilon'$).

Energy loss (conduction, friction): rep. by dielectric loss ($\varepsilon''$).
Effects of relative humidity (RH) on wheat gluten

**Permittivity**

- Increase of permittivity with increase in RH.
  - More polarizations because of water (dipole).
  - Increase mobility of molecular chain and dipoles.

( Electromagnetic properties: Dielectric properties of food)

**Dielectric loss**

- Increase in dielectric loss with increase in RH.
  - Increase mobility of charges in the network. (J. Ahmed, 2007).
RFID (Radio Frequency IDentification)

How does RFID work?

- Wave emission
- Wave captured by the antenna
- Power supplied to microchip
- Wave emitted back to the reader

Reflected Power and reading distance
RFID + wheat gluten coated: Effects of relative humidity

- Effects of humidity on wheat gluten (permittivity and dielectric loss) => Modification of electrical property of RFID antenna.
  - Modification in reflected power.
  - Modification in reading distance.

RFID tag with wheat gluten layer deposited – Impact on reading distance

![Graph showing the impact of moisture and drying on RFID reading distance](image)
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Thank you for your attention!!