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

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RFID bio-based sensing label to monitor food shelf life

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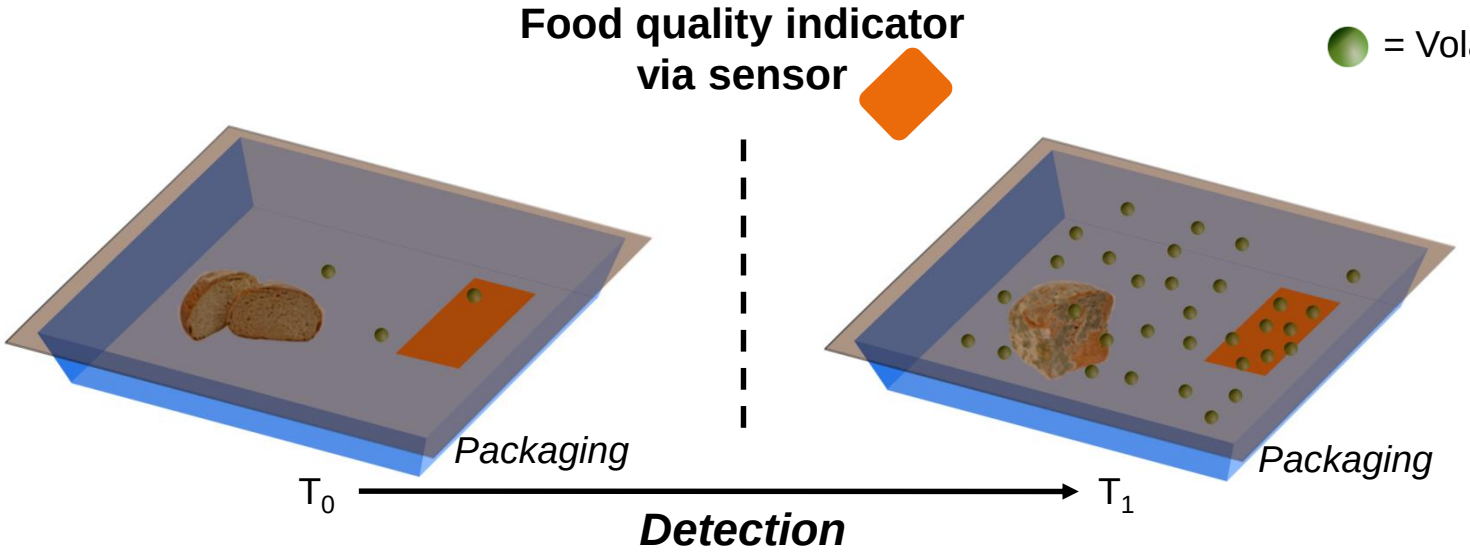
Objective

Development of the sensing bio-material



Threshold concentration in volatile markers of food degradation

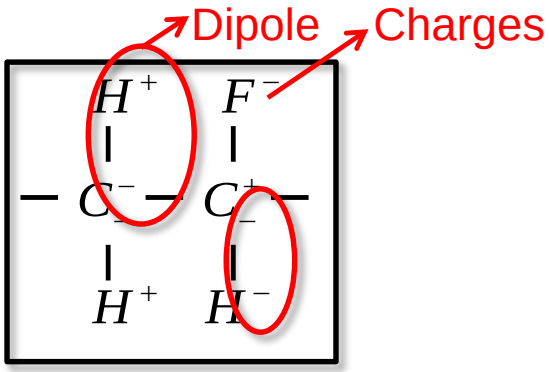
Coupling of RFID (Radio Frequency IDentification) tag with the sensor

RFID: Wireless system for transferring data from a tag attached to an object

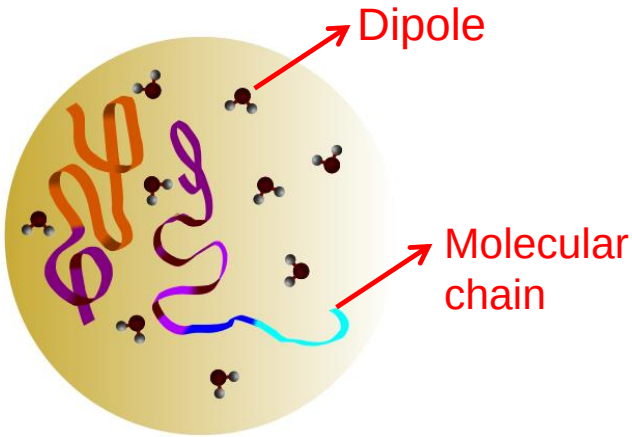
Sensor: Dielectric material

Vegetal protein: Wheat Gluten

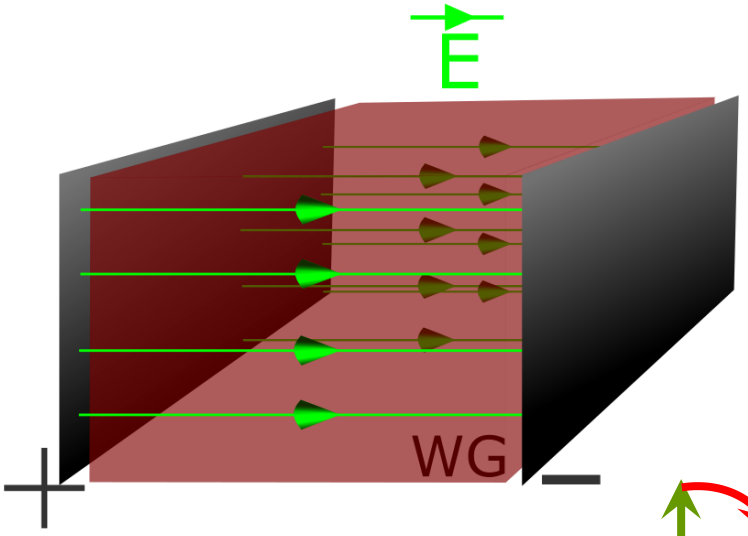
- “bio” material and can be coated onto a substrate.
- displays sensitivity to gases and vapors (considered as food quality markers).
- exhibits electrical properties and dielectric properties (Dipoles, charges, charged molecular chains).



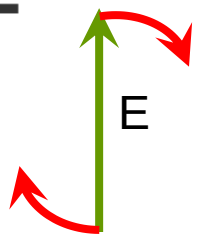
Dissymmetric molecule
(High permanent dipolar moment)



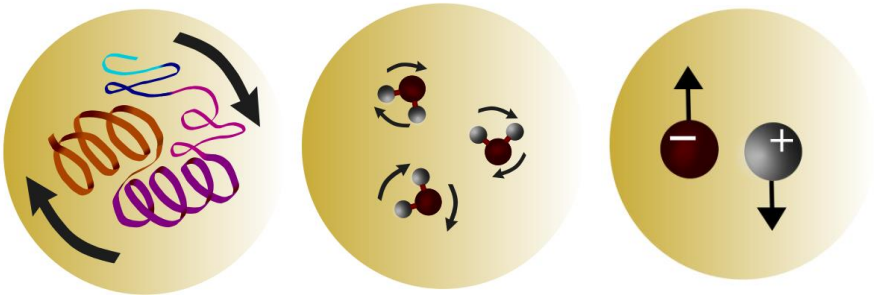
Effects of electric field on Wheat Gluten



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



Alternating field

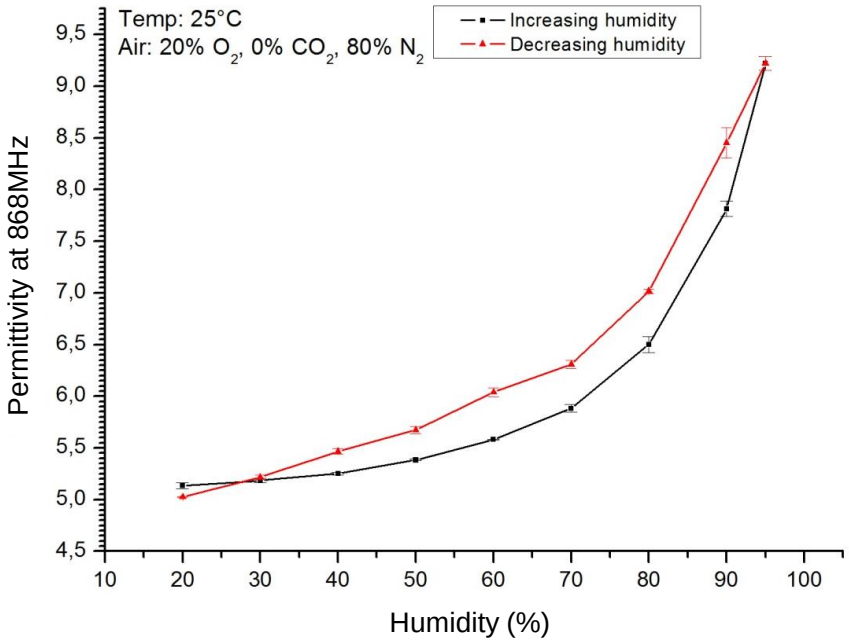


⇨ Energy induced in the wheat gluten material.

⇨ **Energy stored** (dipoles, polarization): rep. by **permittivity (Ɛ')**.
Energy loss (conduction, friction): rep. by **dielectric loss (Ɛ")**.

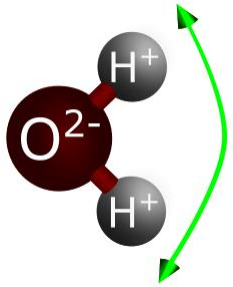
Effects of relative humidity (RH) on wheat gluten

Permittivity



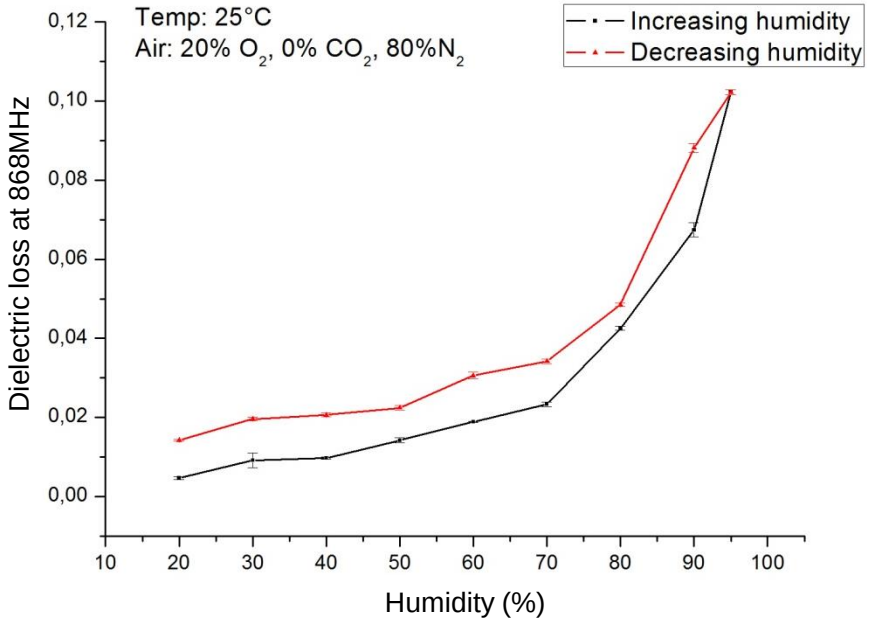
Increase of permittivity with increase in RH.

- More polarizations because of water (dipole).
- Increase mobility of molecular chain and dipoles.

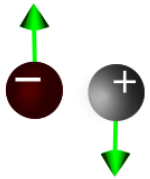


(Electromagnetic properties: Dielectric properties of food)

Dielectric loss



Increase in dielectric loss with increase in RH.

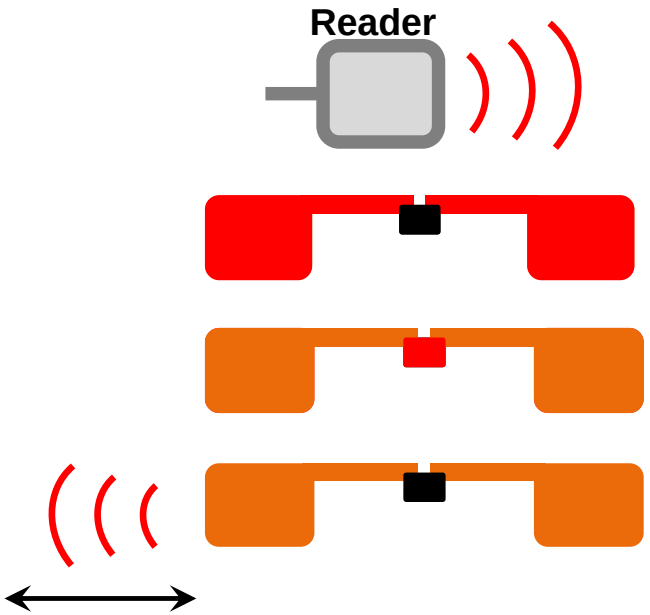


- Increase mobility of charges in the network. (J.Ahmed, 2007).
- Lossy medium. (S.Ryyniinen,1995).

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

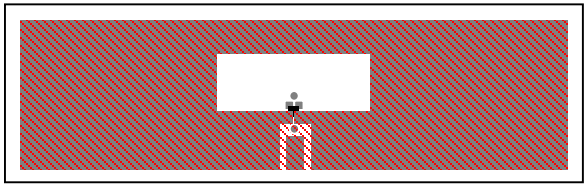


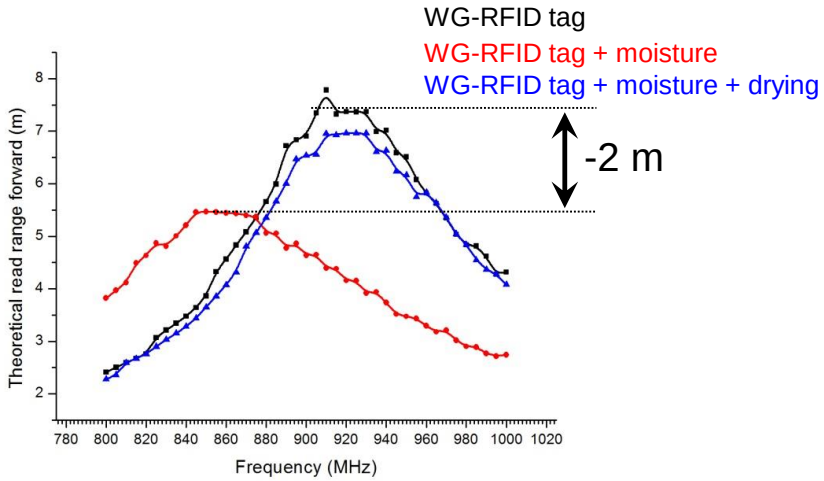
RFID + wheat gluten coated : Effects of relative humidity

• 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





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Thank you for your attention!!