

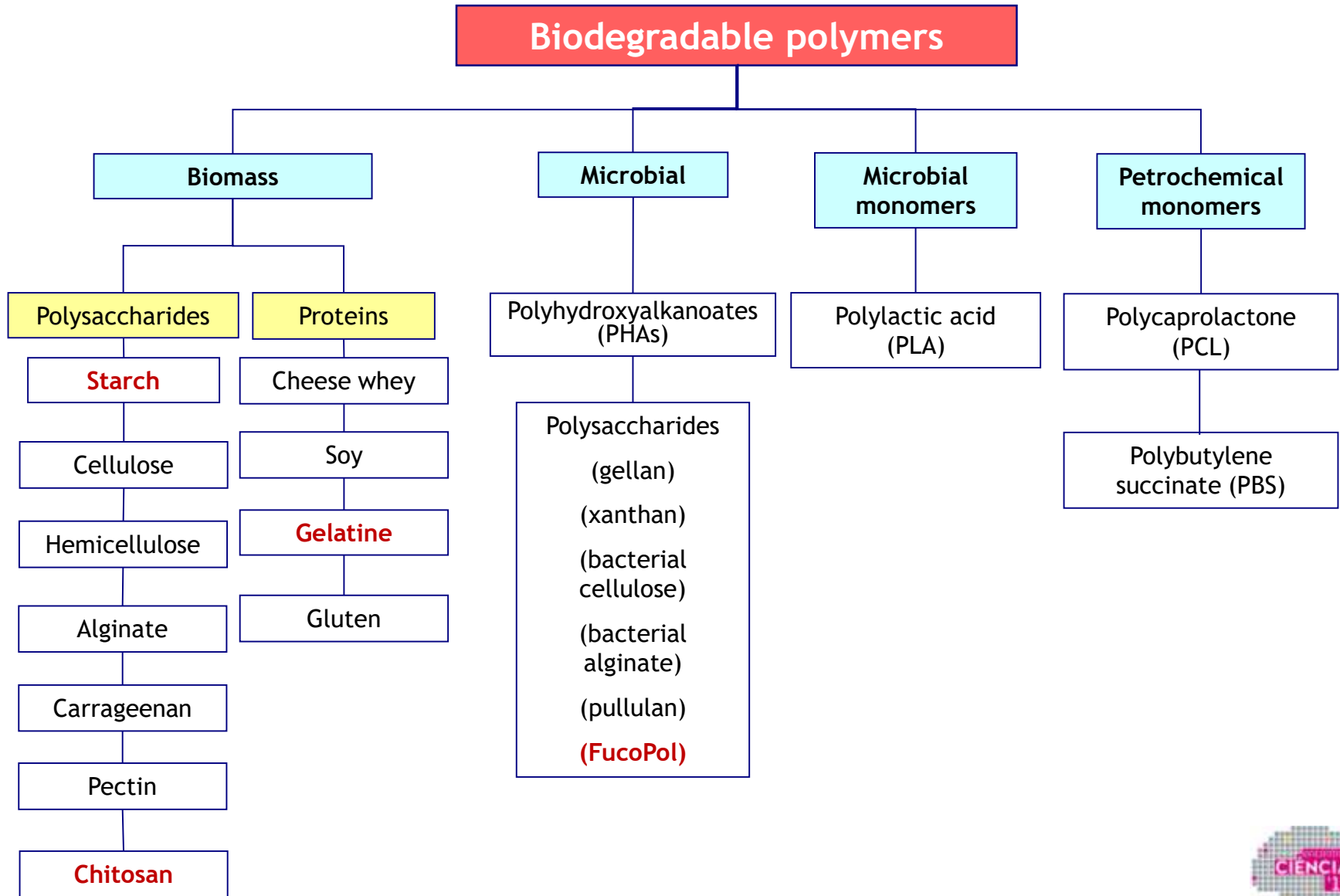
# Sustainable packaging systems based on natural polymers for food products

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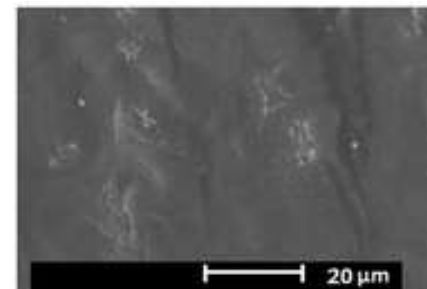
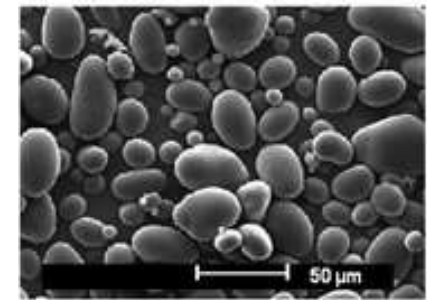
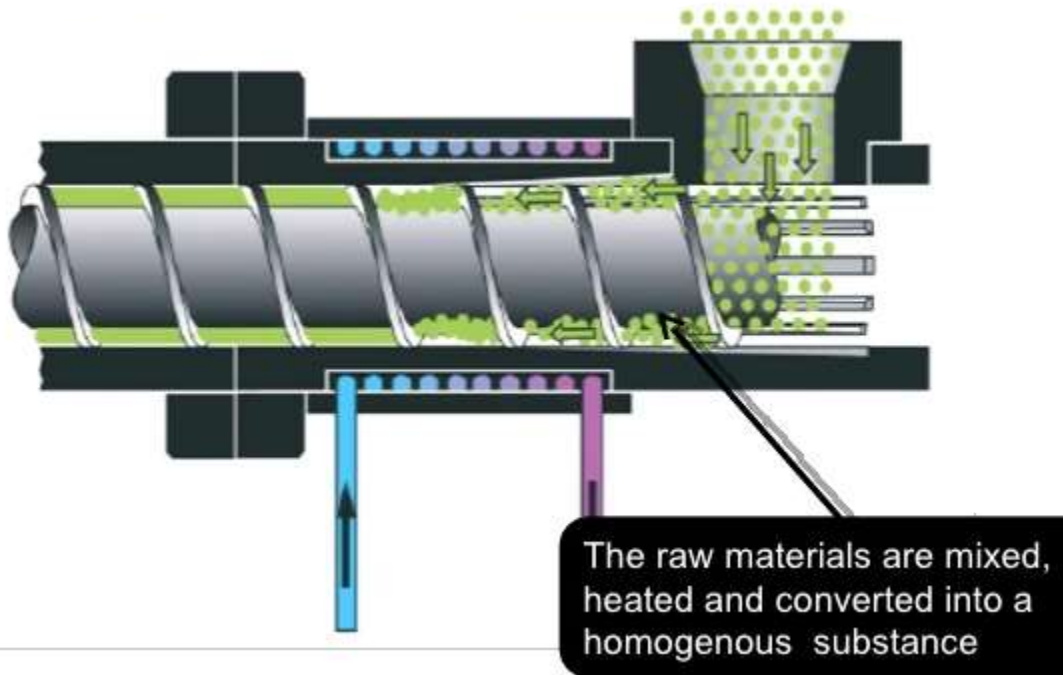
# Introduction



# Introduction

## Thermoplastic Starch

### ■ Extrusion



# Introduction



Figure 2. Products made with Mater-Bi® TPS bioplastic



# Introduction

## Thermoplastic Starch

- ❖ Novamont (Italy): biodegradable formulation based on **starch, cellulose and vegetable oils**



# Application of a Mater-Bi vs PVC

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- ❖ Characterization of a clinging film from Mater-Bi
- ❖ Application in the preservation of fresh fruits and vegetables
- ❖ Potential substitute of conventional PVC films



PVC



# Application of Mater-Bi vs PVC

Films properties at different relative humidity conditions

❖ **Affinity to water**

- Water absorption and vapour adsorption

❖ **Barrier properties**

- O<sub>2</sub> e CO<sub>2</sub>
- Water vapour

❖ **Mechanical properties**

- Tensile tests

RH (%)

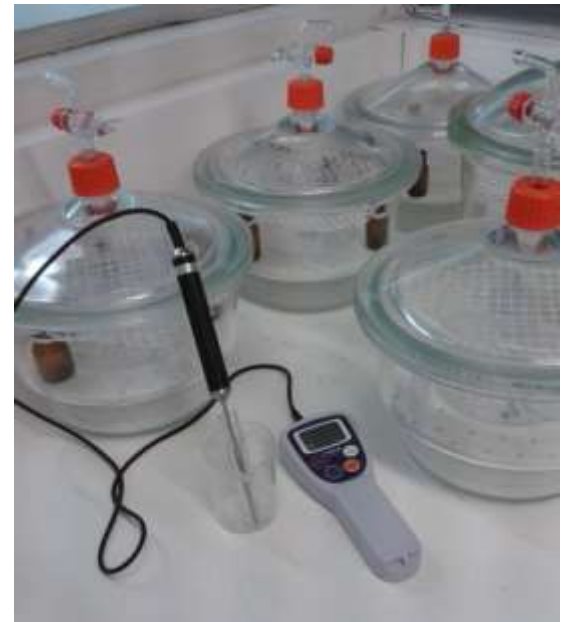
33.2

53.4

75.3

90.1

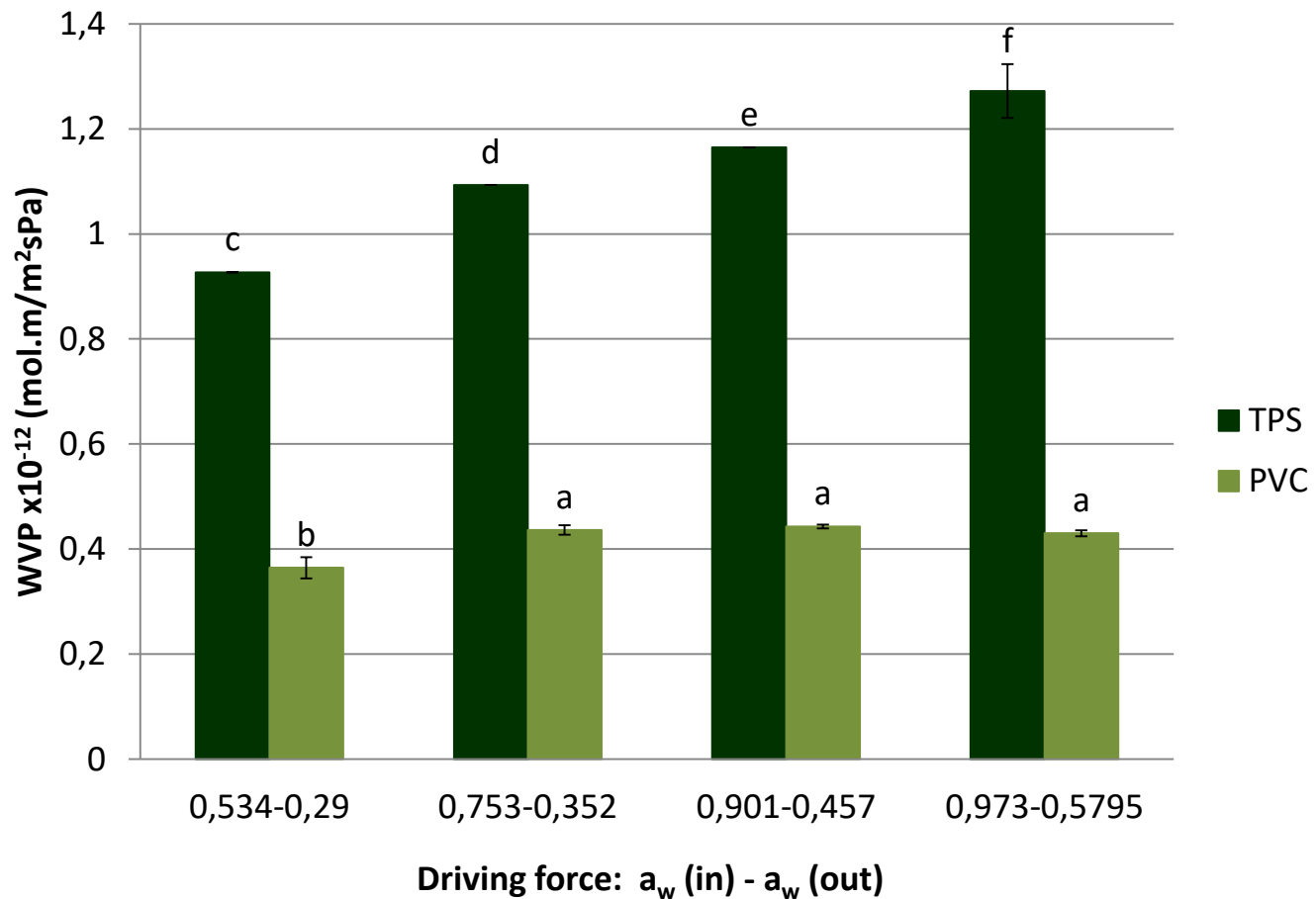
97.3



# Mater-Bi vs PVC

## Barrier properties

### Water vapor permeability



# Fresh spinach preservation

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## Samples:

- ❖ No film (NP)
- ❖ Mater-Bi film (TPS)
- ❖ PVC film (PVC)

## Preservation conditions:

- ❖  $T = 4^{\circ}\text{C}$
- ❖ 70% RH

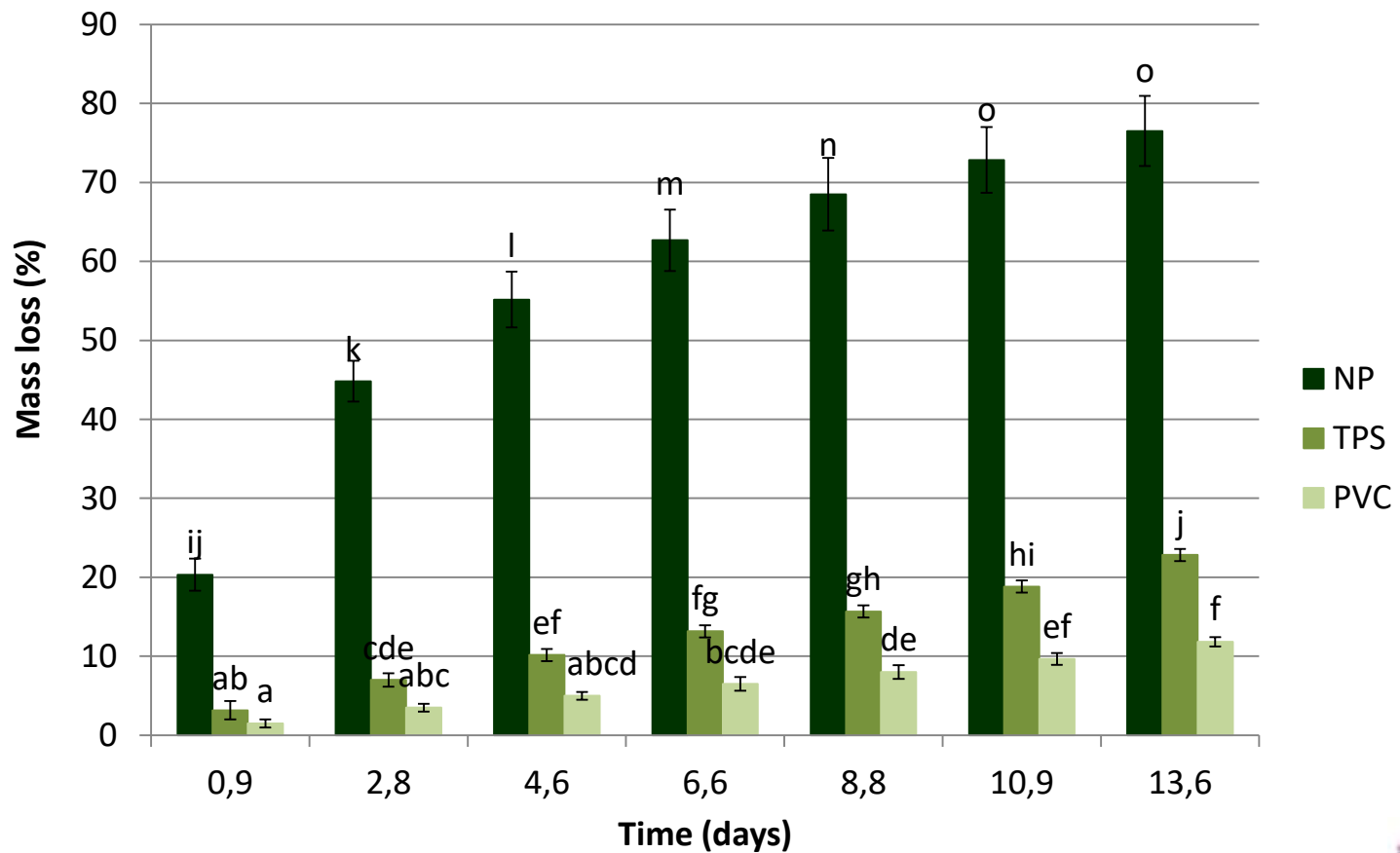
## Measured parameters:

- ❖ Mass loss
- ❖ Gas composition inside the package
- ❖ Texture



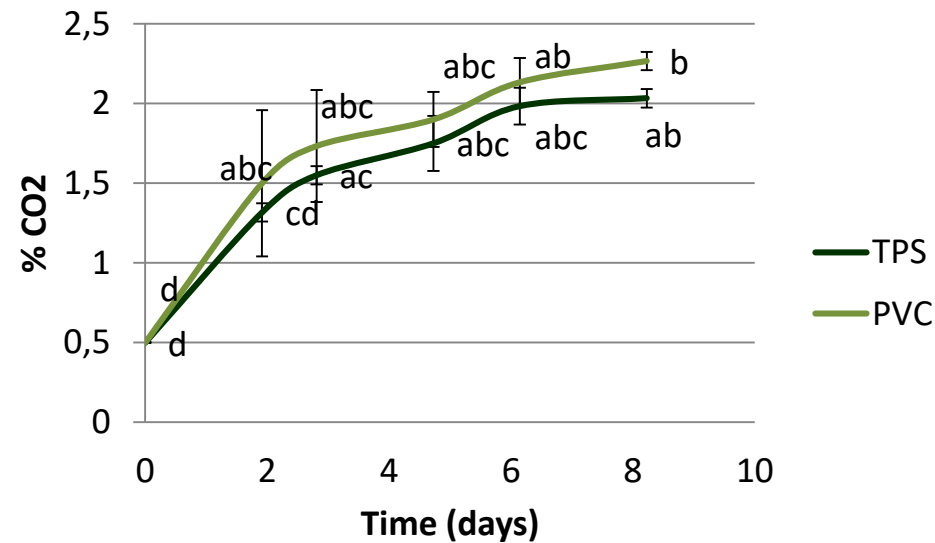
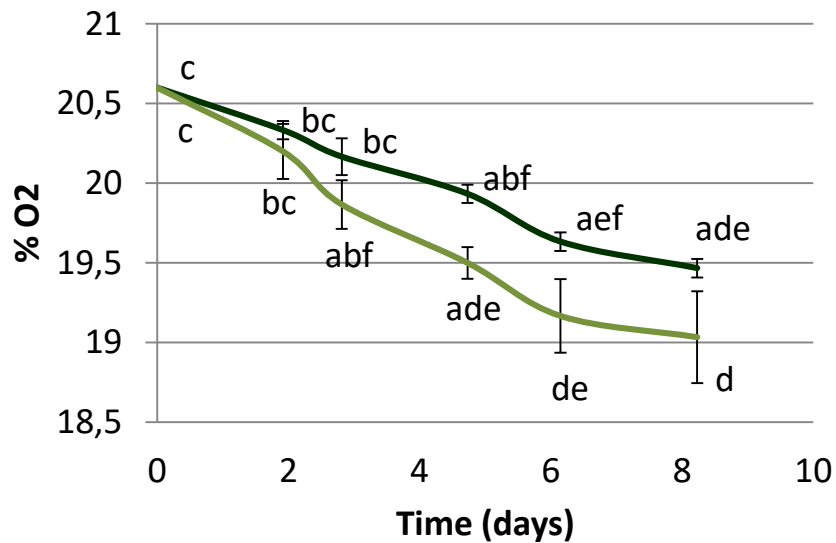
# Fresh spinach preservation

## Mass loss



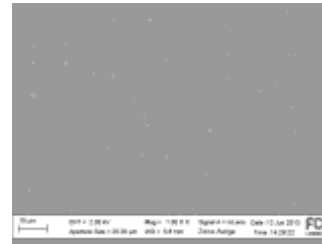
# Fresh spinach preservation

## Gas composition inside the package

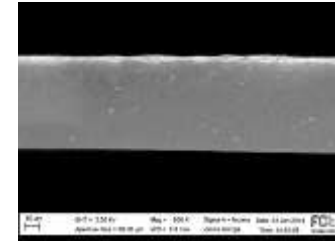


## Biodegradable films from microbial polysaccharides (FucoPol)

## Single-layer FucoPol films

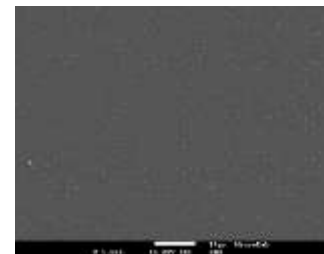


## Fucopol surface

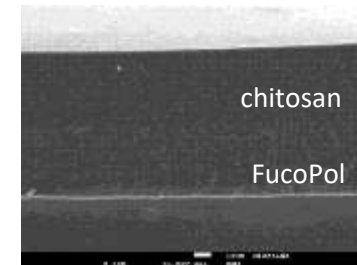


## Cross-section

## Bi-layer FucoPol/Chitosan films



## Chitosan Surface



## Cross-section

### Films characterization:

- Permeability to O<sub>2</sub>, CO<sub>2</sub> and water vapor
- Color and transparency
- Mechanical properties

**Collaboration: ISA - LEAF and FCT/UNL**

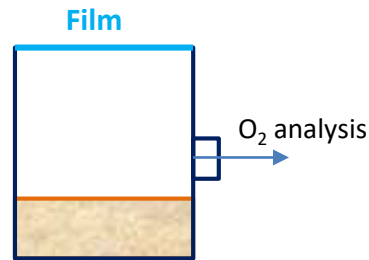


# Biodegradable films from microbial polysaccharides (FucoPol)

## Walnut oil storage

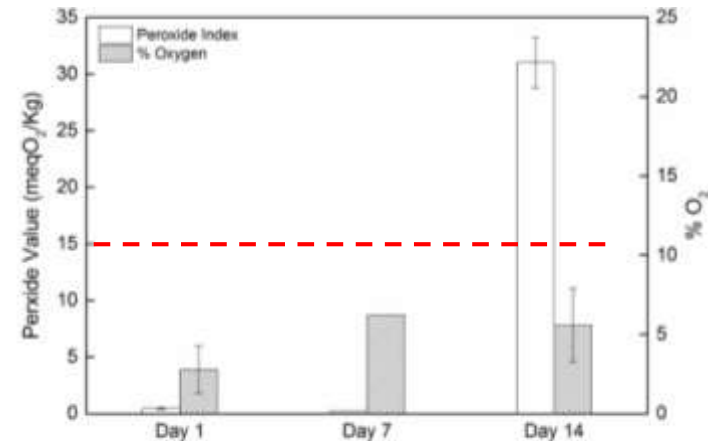
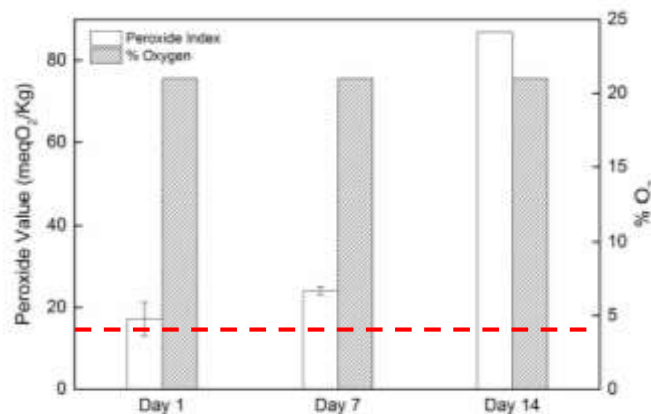
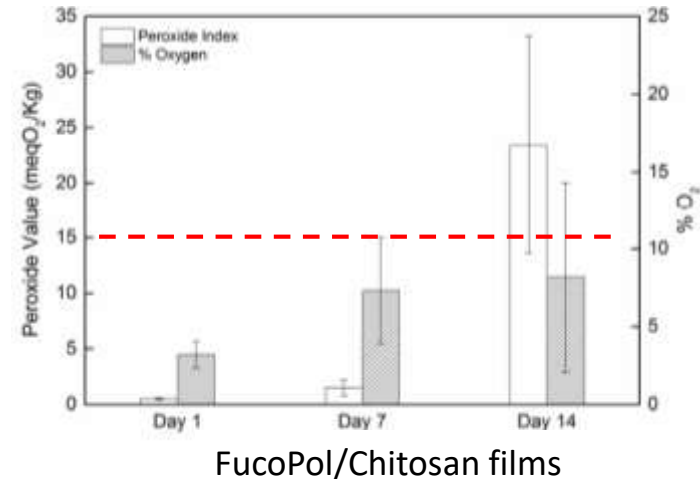
### Storage conditions:

- $38 \pm 2$  °C
- 35% RH
- 24h light
- 14 days
- Flushing with N<sub>2</sub> (day 0)



### Film:

- Bilayer **FucoPol/Chitosan** films
- Commercial films (PA/PE)
- Without film



# Biodegradable active films from agro and pharmaceutical wastes



**Gelatin** residues from pharmaceutical industry

(polymeric matrix)



**Papaya peel powder** rich in antioxidants

(bioactive compounds)



**Commercial chitosan**

(polymeric matrix)



**Olive pomace** rich in antioxidants

(bioactive compounds)



**Films with antioxidant activity**



# Biodegradable active films from agro and pharmaceutical wastes

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## Storage of lard

### Packages:

- Gelatin films
- Gelatin + peel powder (7.5%)
- Commercial PE films

Heat sealed bags



### Storage conditions:

- $38 \pm 2$  °C
- 35% RH
- 24h light
- 22 days

### Evaluation of:

- Peroxide value
- Dienes
- Trienes

# Final remarks

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- **Biodegradable materials for food packaging? Yes, please.**
- **Are there constraints for their use? Yes, unfortunately.**
  - Cost
  - Need to design properties (mechanical, thermal, barrier)
  - Legislation (food contact materials)
  - Food security



# Agradecimentos

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**LEAF**

LINKING LANDSCAPE, ENVIRONMENT,  
AGRICULTURE AND FOOD

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Ana Rita Ferreira et al. (FCT/UNL)

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