

REFUCOAT

BIO-BASED RECYCLABLE PACKAGING



FROM PLASTICS TO POLICY: HOW CAN WE IMPROVE THE PERFORMANCE OF FOOD PACKAGING?

5 MAY 2020

10:00 – 12:00 CEST

&

7 MAY 2020

14:00 – 16:00 CEST

WWW.REFUCOAT.EU



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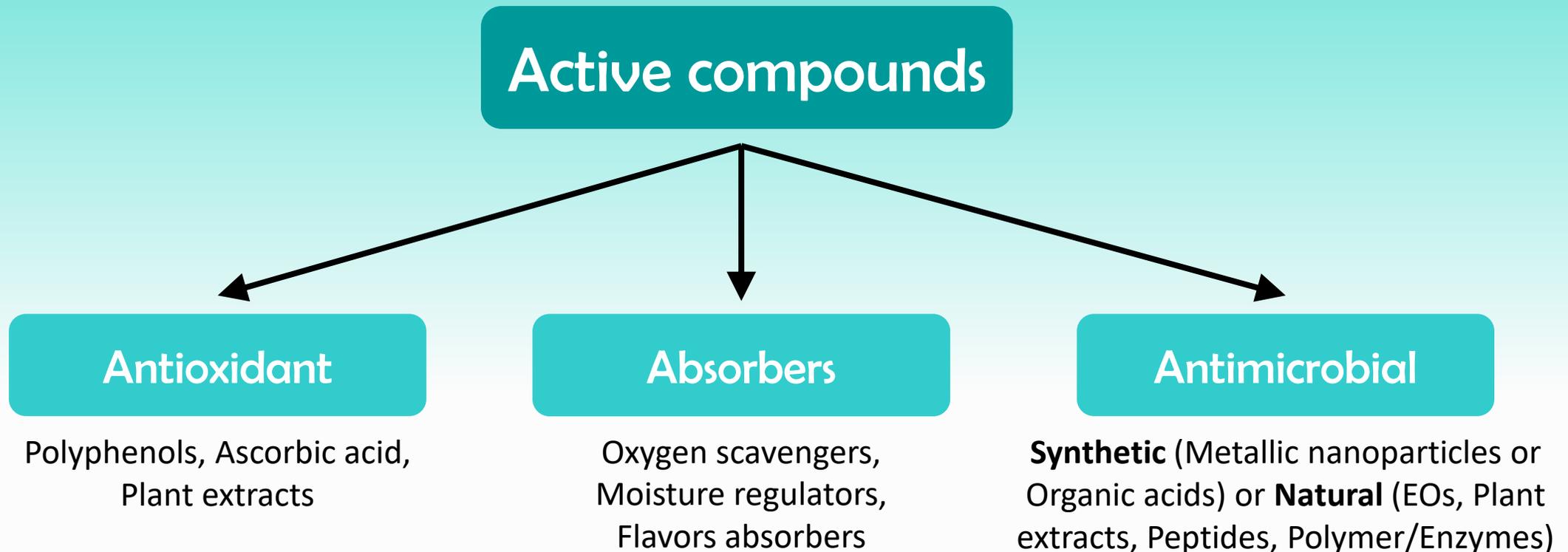
How do we optimise the properties
of coating materials for
application in food packaging?

REFUCOAT

BIO-BASED RECYCLABLE PACKAGING

ACTIVE FOOD PACKAGING SYSTEMS

To extend **Shelf-life** and/or to enhance **Safety** or **Sensory** properties while maintaining the **Quality** of the product



REFUCOAT: ANTIOXIDANT COATINGS



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Lipid Oxidation

- **Mechanism**

1. Lipids + O₂ → **Hydroperoxides** = colourless, odourless and tasteless
2. Hydroperoxides + time/t°/enzymes → low molecular weight compounds = responsible for rancid flavours and odours

- **Consequence**

- Nutritional quality
- Toxicity
- Off-odour
- Texture/Colour



- **Solution**

- **Avoid** oxygen inside the product and/or
- **Add** antioxidant compounds in the product and/or into or coated onto the packaging materials

Antioxidant Compounds

- **Primary**

Chain breaking retard the radical chain reaction by avoiding the propagation or initiation of radicals by hydrogen atom transfer to radicals

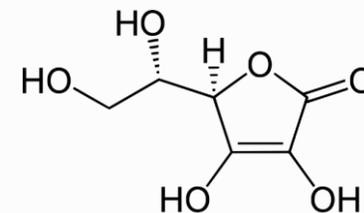
→ Phenolic antioxidants from plants, Rosemary extract or essential oil



- **Secondary**

Regenerating primary AO, chelating metals, giving acidic pH to the matrix. Sequester oxygen from the matrix.

→ Ascorbic acid and derivatives



Background on Antioxidant Coatings

Example of successful development of active coating : OliPHA

EXTRACT from **OLIVE WASTE WATERS**

80% Hydroxytyrosol: polyphenol found in olive leaves & oil,
with **high antioxidant activity**



Results

- Improvement of food quality attributes, especially related to the oxidation of the main food components
- Polyphenol extract can also act as an antimicrobial agent



Meat burgers & Gouda cheese

Background on Antioxidant Coatings

Challenges for the development of active coatings

- ✓ A **homogeneous coating solution** with an appropriate **viscosity** to obtain a **uniform coating**
- ✓ A good **adhesion** to the chosen substrate
- ✓ An **appropriate concentration of the active compound** to obtain **antioxidant effects** on the target food
- ✓ A **sustained release profile** of the active
- ✓ A **coating stability** during storage
- ✓ A **feasible wet coating application for industrial use**

Antioxidant Coatings: RefuCoat

Coatings development

Food products

- Potato chips
- Bread crumbs



Biobased film

- BioPE



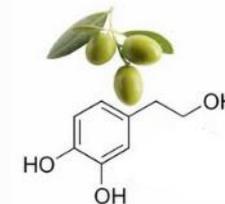
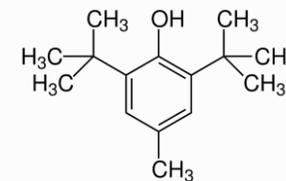
Biobased polymer

- Sodium alginate + plasticiser



Active compounds

- Encapsulated rosemary essential oil
- BHT
- OliPHA polyphenols



Antioxidant Coatings: RefuCoat

Potato chips packaging at lab scale

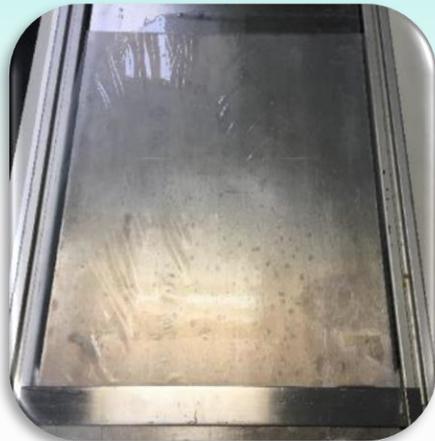


Plasma Treatment

150 s
55 kV

Coating

12 μ m rod coater



Drying
Room t°



Packing
35 g
16 x 14.5 cm bags



Storage

40°C
50% RH



22°C
50% RH

Antioxidant Coatings: RefuCoat

Shelf-Life Analysis: Testing every 2 weeks during 4 months

Lipid oxidation



Peroxide value
(mequiv/kg fat)

Acid value
(mg KOH/g fat)

Primary

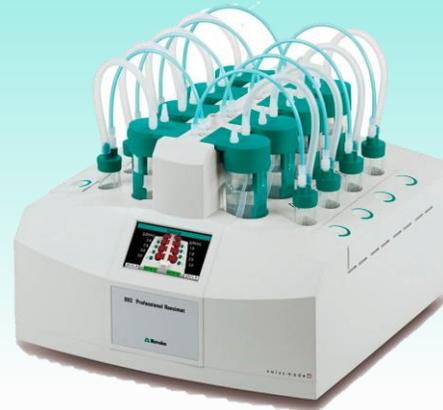


TBARS

(mg MDA/kg product)
Thiobarbituric Acid Reactive
Substances

Secondary

Oxydation Stability
Rancimat 110°C



Moisture Content
(%)



Sensorial Analysis

- Visual appearance
- Crispiness
- Odour

REFUCOAT: ANTIMICROBIAL COATINGS



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Antimicrobial Coatings: RefuCoat

- Aim is to slow down or prevent microorganism proliferation in packaged food.
- It is useful in foods that are prone to quick deterioration because of microorganism proliferation (e.g. meat or fish).
- The general objective of antimicrobial active packaging is, thus, to contribute to increase shelf life of packaged foods.

2 STRATEGIES

1. INCREASE OF SHELF LIFE



Active substance: **Lauroyl Arginate Ethyl (LAE)**



2. FOOD SAFETY



Active substance: **Bacteriophages**

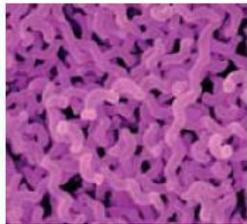
1. LAE as antimicrobial active substance

The problem: microorganism proliferation

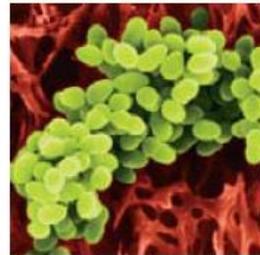
- Microbial contamination is the primary cause of **food wastage**.
- It reduces food quality, limits product shelf-life and increases food-borne illness risks to consumers.
- Contamination occurs primarily on the surface of foods especially for **muscle-based food products**.



Listeria monocytogenes
B4/97¹



Campylobacter jejuni
ATCC 29428



Staphylococcus aureus
ATCC 6538

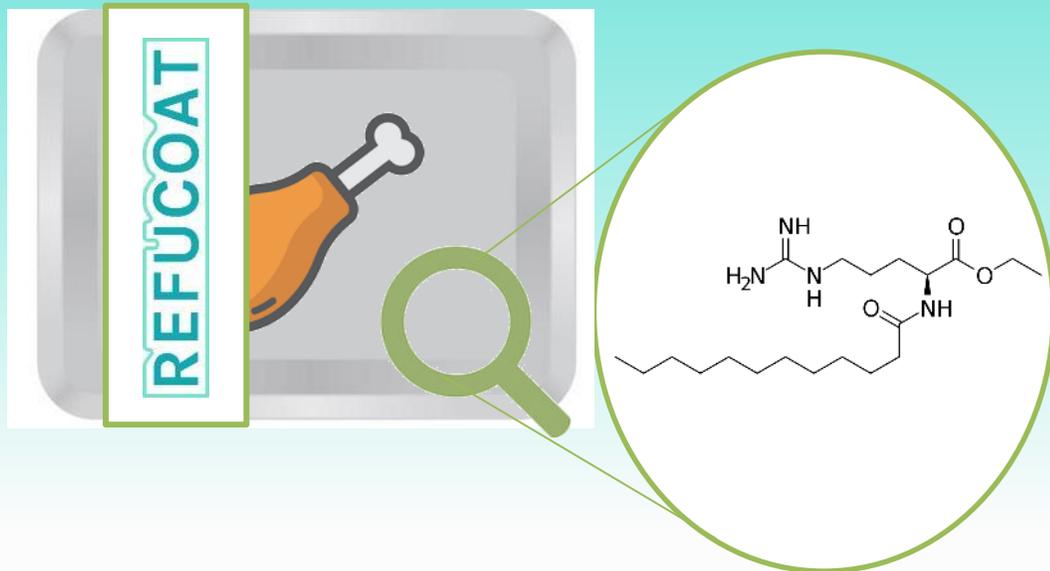
A solution: LAE



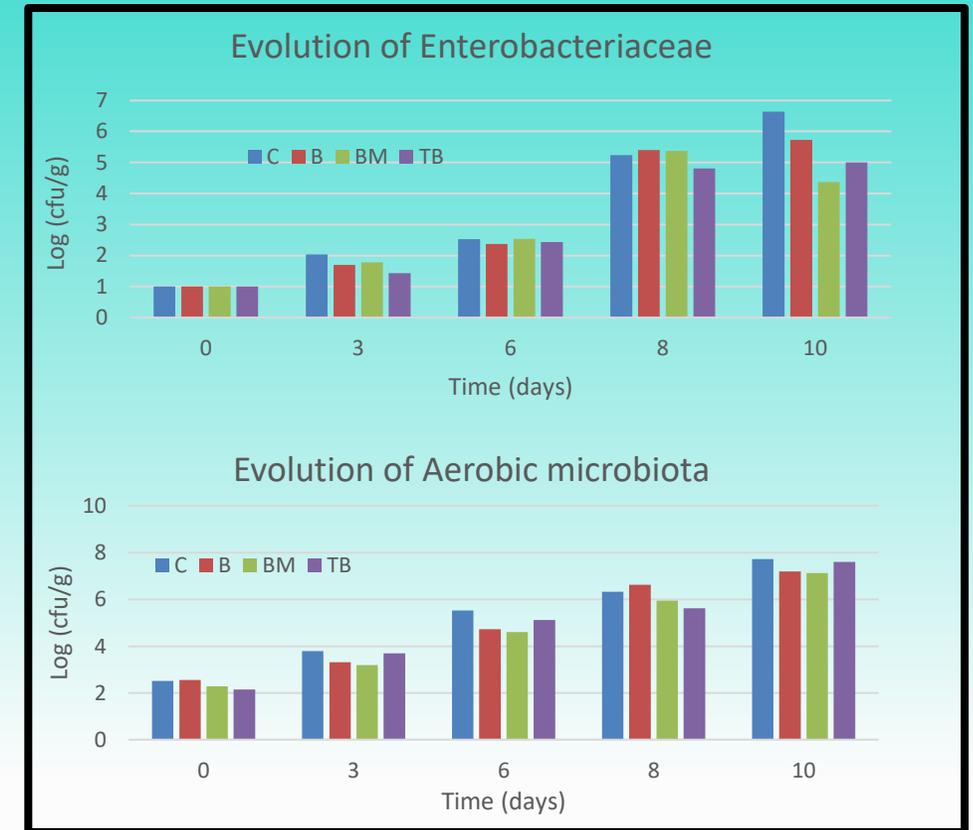
- It is used as a **preservative in meat products** such as sausages. Its usual application is by immersion..
- Its **application as coating in packaging materials**, will contribute to a **lower concentration** of this additive in the food product.
- At the moment it has not been applied to **chicken**.

REFUCOAT Approach to the use of LAE

LAE has been incorporated into **REFUCOAT trays** and **lid films** as **coatings**. The packages has been used to packaging **chicken**.



Evolution of the population of the two types of microorganisms monitored during the shelf-life of the product.



- The population grow faster in the control samples, which means that LAE is preventing, at some extent, microbial growth.
- The best results are shown by BM and TB samples.

2. Bacteriophages as antimicrobial active substance

The problem: Salmonella & Food safety



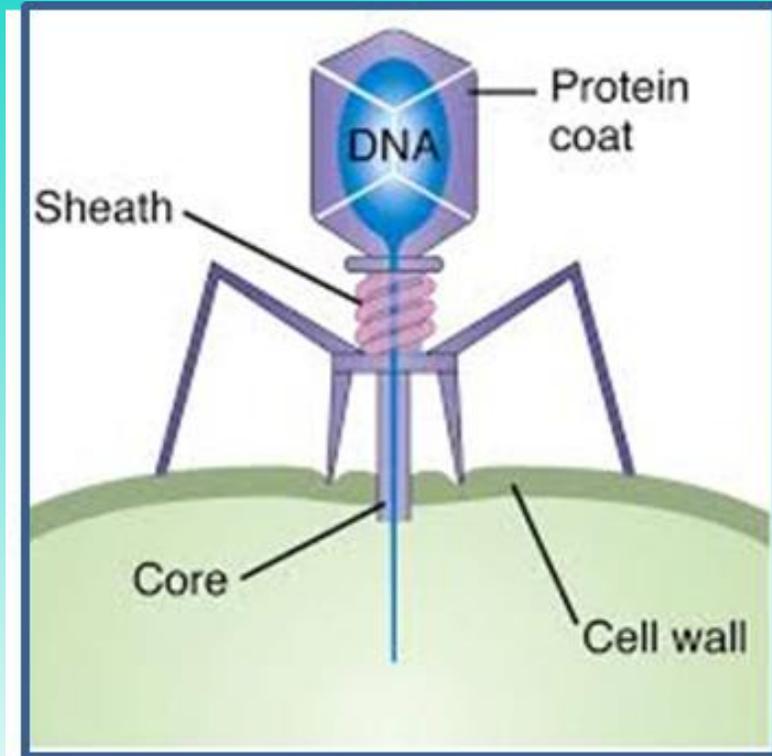
Salmonellosis, is a disease transmitted by food and caused by bacteria of the genus *Salmonella*. Most infections are contracted through contaminated food (usually veal, poultry, eggs or milk).



Preventing the presence and proliferation of *Salmonella* and other pathogens in meat products is pivotal for **FOOD SAFETY**

A solution: Bacteriophages

Bacteriophages



Definition: viruses that infect bacteria. Hence, a Bacteriophage of Salmonella will attack just to Salmonella preventing its replication and proliferation.

Advantages:

- **Abundant** microorganisms in our environment,
- **Highly selective** → **Harmless** to humans, animals and plants as they are **inert in the absence of target hosts**

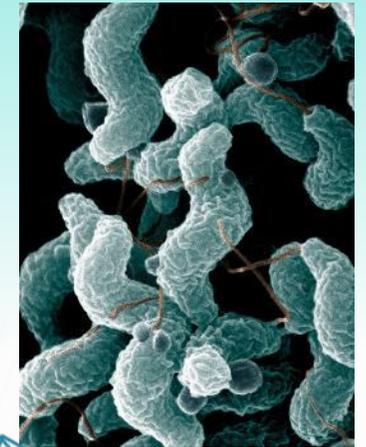
A solution: Bacteriophages



Highly selective

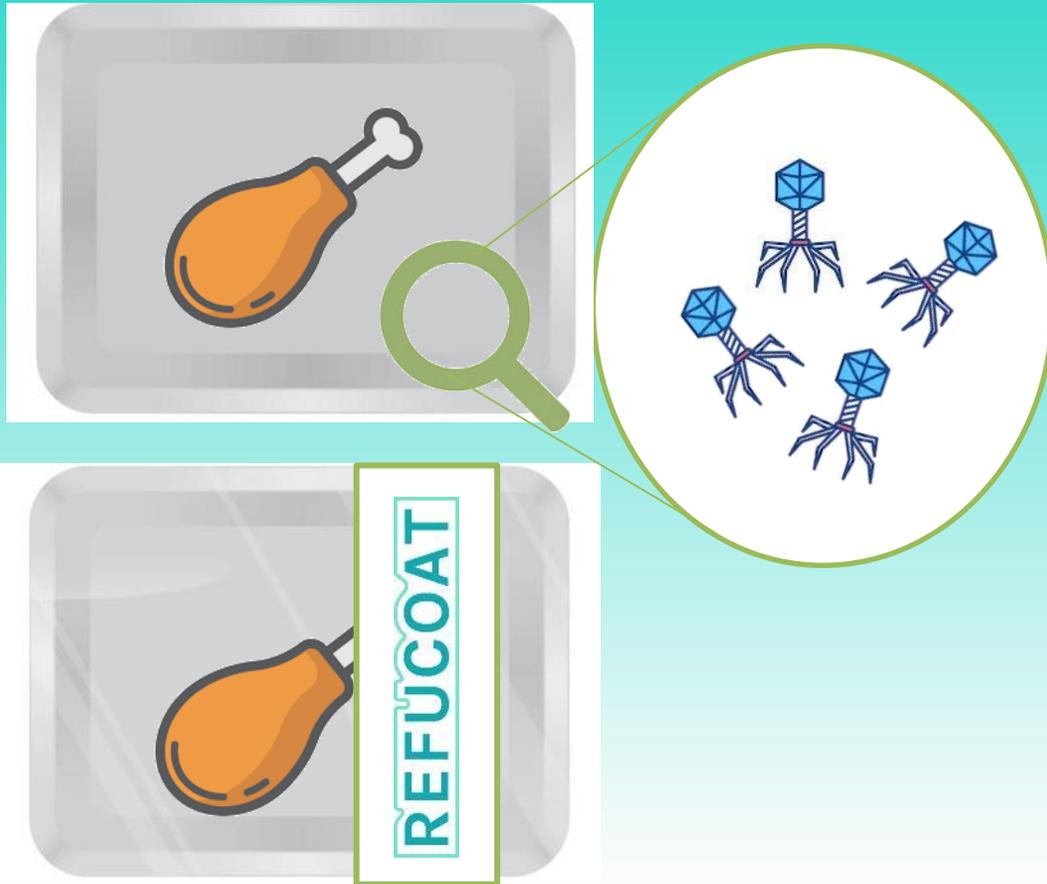


Salmonella

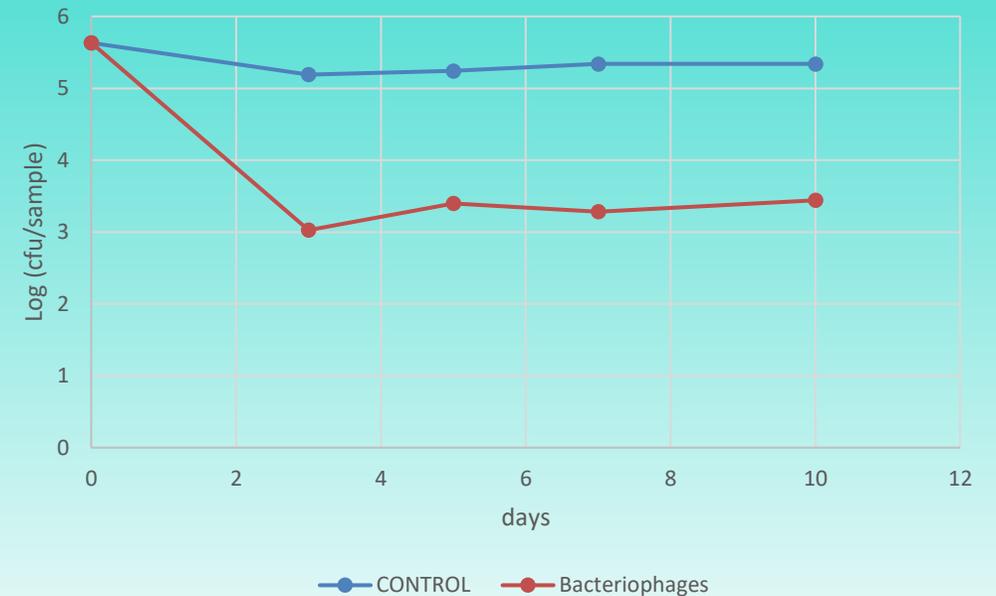


Capylobacter

REFUCOAT Approach to the Use of Bacteriophages



Bacteriophages have been incorporated into **REFUCOAT trays** for chicken to prevent the proliferation of *Salmonella*. In this case, they were incorporated through absorbing pads



The presence of bacteriophages in the trays have an effect of reducing the *Salmonella* spp counts in the packages.

Conclusions

- Active packaging can help to extend **Shelf-life** and/or to enhance **Safety** or **Sensory** properties while maintaining the **Quality** of the product.
- In REFUCOAT both, antioxidant (chips, breadcrumbs) and antimicrobial (chicken) active coatings have been explored.
 - **Antioxidant coatings: Expected results**
 - Decreased lipid oxidation values in comparison with control food packaged with non coated packaging materials
 - Conservation or improvement of organoleptic properties of the food products
 - **Antimicrobial coatings: Conclusions**
 - LAE: has been incorporated to the package as coating showing good results (reductions of microorganism proliferation) which means that it can help to increase shelf life.
 - Bacteriophages are viruses capable of attacking, specifically a bacteria. In REFUCOAT, bacteriophages has been investigated against proliferation of Salmonella showing promising results.

Thank you

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The logo for AINIA, featuring the word "ainia" in a bold, lowercase, orange sans-serif font.The logo for REFUCOAT, featuring the word "REFUCOAT" in a bold, uppercase, teal sans-serif font with a thin teal border. Below it, the text "BIO-BASED RECYCLABLE PACKAGING" is written in a smaller, teal, uppercase sans-serif font.

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The logo for IRIS TECHNOLOGY GROUP, featuring a stylized graphic of three overlapping shapes in teal, orange, and green to the left of the word "IRIS" in a bold, uppercase, teal sans-serif font. Below "IRIS", the text "TECHNOLOGY GROUP" is written in a smaller, teal, uppercase sans-serif font.