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Development of a new antimicrobial edible film for fresh meat products.

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Introduction

Food waste has become a major issue worldwide. According to FAO, about a third of the food for human consumption is wasted globally, representing around 1.3 billion tons a year. The food that costs the most because it is thrown away without being consumed is fresh meat. The development of an antimicrobial and edible film for this food would help reduce meat waste and will also be a good alternative to reduce packaging costs and cut the environmental impact.

Objective

The MeatCoat project aims to create a functional, antimicrobial and edible coating, able to increase shelf-life of fresh meat through the reduction of microbial growth. This technology will help replace part of the less efficient and non recyclable plastic packaging trays which are widely used today and will assure consumers fresher products with increased sensory quality.

Materials and Methods

Natural proteins were integrated in an edible composite coating. Antimicrobial components were then added to form different formulations for the edible film. The different formulations were fully characterized for their mechanical and barrier properties : tensile strength, Water Vapor Transmission Rate (WVTR), and Oxygen Transmission Rate (OTR). The antimicrobial properties against spoilage micro-organisms were also tested. Beef meat samples from the same batch were treated with four different coating formulations. Untreated samples were used as control. Treated and untreated samples were packed in trays under modified atmosphere packaging (MAP) and stored for 12 days at 4°C. At several sampling times, microbial enumerations were performed in triplicate on treated and untreated samples for the total viable counts of mesophilic and aerobic flora (ISO 4833), *Pseudomonas* (ISO 13720), *E. coli* (ISO 16649-2), and *Brochotrix thermosphacta* (ISO 13722). Results were used to identify the most efficient formulation against spoilers. Sensory analysis were also performed to check consumers' acceptance of coated meat.

Results

Microbiological results

Meat samples treated with edible coating showed a significant reduction in total viable counts (TVC) and *Pseudomonas* (PSE) after 12 days at 4°C compared to untreated samples. Figure 1 shows that a 2-log CFU/g reduction in spoilers' population can be achieved, suggesting a possible shelf-life extension of 3 days. Some preliminary results also showed that some of the tested formulations were efficient against *E. coli* and *Brochotrix thermosphacta*.

Characterisation of the natural edible coating

Table 1 presents the mechanical and barrier properties of the formulation showing the best antimicrobial effect. These properties are in accordance with the application requirements, the coating will act as a protective skin against oxygen, to slow oxidation reactions and avoid the rancidity of fresh meat.

Table 1: Mechanical and barrier properties of the most efficient coating.

Mechanical properties	Barrier properties	
Tensile strength	Water Vapor Transmission Rate : ASTM E96 at 50% rh 23°	Oxygen Transmission Rate ASTM D3985-05 at 0% rh 23°
14 MPa	38.0 g/m².day	6.8 cc/m².day

Sensory quality of treated samples

Colorless, odorless, almost invisible compared to the controls. Just a little more more glossy than control meat.

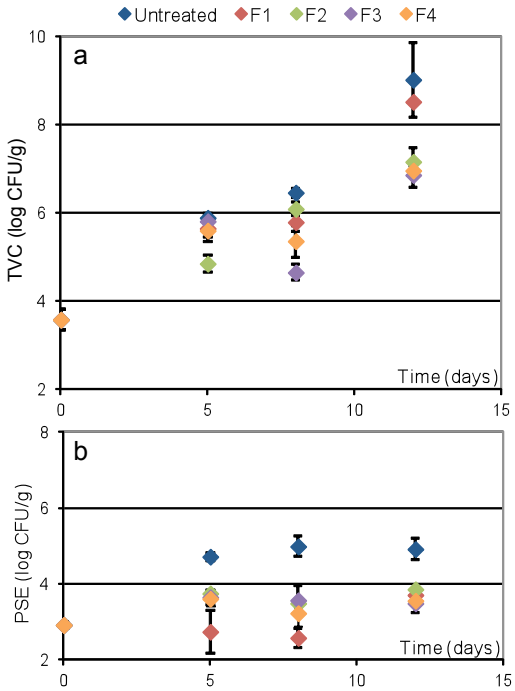

Figure 1: **Growth of Total Viable Counts (TVC) (a) and *Pseudomonas* (PSE) (b) on treated and untreated meat stored at 4°C with MAP packaging.**

Conclusions

- Several formulations were developed for the edible antimicrobial coating of beef meat,
- Some formulations provided satisfactory antimicrobial properties, enabling shelf life increase (up to 3 days),
- Mechanical and barrier properties in accordance with specifications and without significant effect on the appearance of beef apart from a slight increase in gloss.

MEATCOAT
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