ABSTRACT TEMPLATE

Abstract deadline: deadline June 1st, 2023

Please, indicate with X the session you think that best fit your abstract:

PREFERRED SESSION	Mark with X
Food safety (FCM)	
Active and smart packaging	
Innovative materials for food packaging	X
Food waste reduction and valorization in packaging	
Sustainability and circularity measurement	
Recycling and end of life solutions	
Consumer behavior and circular consumption models	
Food packaging traceability and supply chain management	

Title:

Performance of ZnO NPs as antimicrobial after incorporation in a packaging matrix. In situ test using salmon as food model.

Authors and affiliations

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Introduction and motivation

Properties of biodegradable materials may not suffice the required protection and shelf-life specifications according to the standards of distribution and supply chains, resulting in shorter shelf-life and increased food losses. Active packaging (AP), such as antimicrobial and antioxidant, is an approach with increasing interest for improving the performance of the packaging system, in particular those bio-based and biodegradables.

Polybutylene adipate terephthalate (PBAT), a synthetic biodegradable polyester, is the main biodegradable material commercially used today for flexible packaging. PBAT and its blends has raised much attention of researchers and industry. It is fully biodegradable and compostable. Currently, it is produced from fossil-based resources, but it is expected that will be produced from biomass in near future.

Zinc oxide nanoparticles (ZnO NP) are known to have good antimicrobial properties and has been applied in AP. ZnO has a positive opinion European Food Safety Authority (EFSA) for packaging applications as transparent ultraviolet light (UV) absorbers.

In this work a PBAT based material with ZnO NP was developed for food packaging and tested in a model food (salmon fillet) to control microbial hazards that compromise product safety and shelf-life. The barrier and functional properties of the material were characterized. The migration behavior and the impact of the active film on the product was evaluated.

Methodologies

The performance of neat PBAT and PBAT/ZnO material (with 3,5% incorporation) was compared.

The film barrier to water vapour and oxygen were determined, according to the methods ASTM F1249 and ASTM D 3985, respectively. Overall migration and specific migration of Zn was also performed for 10 days at 20 and 40 °C, in food simulants: acetic acid 3% and ethanol 10%. The kinetics of the migration of Zn was determined and the Zn concentration was measured by flame EAA technique.

Experiments with the model food (salmon fillets) were conducted to assess the functional performance of the films. The salmon pieces were packed in PBAT and PBAT/ZnO films and stored at 3±1 ºC and 80% HR for 17 days. The following parameters were monitored during storage: moisture, pH, total volatile basic nitrogen (TVB-N) content, weight loss, amount of exudate, zinc content and sensorial properties (aspect, color, odor and texture). Microbiological analyses of the food products were also performed using standards methods and the following parameters were considered: enumeration of total microorganisms at 30 and 7 °C, Enterobacteriaceae, Pseudomonas spp., mesophilic lactic acid bacteria (LAB), molds and yeast at 25 ºC, Listeria monocytogenes. The antibacterial activity of the composite films

were also investigated for Escherichia coli and Staphylococcus aureus by viable cell count assay.

Results

The results are contradictory regarding the efficacy of the ZnO against the microbial agents tested. While permeability, impact in exudate fluid and weight loss show good results for PBAT/ZnO, migration and antimicrobial studies show that the nanocomposite PBAT/ZnO does not comply with the requirements to extend the shelf-life.

Significance of the work

Despite the number of publications and works confirming the activity of ZnO as antimicrobial, many works only present results for the activity of the component in *in vitro* assays and not after incorporation in a matrix in contact with a real food model. This work focuses on the assessment of an active packaging PBAT/ZnO in a real application and highlights the limitations of such systems in real conditions of use.

Is this work aligned with Circul-a-bility objectives and working groups? X Yes No
If yes, please explain.

The research work is aligned with Circul-a-bility objectives of working group 2: Fish and meat. The study of biobased material of PBAT/ZnO was addressed for packaging fish salmon with the objective of extending the shelf life and decrease the food losses.