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DEVELOPMENT OF BIO-BASED AND BIODEGRADABLE PLASTICS FOR ACTIVE FOOD PACKAGING FROM MIXTURES OF INGREDIENTS AND ACTIVE SUBSTANCES FROM AGRO-INDUSTRIAL WASTE. ET1APLAUSO

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INTRODUCTION AND OBJECTIVES

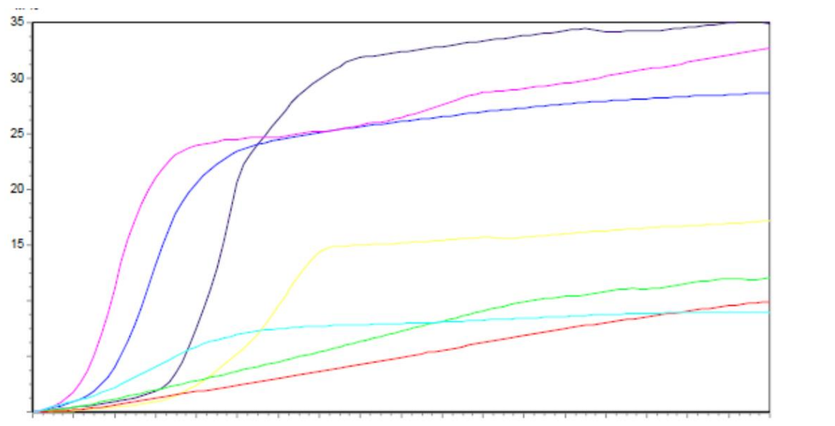
In Europe, the transformation processes of the agro-food industry generate large quantities of wastes, affecting the competitiveness of the sector and posing significant environmental problems. Various investigations have shown that these agro-industrial by-products represent an excellent source of bioactive substances, such as antimicrobials and antioxidants, which can replace synthetic additives in foods, cosmetics and active plastic packaging. This article describes the results of the ET1APLAUSO project, which aims to develop bio-based , biodegradable and recyclable plastics with properties suitable for flexible packaging, incorporating extracts of agro-industrial by-products.

Valorisation of agro-industrial waste represents an opportunity to improve sustainability of the food sector and address environmental challenges. In collaboration with the Technological Centre for Footwear and Plastics of the Region of Murcia (CETEC), ET1APLAUSO project seeks to implement innovative solutions by incorporating bioactive compounds into biodegradable plastics.

METHODOLOGY

1 . Lemon, pomegranate and grape by-products were used. Bioactive extracts were obtained by aqueous extraction and subsequent freeze-drying. Biodegradable films were developed incorporating these extracts to evaluate their antioxidant and antimicrobial capacity (fig 1). **2.** To determine whether the bioactive substances extracted from agro-industrial by-products maintain their antimicrobial properties after being incorporated into the plastic manufacturing process. Antimicrobial activity of the developed materials was validated according to ISO 22196 standard. Antimicrobial study focused on Salmonella, a key indicator microorganism in hygienic-sanitary control (fig 2). **3** . Effect of the active films on paprika contaminated with enterobacteria was evaluated. Paprika samples packaged with active films and controls were stored at 21°C and analyzed after 15 days (fig 3).

Fig 1. Active films with extracts



Meas. No.	New IDT M [hrs.]	New IDT E [hrs.]	Orig. det. time [hrs.]	Orig. CFU	Temperature [°C]	Info 1
3220	-	-	3,73	-	37,00	CONTROL SALMONELLA
3236	-	-	4,93	-	37,00	SALMONELLA VS 81971.1 5gr/Kg
3888	-	-	2,15	-	37,00	CONTROL SALMONELLA
3891	-	-	6,54	-	37,00	SALMONELLA VS 89208003 5g/kg
3892	-	-	9,13	-	37,00	SALMONELLA VS 89208004 5g/kg
4400	-	-	1,49	-	32,00	CONTROL SALMONELLA
4401	-	-	3,48	-	32,00	SALMONELLA VS 94795 5%

Fig 2. Antimicrobial activity of pomegranate active film

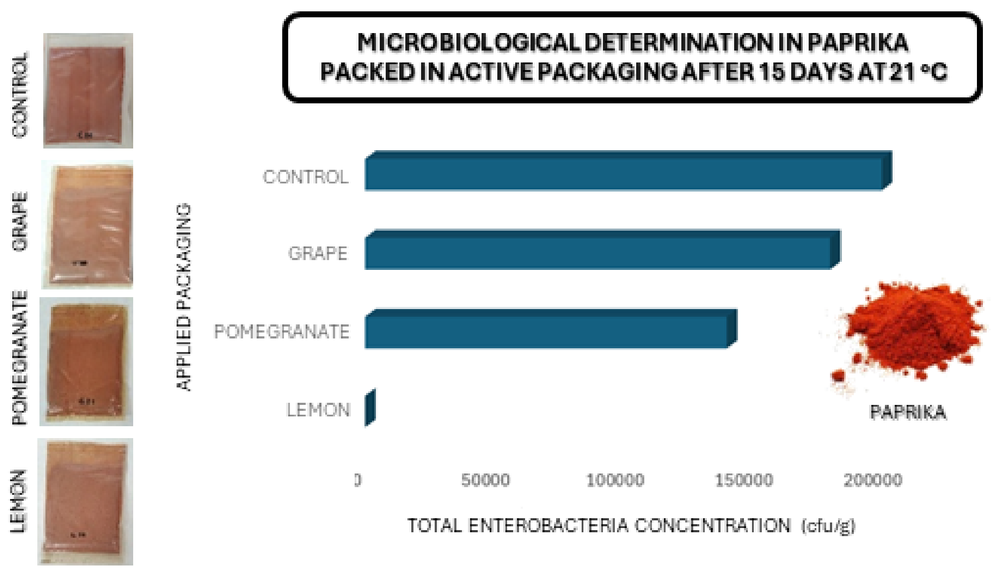


Fig 3. Validation of active films in the packaging of inoculated paprika

RESULTS AND CONCLUSIONS

- Three active films have been obtained in which extracts of grape skin, pomegranate peel and lemon peel have been incorporated.
- Under in vitro conditions, antimicrobial activity of the developed plastics was confirmed.
- In food tests, active packaging reduced microbial load of inoculated paprika, highlighting effectiveness of the film with lemon extract, achieving a significant decrease in CFU/g compared to the controls.

CONCLUSIONS

- Biodegradable plastics developed from agro-industrial waste extracts show significant potential as active packaging, reducing the microbial load in stored foods.
- Lemon extract stands out for its high antimicrobial activity, followed by pomegranate and grape extracts.
- This approach not only valorises agro-industrial by-products, but also promotes sustainability in the food and packaging sectors.

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