I International Congress ENZOEM

Emerging Diseases: New Horizons from a *One Health* Perspective

February 5–7, 2025

Rectorate of the University of Córdoba

Organized by: ENZOEM Unidad de Investigación Competitiva de Zoonosis y Enfermedades Emergentes

Universidad de Córdoba

ID 3335. Bioprotection and Valorization of Avocado Agro-Waste: A Holistic Approach to Microbial Food Safety and Sustainability

Andrea Lucena[1], Ramón Morcillo-Martín[1], Alejandro Rodríguez[1], Eduardo Espinosa[1], Fernando Pérez-Rodríguez[2].

1. 1BioPrEn Group (RNM-940), Chemical Engineering Department, Instituto Químico para la Energía y el Medioambiente (IQUEMA), Faculty of Science, Universidad de Córdoba, 14014 Cordoba, Spain
2. 2Department of Food Science and Technology, UIC Zoonosis y Enfermedades Emergentes ENZOEM, ceiA3, Universidad de Córdoba, 14014, Córdoba, Spain.

Tipo de comunicación/Type of communication: Oral

Afiliación/Affiliation: 1BioPrEn Group (RNM-940), Chemical Engineering Department, Instituto Químico para la Energía y el Medioambiente (IQUEMA), Faculty of Science, Universidad de Córdoba, 14014 Cordoba, Spain.
2Department of Food Science and Technology, UIC Zoonosis y Enfermedades Emergentes ENZOEM, ceiA3, Universidad de Córdoba, 14014, Córdoba, Spain.

Introducción y Objetivo/Background and objectives

Avocado (Persea americana) crops generate significant waste streams, including pruning residues and leaves, which represent underutilized sources of bioactive compounds and microbial biodiversity. This study explores the valorisation of avocado agro-waste focusing on bioprotection and sustainable packaging innovations, aligning with food safety and environmental sustainability challenges.

Métodos/Methods

Firstly, potential of avocado pruning waste (APW) hemicelluloses to develop bioactive polyvinyl alcohol (PVA) films was demonstrated.Secondly, avocado leaves were valorised for their bioactive phenolic compounds and bioprotective microbial communities.Additionally, metagenomic profiling of microbial diversity in leaf-soil compartments were performed.

Resultados/Results

The extraction and fractionation of hemicelluloses resulted in fractions with distinct molecular weight ranges, exhibiting significant antioxidant and antimicrobial properties. These hemicelluloses were incorporated into PVA films, enhancing their bioactive and functional attributes, such as antioxidant capacity (>40% AOP), UV-blocking properties (>80%), and mechanical performance, while ensuring biodegradability in humid environments.Using microwave-assisted extraction (MAE), phenolic-rich extracts were obtained, demonstrating strong antimicrobial activity against foodborne pathogens (e.g., Listeria monocytogenes and Staphylococcus aureus). Additionally, metagenomic profiling of microbial diversity in leaf-soil compartments revealed strains with potential for bioprotective applications, including bacteriocin producing species. Functional analysis highlighted genes associated with antimicrobial peptides, suggesting promising candidates for controlling spoilage and pathogenic microorganisms.
Key bacterial and fungal taxa, including Streptomyces, Bacillus, Pseudomonas, and Cladosporium, were abundant in leaf-soil interfaces and contained genes encoding antimicrobial compounds and lignocellulolytic enzymes, essential for pathogen inhibition and bioconversion, respectively.

Conclusión y Relevancia/Conclusions and relevance

These findings demonstrate the multifaceted valorisation potential of avocado agro-waste, providing innovative solutions for sustainable food packaging and biological control strategies for controlling foodborne pathogens, based on a circular bioeconomy and reducing environmental burdens.