

Agro-industrial avocado residues as functional additives for cellulose-based food packaging

Susana Guzmán-Puyol^{1*}, *María del Rocío Muñoz-Pérez*¹, *José Alejandro Heredia-Guerrero*¹

¹*Instituto de Hortofruticultura Subtropical y Mediterránea La Mayora, Consejo Superior de Investigaciones Científicas-Universidad de Málaga (IHSM, CSIC-UMA), Bulevar Louis Pasteur 49, 29010, Malaga, Spain*

susana.guzman@csic.es

The development of food packaging materials based on renewable polymers is a major challenge within the transition towards a circular bioeconomy. In this sense, cellulose-based films are promising biodegradable alternatives. However, their high-water sensitivity limits their performance under humid conditions.

In this work, lipid-rich extracts obtained from agro-industrial avocado residues were investigated as functional additives to tailor the properties of glycerol-plasticized cellulose-based bioplastics. First, the lipid fraction was extracted using chloroform, and the process was optimized through experimental design, establishing 55 °C and 50 min as optimal conditions. Then, those extracts were incorporated into cellulose-glycerol formulations at different concentrations (0-20 wt.-%), and the resulting films were characterized in terms of optical, morphological, mechanical, hydrodynamic, and antioxidant properties. Transparency values slightly decreased with increasing avocado extract content but well above the threshold of transparent materials while SEM revealed a good dispersion of the extracts into the cellulose matrix. Mechanical testing revealed no significant changes in the main tensile parameters. In contrast, hydrodynamic properties were markedly improved. Water uptake values at 100% relative humidity were reduced by approximately 20% and a significant reduction in water vapor transmission rate was observed. Moreover, the films exhibited antioxidant capacity, with radical scavenging activity values of around 20% after 96 h. Finally, overall migration using Tenax® as a dry food simulant was tested to confirm the compliance with current regulatory limits. In view of these results, plasticized cellulose-glycerol bioplastics with avocado extracts can be proposed as functional, high barrier food packaging materials.

Keywords:

Cellulose; Avocado residues; Bioplastics; Active food packaging; Circular bioeconomy.

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