**Development of Biodegradable Active Films Containing Olive Waste Polyphenols Extracted with NaDES for Sustainable Food Packaging Applications**

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Olive oil production, one of the main agro-industrial activities in Southern European countries, generates large quantities of waste (over 21 million tonnes) containing polyphenolic compounds in relevant concentrations. In recent years, the interest, from a circular economy perspective, in the recovery of these compounds to take advantage of their natural biological and antioxidant properties has grown significantly. Natural Deep Eutectic Solvents (NaDES), known as green solvents, have been shown to extract phenolic compounds from olive leaves very efficiently and are a good alternative to conventional organic solvents. Once obtained, the polyphenol-rich extracts can be purified by techniques such as adsorption on polymeric resins, allowing their use in food, chemical, cosmetic, or pharmaceutical industries. In addition, NaDES extracts have the potential to be directly incorporated into a biodegradable polymeric matrix to prepare active films for potential food packaging applications. The resulting films can extend food shelf life due to their antibacterial and antioxidant properties. Therefore, developing biodegradable films with polyphenol extracts offers a practical solution for managing agri-food waste and creates new opportunities for sustainable materials to be used in several industries.

Tthe main objective of this work is to prepare and characterize biodegradable active films containing olive polyphenol extracts for potential application in food packaging. In this work, olive waste NaDES (glycerol-choline, 1:5 M, 30% water) polyphenolic extracts (NDPE) was characterized by HPLC-MS/MS. The main constituents of the extracts were oleuropein (0.37 mg/g) and its aglycone and glucoside forms, luteolin-7-O-glucoside (0.38 mg/g), 3-hydroxytyrosol (0.11 mg/g), rutin (0.07 mg/g), p-coumaric acid (0.06 mg/g), diosmin (0.04 mg/g). The antioxidant activity was determined by FRAP (20 mg eq trolox/g). The NDPE was loaded at different concentrations (5-50 wt%) into a carboxymethylcellulose matrix crosslinked with PEDGE to prepare active films. The obtained transparent films were characterized by different techniques such as FTIR, TGA, SEM, color, as well as determining mechanical properties. Polyphenols release in acid media show that major components (oleuropein, luteolin-7-O-glucoside and 3-hydroxytyrosol) were released and a platoo was reached at 6h. Finally, the antibacterial properties against foodborne pathogens were assessed. Results show the potential of using olive waste residues as a source of valuable polyphenolic compounds.

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