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Olive Pomace Aqueous Extracts as Ingredients for Edible Film Development

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Abstract

The increasing demand for sustainable materials and green methods in the frame of circular bioeconomy has intensified the efforts in the valorisation of agro-industrial by-products. Olive pomace, originating from the two-face olive oil extraction system, is a semi-solid dark byproduct (OB) rich in polysaccharides, proteins and bioactive components, such as phenolic compounds, though exhibiting significant environmental management challenges, as it is characterized by high organic load. The present study investigates the recovery and utilization of soluble biopolymers for the development of edible films, using alkaline assisted aqueous extraction method. The extraction process included a hydration step under alkaline conditions (pH 10.0) for both untreated and defatted by-product. The mixtures were agitated and centrifuged, and the recovered supernatants were collected and concentrated prior to film formation. Film forming solutions based solely on extract derived from the untreated by-product (OB_E) or the defatted by-product (OB_DF_E) as well as combinations with carboxymethyl cellulose (CMC) using glycerol as plasticizer were cast to evaluate the material's intrinsic film-forming capacity. Edible films formed based on different ratios of OB_E or OB_DF_E and glycerol demonstrated the formation of stand-alone films. Physicochemical characterization of the films displayed promising performance in terms of colour, gloss, thickness, opacity, gas barrier properties, and mechanical behavior. Moreover, a strong interaction between the recovered OB biopolymers and water molecules highlighted their high hydrophilic nature. Handling difficulties associated with increased stickiness of these films were eliminated in the case of CMC-based edible films, which presented improved film processability and structural stability. Overall, this study offers an eco-friendly, sustainable approach for the valorisation of olive oil industry by-products into biodegradable edible films and coatings.

Keywords: olive mill waste valorisation, green extraction, edible films, sustainable packaging