**Hemicellulose and xylooligosaccharides from olive stones: an innovative source for food applications**

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Hemicellulose (HC), the second most abundant renewable component of lignocellulosic biomass, is recently gaining attention for its functional and technological properties, as well as for its potential as a source of prebiotic xylooligosaccharides (XOS), both promising features for food applications1,2. Among lignocellulosic biomasses, olive stones (OS) separated during the production of EVOO represent a rich but underexplored source of hemicellulose, comprising 20–30 wt% of their composition3. In this context, OS are an underutilized by-product, contributing to an annual waste generation of 4.1 to 5 million tons in the olive industry4. The extraction of HC from OS might represent a promising approach for valorizing this by-product, thus improving biomass utilization efficiency5.

Based on these considerations, this study investigates OS as a novel source of HC, leveraging agro-industrial residues to obtain high-value ingredients. HC was extracted from olive stone powder (OSP), previously obtained from the drying, milling, and sieving of OS from a local oil milling facility. The extraction process involved alkaline treatment of OSP with NaOH, followed by acidification with HCl, and purification of the resulting HC via ethanol precipitation. The obtained HC was characterized for its chemical and physicochemical properties and then subjected to acid hydrolysis with HCl to produce XOS. Both HC and XOS were *in vitro* fermented with simulated human gut microbiota. Complete hydrolysis into neutral sugars showed that the main components of HC were xylose (94.8% w/w), glucuronic acid (4.4% w/w), and arabinose (1.1% w/w). In contrast, XOS were primarily composed of xylose (87.1% w/w), glucuronic acid (10.8% w/w), arabinose (3.0% w/w), along with smaller amounts of galactose (1.3% w/w) and rhamnose (0.6% w/w). Physicochemical characterization demonstrated that, despite HC exhibiting limited emulsifying and thickening capacities, emulsions prepared with different concentrations of XOS were stable over time. *In vitro* fermentation of HC and XOS resulted in significant short-chain fatty acid (SCFA) production, with acetic, propionic, and butyric acids predominantly derived from HC and formic, acetic, and propionic acids from XOS.

These results highlight the potential of HC and XOS derived from OS as a multifunctional hydrocolloid and prebiotic source. This innovative strategy underscores its relevance for the food industry and the valorization of agricultural residues, aligning with sustainability and circular economy principles.

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