



Valorization of Plant Biodiversity via Green Extraction of Polyphenols from Hazelnut Byproducts

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The sustainable valorization of plant biodiversity represents a key strategy to address the growing demand for natural bioactive compounds while reducing agro-industrial waste. In this context, the present study explores the recovery and functional exploitation of hazelnut cuticles, an abundant byproduct of the nut processing industry, as a rich and underutilized source of phenolic compounds. These plant-derived materials embody a significant reservoir of biodiversity, containing a wide array of structurally diverse polyphenols with well-documented antioxidant and anti-inflammatory properties.

A comprehensive phytochemical characterization was performed using liquid chromatography–mass spectrometry (LC-MS), enabling the identification of key bioactive molecules, including flavonoids and phenolic acids. This analytical approach guided the development of an environmentally sustainable extraction strategy based on Natural Deep Eutectic Solvents (NADES), specifically a choline chloride–lactic acid system. NADES, inspired by naturally occurring plant metabolites, provide a green alternative to conventional organic solvents, enhancing extraction efficiency while preserving the integrity of sensitive compounds.

The obtained extract was incorporated into a plant-based beverage matrix, demonstrating how biodiversity-derived compounds can be effectively transferred into functional food systems. The fortified beverage exhibited significantly enhanced total phenolic content and antioxidant capacity, confirming the successful valorization of the raw material. Furthermore, *in vitro* gastrointestinal digestion revealed high bioaccessibility of phenolic compounds (89.7%), highlighting their potential bioavailability.