

Proceeding Paper

# Multistep Process Extraction of Almond Hull Biomass with Pulsed Electric Fields and Supercritical CO<sub>2</sub> to Recover Carbohydrates and Biologically Active Compounds <sup>†</sup>

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**Abstract:** This work reports a combined sequential extraction with pulsed electric field (PEF) and supercritical fluid extraction (SFE) using SC-CO<sub>2</sub> in almond hull (AH) biomass, a recognized source of primary metabolites and bioactive products. Compared to traditional methods (maceration, percolation, etc.), this hybrid technique showed higher yields in total antioxidant capacity (TAC) and polyphenols content (TPC), being an enabling, sustainable and efficient approach for the recovery of these compounds. The liquid extracts obtained after both PEF and PEF + SFE treatments were analyzed by LC-MS, obtaining that the main polyphenols present were flavanols ((+,-)-catechin, (+,-)-epicatechin), flavonols (kaempferol and isorhamnetin) or flavons (luteolin, scutellarein, nepetin or 3-hydroxyphloretin), as well as others glycosylated derivatives such as kaempferol 3,7-O-diglucoside. Moreover, NMR analysis allowed to detect some freely accessible carbohydrates (glucose, fructose or sucrose), useful starting material for platform chemicals (levulinic acid or 5-hydroxymethylfurfural), or as additives in many foodstuffs. This analysis showed an interesting lipidic fraction obtained with SFE treatment as well. The post-extraction residual solid biomass was characterized by several techniques such as TGA, FT-IR and SEM. The latter showed the formation of surface pores after PEF treatment, as well as the compaction of fibers after SFE, proving the excellent extraction efficiency of this new hybrid technique.

**Keywords:** almond hull; biomass valorisation; PEF; SFE; multistep process; enabling technologies; circular economy