Natural Deep Eutectic solvents pre-treatments ease pectin water extraction from apple pomace

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As a widely produced fruit in the world, apple once processed into a variety of products generates a large amount of pomace that is a traditional source of pectin. Industrial pectin extraction processes classically use harsh chemicals that pose environmental concerns. Recently, natural deep eutectic solvents (NADES) formed by hydrogen bonding acceptor and hydrogen bonding donor metabolites emerged as innovative solvents for extracting diverse molecules from biomass and were explored for extracting polysaccharides from food related wastes.

In the present study, as an alternative to classical extraction (water extraction, mineral acid extraction, sequential extraction with chelating agent), two NADES: Choline chloride (CC):Lactic acid (LA), CC:Glycerol (G) were tested alone or in sequence (first. CC:G and second. CC:LA) as a pre-treatment of apple pomace to ease water extraction of pectin. Extraction yields, sugar composition, degree of methyl and acetyl esterification and molecular weight distribution were characterized to evaluate the impact of these pre-treatments. The process was adjusted to limit cell wall polysaccharide degradation and losses allowing for the later recovery of other valuable polymers (hemicellulose, cellulose) from the residues.

Results show that combining CC:LA and CC:G pretreatment improves extraction yield (21.1, pomace dw%) compared to classical methods (the highest yield 17.5%). Moreover, CC:G enhanced the later CC:LA pretreatment ability by 4.5%. Overall, the sequential NADES pretreatment facilitated extraction of a large amount of high methyl esterified pectin (65.7% of pomace uronic acids). This sequential pretreatment lead to the recovery of pectin with higher rhamnose/uronic acid ratio compared to classical extracts which indicated a higher content in rhamnogalacturonan I structural domains.

Thus, NADES pretreatment succeeded in increasing the extraction yield of pectin by hot water extraction and offer a “green” alternative to classical harsh chemical extraction. The impact of the chemical characteristics of pectin enriched in rhamnogalacturonan domains remains to be evaluated with regard to their functional properties.

Keywords: Biorefinery; Cell wall polysaccharides; Valorization of food waste

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