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Valorisation of Apple Pomace Seed Oil: Effect of the Use of Pulsed Electric Fields on Oil Recovery and Oil Functional Properties.

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Abstract

Apple pomace is an important byproduct produced during the industrial production of apple juice and cider. It represents up to 25% of the original apple pulp and contains 2-4% of seeds. Seeds represent a significant source of phytochemicals and a high-value oil. Conversely, the implementation of non-thermal emerging technologies as preliminary treatments of raw materials has been demonstrated to enhance process efficiency by reducing extraction times. The objective of this study was to assess the impact of pulsed electric field (PEF) pretreatment of apple seeds on the subsequent oil extraction process. The primary variables of interest included the oil extraction yield, the colour of the extracted oil, the recovery of polyphenols (TPC) and flavonoids (TFC), the antioxidant capacity (DPPH• and ABTS•+), and the recovery of significant liposoluble compounds. Additionally, the PEF impact was assessed in the deffated seeds by evaluating TPC, TFC, and antioxidant capacity. Apple seeds were extracted from the apple pomace that was obtained subsequent to the cider production process in the Food Pavilion at the Czech University of Life Sciences Prague. These specimens were meticulously washed to ensure the complete elimination of any residual pulp matter. Prior to the implementation of PEF treatment, the seeds were subjected to a soaking process in tap water at a 1:1 ratio for a duration of four hours. This procedure was undertaken with the objective of adjusting the moisture content of the seeds and thereby facilitating the initiation of seed coat opening. For PEF treatment, three energy levels were applied (4.5, 11.25, and 15 kV/cm) while frequency (150 Hz), number of pulses (120), and pulse width (30 µs) were constant. Untreated seeds were used as a control. Following the PEF treatment, the seeds were subjected to a drying and grinding process. The extraction of oil was carried out by Soxhlet using hexane as the extraction agent. ANOVA showed no significant differences ($p>0.05$) for any of the evaluated parameters in the oil or the deffated seeds, except for oil ABTS•+ antioxidant capacity (1.59 ±0.88 TE µM/mL) and oil Vitamin A content (0.010±0.001µg/g Oil). Principal component analysis (PCA) explained 76.69% of the variance with the first three principal components. PC1A separated oils into two groups, one corresponding to the control and the lower PEF treatments (4.5 and 11.25 kV/cm), and the second group corresponding to the higher intensity treatment (15 kV/cm). The other PC (2 and 3) did not separate the oil samples. Eigenvector 1 showed that oils with the stronger treatment presented higher values of DPPH•, TPC, ABTS•+, Lignans, and Orizanol. Results show that lower intensities are not enough to modify the properties of the extracted oil, but that high intensities also did not modify the defatted seeds' properties.

Keywords: Pulsed Electric Field, apple pomace seeds, oil extraction, total phenol content, antioxidant

activity

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