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Bioactive compounds and antioxidant capacity in fennel seeds influenced by pressurized liquid extraction

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Abstract

Fennel (*Foeniculum vulgare* Mill.) is a well-known aromatic plant, widely used as spice and remedy herb. It provides many beneficial effects and is used as diuretic and expectorant, as well as for various dyspeptic disorders. Beside essential oils, fennel seeds are abundant with various phenols, which are known as strong antioxidants and thereby contribute to human health. Among different extraction methods for phenols isolation, pressurized liquid extraction (PLE) represents a novel technique with numerous advantages over conventional extraction approaches. Its efficiency manifests through combination of high temperature and pressure, enabling extraction time shortening, as well as decreased solvent consumption, thus being environment-friendly technique. In order to achieve maximum extraction yield, it is of great importance to select optimal PLE conditions, e.g., extraction temperature and time. Additionally, solvent selection also affects on content of targeted compounds, where phenols amount depends on polarity of solvent. Hence, the aim of this study was to examine the effect of temperature (75 and 100 °C), static time (5 and 10 min) and cycle number (1, 2 and 3) on total phenols (TP) and total flavonoids (TF) content, as well as the antioxidant capacity (AC) in fennel seeds using three-step exhaustive PLE. Firstly, grinded dry fennel seeds were subjected to PLE using non-polar solvent (hexane) under the mentioned conditions in order to remove seeds' lipid fraction. Afterwards, defatted samples were extracted with polar solvents by the increasing polarity: aqueous acetone solution (30 %, v/v) followed by aqueous methanol solution (30 %, v/v). Obtained acetone (AE) and methanol (ME) extracts (n = 24) were analyzed for TP (Folin-Ciocalteu method), TF (aluminium chloride colorimetric assay) and AC [ferric reducing antioxidant power (FRAP) method]. Multivariate analysis of variance (MANOVA) and Tukey's HSD test ($p \leq 0.05$) were applied for statistical analysis of collected data. Expectedly, AE were described with higher values of analyzed parameters (grand means: TP = 416.18 mg/100 g, TF = 41.87 mg/100 g, AC = 359.57 mg AAE/100 g) in comparison with ME (grand means: TP = 80.25 mg/100 g, TF = 16.41 mg/100 g, AC = 96.13 mg AAE/100 g). Furthermore, all examined influences significantly affected TP, TF and AC in all samples, except temperature on TP in ME. Thus, conditions of 100 °C/10 min/3 cycles showed the greatest yield of tested parameters in AE, while 100 °C/5 min/1 cycle were sufficient for maximum TP and AC levels in ME. Regarding TF in ME, slightly longer extraction time was required to achieve the highest efficiency (100 °C/10 min/1 cycle).

Conflict of Interest

There is no conflict of interest.