Assessment of the antioxidant/antiradical activity and phytochemical profile of ultrasound-assisted extracts of aromatic plant by-products using spectrophotometric assays and untargeted LC-MS/MS analysis

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Objective: Striving to meet the socioeconomic demands of modern society, the concepts of ''by-product to co-product'' and ''repurpose-upcycle-reuse'' are attracting increasing attention. Therefore, plant by-products comprise an easy-to-access and low-cost source of bioactive compounds, which confer significant health-promoting properties. In this regard, the present study investigates the potential of the re-valorization and incorporation of aromatic plant by-products in the development of novel foods. To fulfill this scope, the objectives of this project are (a) to obtain extracts of aromatic plant by-products by optimizing ultrasound-assisted extraction (UAE) using experimental design models, (b) to evaluate the total phenolic content (TPC), the antioxidant and antiradical activity and (c) to assess their phytochemical profile, by implementing spectrophotometric assays and liquid chromatography-tandem mass spectrometry (LC-MS/MS) analysis, respectively.
Methods: Ultrasound-assisted extraction was applied to acquire extracts from five aromatic plants of Greek flora (i.e. Lavandula angustifolia, Origanum vulgare, Rosa Damascena, Helichrysum stoechas and Crocus sativus) as well as from their by-products disposed after their hydro- or steam- distillation. The extraction parameters (% ethanol content, extraction time, solvent/material ratio and ultrasound power) were optimized, in terms of TPC, using Box-Behnken design. The TPC of all extracts was determined using the Folin-Ciocalteu method, while the antiradical and antioxidant activity were estimated by the ABTS•+ and FRAP method, respectively. The phytochemical profile of selected extracts was also assessed by using an Agilent 1200 HPLC and a 3200 Q TRAP triple-quadrupole linear ion trap mass spectrometer system.
Results: According to our results, ethanol content was the most critical factor for polyphenols extraction from lavender, oregano and rose petals by-products. In all cases, the highest TPC values were achieved at 25 min and 40 mL/g solvent-to-material ratio. Oregano and rose petals extracts presented the higher phenolic content. The untargeted LC-MS/MS analysis revealed the presence of bioactive compounds, such as phenolic acids, flavanones, flavonols and other flavonoids.
Conclusions: Based on their antioxidant properties, aromatic plant by-products emerge as promising agents for novel food applications, such as their use in meat products to inhibit microbial growth and lipid oxidation aiming at a shelf-life extension.