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Mentha piperita Formulations in Natural Deep Eutectic Solvents: Phenolic Profile and Biological Activity

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Abstract : Natural deep eutectic solvents (NADES) represent a class of modern systems that have been developed as a green alternative to toxic organic solvents, which are commonly used as extraction media. It has been considered that hydrogen bonding is the main interaction leading to the formation of NADES. The aim of this study was phytochemical characterization and determination of the antioxidant and antibacterial activity of Mentha piperita leaf extracts obtained by six choline chloride-based NADES. NADES were prepared by mixing choline chloride with different hydrogen bond donors in 1:1 molar ratio following the addition of 30% (w/w) water. The mixtures were then heated (60 °C) and stirred (650 rpm) until the clear homogenous liquids were obtained. The Mentha piperita extracts were prepared by mixing 75 mg of peppermint leaves with 1 mL of NADES following by the heating and stirring (60 °C, 650 rpm) within 30 min. The content of six phenolics in extracts was determined using HPLC-PDA. The dominant compounds presented in peppermint leaves - rosmarinic acid and luteolin 7-O-glucoside, were extracted by NADES at a similar level as 70% ethanol. The microdilution method was applied to test the antibacterial activity of extracts. Compared with 70% ethanol, all NADES systems showed higher antibacterial activity towards Pseudomonas aeruginosa (Gram -), Staphylococcus aureus (Gram +), Escherichia coli (Gram -), and Salmonella enterica (Gram -), especially NADES containing organic acids. The majority of NADES extracts showed a better ability to neutralize DPPH radical than conventional solvent and similar ability to reduce Fe3+ to Fe2+ ions in FRAP assay. The obtained results introduce NADES systems as the novel, sustainable, and low-cost solvents with a variety of applications.

Keywords : antibacterial activity, antioxidant activity, green extraction, natural deep eutectic solvents, polyphenols
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