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Investigation of Deep Eutectic Solvents for Microwave Assisted Extraction and Headspace Gas Chromatographic Determination of Hexanal in Fat-Rich Food

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Abstract : The most complicated step of the determination of volatile compounds in complex matrices is the separation of analytes from the matrix. Traditional analyte separation methods (liquid extraction, Soxhlet extraction) require a lot of time and labour; moreover, there is a risk to lose the volatile analytes. In recent years, headspace gas chromatography has been used to determine volatile compounds. To date, traditional extraction solvents have been used in headspace gas chromatography. As a rule, such solvents are rather volatile; therefore, a large amount of solvent vapour enters into the headspace together with the analyte. Because of that, the determination sensitivity of the analyte is reduced, a huge solvent peak in the chromatogram can overlap with the peaks of the analyts. The sensitivity is also limited by the fact that the sample can’t be heated at a higher temperature than the solvent boiling point. In 2018 it was suggested to replace traditional headspace gas chromatographic solvents with non-volatile, eco-friendly, biodegradable, inexpensive, and easy to prepare deep eutectic solvents (DESs). Generally, deep eutectic solvents have low vapour pressure, a relatively wide liquid range, much lower melting point than that of any of their individual components. Those features make DESs very attractive as matrix media for application in headspace gas chromatography. Also, DESs are polar compounds, so they can be applied for microwave assisted extraction. The aim of this work was to investigate the possibility of applying deep eutectic solvents for microwave assisted extraction and headspace gas chromatographic determination of hexanal in fat-rich food. Hexanal is considered one of the most suitable indicators of lipid oxidation degree as it is the main secondary oxidation product of linoleic acid, which is one of the principal fatty acids of many edible oils. Eight hydrophilic and hydrophobic deep eutectic solvents have been synthesized, and the influence of the temperature and microwaves on their headspace gas chromatographic behaviour has been investigated. Using the most suitable DES, microwave assisted extraction conditions and headspace gas chromatographic conditions have been optimized for the determination of hexanal in potato chips. Under optimized conditions, the quality parameters of the prepared technique have been determined. The suggested technique was applied for the determination of hexanal in potato chips and other fat-rich food.

Keywords : deep eutectic solvents, headspace gas chromatography, hexanal, microwave assisted extraction
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