BOOK OF ABSTRACTS

11th International Symposium on
RECENT ADVANCES IN FOOD ANALYSIS

November 5–8, 2024

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Jana Pulkrabová, Monika Tomaniová, Stefan van Leeuwen, Michele Suman, Michel Nielen and Jana Hajšlová

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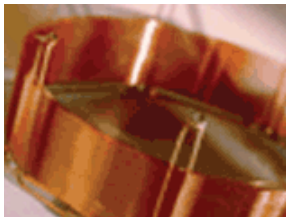

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MICROWAVE-ASSISTED METHODS FOR GREENER AND MORE PRACTICAL (BLUENESS) FATTY ACID PROFILING IN FOOD

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Fatty acids (FA) are predominant components of the lipid fraction in foods, and their analysis is important for industrial applications and understanding their implications for nutrition and health. While the standard laboratory procedure for profiling fatty acid is gas chromatography coupled with flame ionization detection (GC-FID), the sample preparation can be performed following somewhat different protocols. Typically, the lipids fraction is extracted from the matrix and then the FAs are converted into their more volatile derivatives FAMEs. FAMEs are generally formed under acidic (BF_3, HCl, H_2SO_4) or alkaline conditions (KOH, NaOH, CH_3NaO) through esterification and/or transesterification.
This study compares different extraction and derivatization methods for FAME analysis, including the use of microwave-assisted technologies to increase the productivity and greenness of the processes. Two different microwave-assisted extractions (solvent extraction and extraction with hydrolysis) were used and the extracts were derivatized with two other different methods: the conventional derivatization with BF_3 and microwave-assisted derivatization using a methanolic hydrogen chloride solution. The combinations of these extractions and derivatizations were then compared with one-step microwave-assisted extraction and derivatization and to two AOCS Official methods (Ce 2b-11 and Ce 2c-11) used as references.
The FAME were identified and semi-quantified using comprehensive two-dimensional gas chromatography coupled with a flame ionization detector and a reverse fill/flush flow modulator (GC×GC-FID).
All methods were evaluated for their greenness and practicality using two recent tools, namely AGREEprep and BAGI, respectively.
The microwave-assisted processes were demonstrated to be comparable to official methods in terms of performances. Among all the methods, the one-step microwave-assisted extraction and derivatization achieved the highest score for greenness and practicality, 0.51 and 75, respectively; while the official methods had 0.22 and 67.5, respectively. In the end, a particular focus should be given to the derivatization step. It was shown that the BF_3 can be replaced by methanolic hydrogen chloride microwave-assisted derivatization. This method achieves the same performance as the other methods while enhancing greenness, operator safety, and throughput.

Keywords: microwave-assisted methods, fatty acids methyl esters, bidimensional chromatography, green chemistry

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