

BOOK OF ABSTRACTS



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GSAC-13: MASE–SPE Strategy for Rapid and Green Sterol Analysis in Extra Virgin Olive Oil (EVOO)

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Abstract

Sterol analysis is essential for verifying the authenticity and quality of extra virgin olive oil (EVOO), which due to its high nutritional and economic value, is frequently subject to fraud through blending with lower-cost oils. Accurate sterols profiling is therefore essential for authenticity verification and regulatory compliance. However, the official International Olive Council (IOC) method remains labor-intensive, time-consuming, and solvent-intensive due to its multi-step procedures, which includes saponification, liquid–liquid extraction, thin-layer chromatography (TLC), and gas chromatography with flame ionization detection (GC-FID). These limitations reduce its applicability for high-throughput analysis and do not align with the principles of green chemistry. This work presents a simplified, rapid, and greener analytical workflow combining microwave-assisted saponification and extraction (MASE) with solid-phase extraction (SPE) purification for sterols analysis. In the developed approach, conventional reflux heating was replaced by microwave irradiation in a closed-vessel system, enabling simultaneous saponification and extraction in a single step. Experimental design methodology was applied to optimize operating conditions, achieving analytical results comparable to those obtained with the IOC reference method. Furthermore, traditional TLC purification was replaced by an optimized SPE procedure, reducing solvent consumption by over 90% and increasing sample throughput to approximately 12 samples per hour. The greenness assessment AGREEPrep and White Analytical Chemistry (WAC) metrics confirmed improvements in sustainability, operational efficiency, and overall method whiteness, while preserving analytical equivalence for sterols determination. This workflow is specifically designed to routine laboratories with limited economic resources, offering a robust, cost-effective, and regulatory-compliant alternative for high-throughput sterol analysis.

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References

1 - International Olive Council: Madrid, Spain, 2017