EVOQUE project: Enhanced selectivity VOC detection using novel GC-QEPAS

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The **EVOQUE** project aims to develop a novel photonic-based sensing system designed to exceed current standards and address the demanding requirements of at-line, on-line, and in-field monitoring in agriculture, food quality, environmental pollution, and industrial emissions.

The proposed system will integrate Gas Chromatography (GC) with Quartz-Enhanced Photoacoustic Spectroscopy (**QEPAS**) into a single, compact rack-mounted instrument. This innovative coupling of fast GC with **QEPAS** spectroscopy is a key technological challenge. Each component of the system is being specifically designed and optimized to achieve high performance.

By combining these technologies, **EVOQUE** aims to deliver a compact, cost-effective, and user-friendly sensor system suitable for on-site deployment in various environmental settings.

This integrated approach positions **EVOQUE** as a versatile tool for real-time, non-destructive VOC analysis across multiple sectors, contributing to improved environmental monitoring and public health outcomes.

Key developments include:

- A versatile sampling system with preconcentration capabilities (e.g., SPME, HiSorbTM, Arrow, and thermal desorption).
- A fast GC oven system enabling fast, repeatable analyses.
- A heated transfer line optimized to match detector flow and pressure requirements.
- An integrated software platform for data acquisition and automated sequence control over time.
- Tailored column selection based on application and target VOCs.

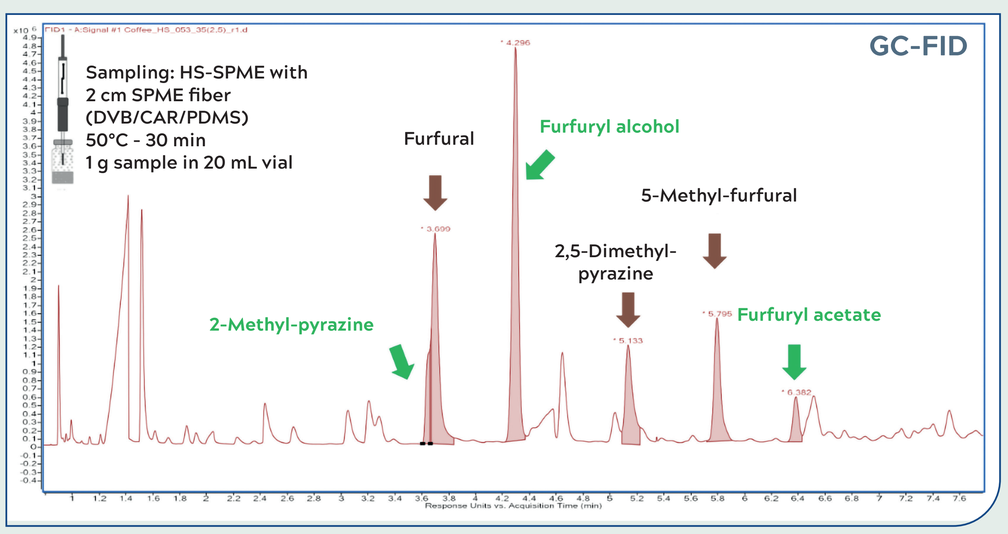

Figure 1: Example of Hazelnut for food application sample tested with SPME sampling.

Dead volume minimization and system miniaturization

Dead volume in the detector is a known issue that negatively impacts GC separation, resulting in peak tailing and reduced resolution. Addressing this is a central focus of the **EVOQUE** project. Strategies under development include minimizing dead volumes within the detector and associated connectors, optimizing internal flow paths, using make-up gases, and implementing vacuum conditions at the detector interface.

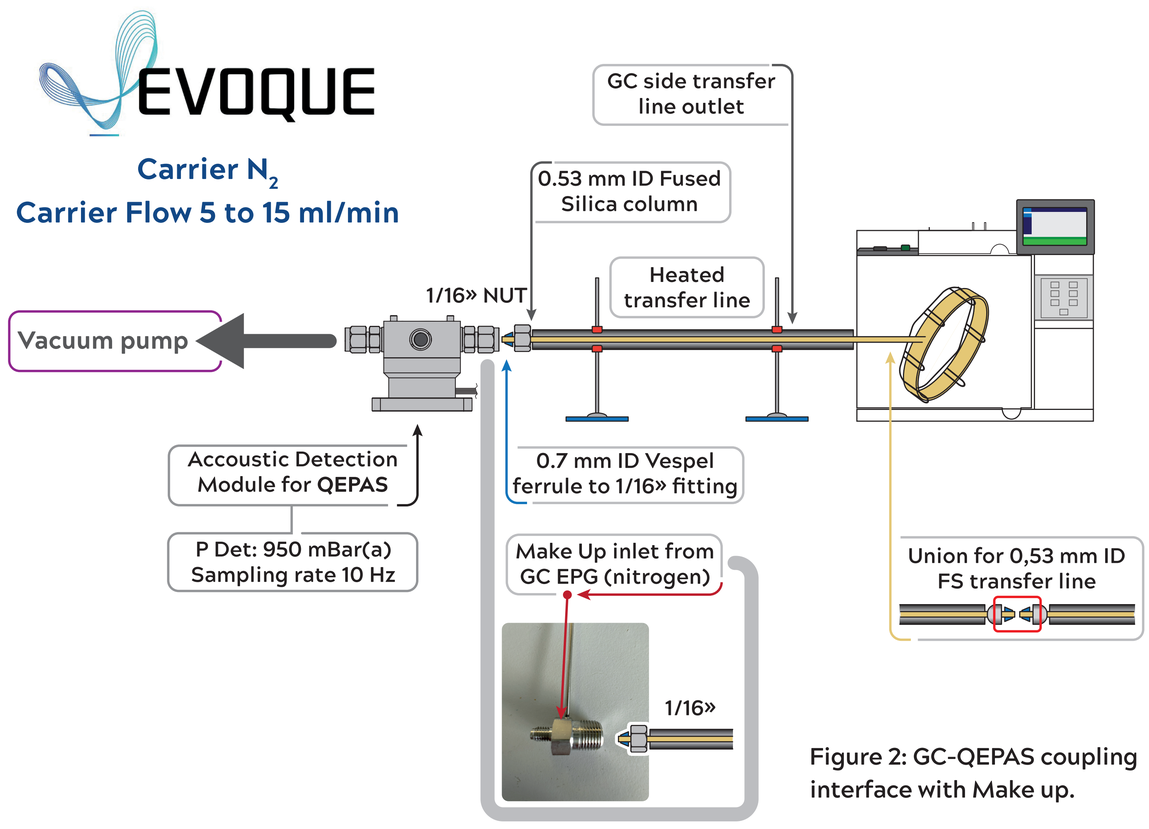

Figure 2: GC-QEPAS coupling interface with Make up.

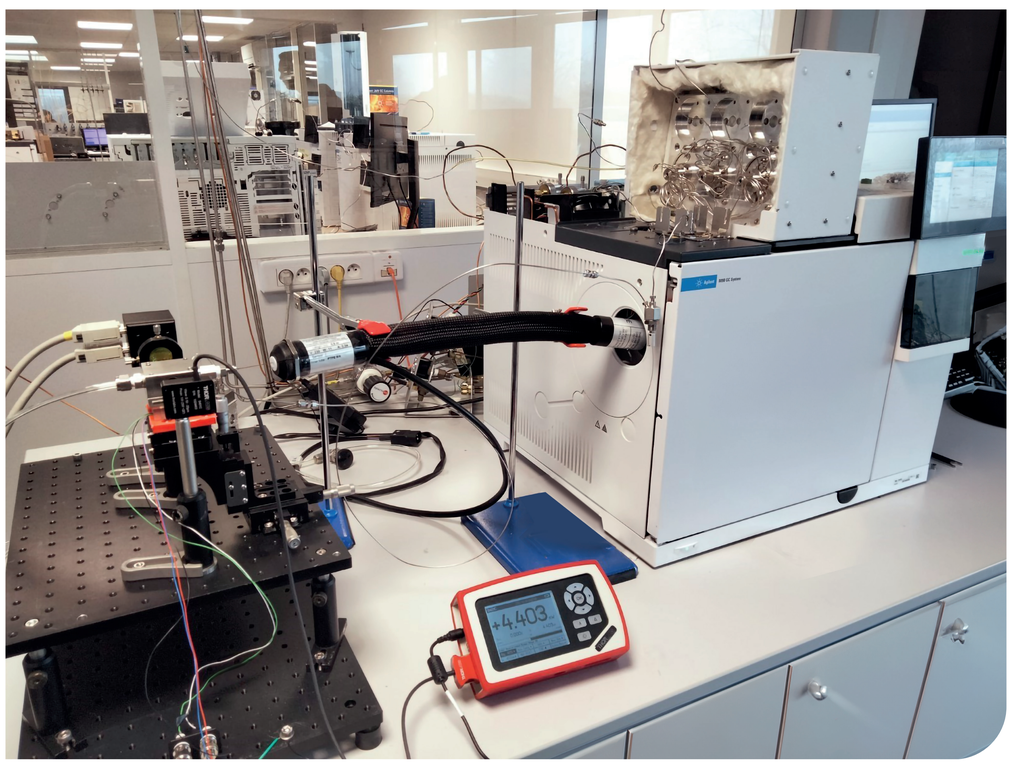

Figure 3: GC-QEPAS 1st coupling installation.

Initial tests were performed on VOCs at ppm levels. The implementation of a make-up gas significantly reduced dead volume effects, resulting in improved signal shape and peak resolution.

Compound	Concentration (%mol)
(C1) CH_4	95,45
(C2) C_2H_6	4,25
(C3) C_3H_8	0,29
(C4) C_4H_{10}	<0,01

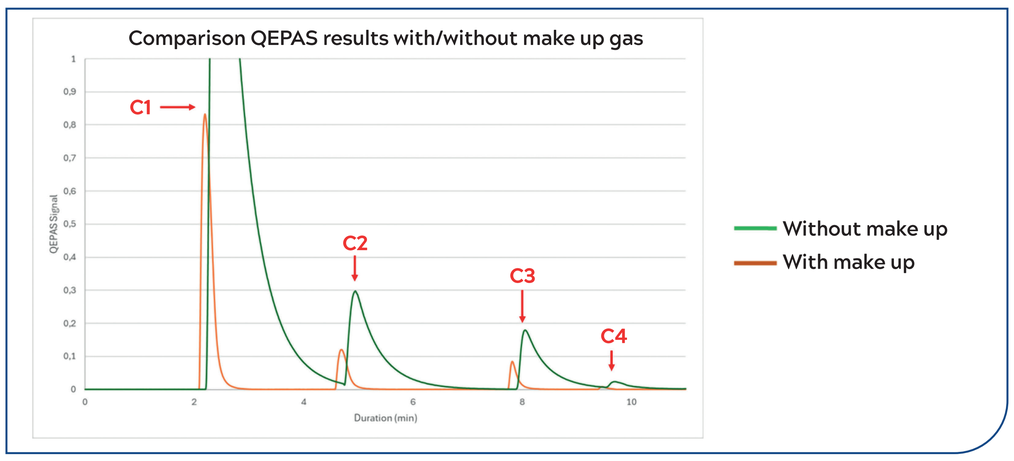

Figure 4: Difference between 2 analysis with and without make up gas.