Potential of the Reversed-Inject Differential Flow Modulator for Comprehensive Two-dimensional Gas Chromatography in the Quantitative Profiling of Complex Natural Samples

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Abstract

A "second generation" design of differential flow modulation for comprehensive two-dimensional gas chromatography (GC×GC) was recently introduced [1,2]. This new configuration, based on the original device from Seeley et al. [3], adopts a reverse fill/flush injection dynamic instead of the forward flush/fill implemented in the "first generation" devices. Advantages include: (a) higher efficiency of band re-injection with improved ^{2}D peak-widths and symmetry, (b) adjustable collection channel volume, (c) better handling of the overloading phenomenon without dramatic loss of peak-capacity/ resolution, and operation with hydrogen and helium carrier.

In this study, the first Capillary Flow Technology (CFT) reverse-inject differential flow modulator was implemented with different column configurations (lengths, diameters and stationary phase coupling) and detector combinations (Mass Spectrometry -MS and Flame Ionization Detection - FID) to evaluate its potential in the quantitative profiling of medium-to-highly complex essential oils and food volatiles fractions. In particular, a parallel dual-secondary column dual-detection configuration that has shown to improve the information potential of thermally modulated GC×GC platforms in terms of MS identification, reliability and accurate FID quantitation [4], was used here for the detailed characterization of essential oils (lavender, mint and vetiver) and food volatiles of interest for aroma blueprinting (extra-virgin olive oil and roasted hazelnuts).

Experimental results demonstrate that by changing column dimensions and configuration, the system flexibility can be greatly improved affording: (a) to extend the modulation period to match for ^{2}D selectivity exploitation, (b) to operate with carrier gas linear velocities close-to-optimal values in both dimensions and (c) to handle overloaded peaks without dramatic losses in ^{2}D peak-capacity and resolution.

References

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