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HIGH EFFICIENCY MICROFABRICATED PLANAR COLUMNS FOR ANALYSIS OF REAL-WORLD SAMPLES OF PLANT AND FOOD VOLATILE FRACTION

Cecilia Cagliero[1], Maria Mazzucotelli[1], Stefano Galli[2], Mario Galli[2], Filippo Bonafè[3], Ivan Elmi[3], Stefano Zampolli[3], Chiara Cordero[1], Erica Liberto[1], Barbara Sgorbini[1], Patrizia Rubiolo[1], Carlo Bicchi[1]

[1] Dipartimento di Scienza e Tecnologia del Farmaco - Università di Torino, Via Pietro Giuria, 9, 10125 Torino, Italy

[2] MEGA s.n.c., Via Plinio, 29, 20025 Legnano, Italy

[3] CNR-IMM Bologna, via Gobetti 101, 40129 Bologna, Italy

Compact and miniaturized instrumentation, with technical characteristics and performance comparable to those of conventional setups, has obvious benefits in terms of saving energy, materials, and laboratory space and, at the same time offers the possibility of “in-field” applications.

In view of a possible application of on-chip GC for the in-situ analyses of the volatile fraction emitted from plants and/or food, this study evaluates the performance of a set of planar columns developed to analyze complex mixtures. The study is focused on column development and the analyses are carried out with a conventional GC unit. In a previous study, the performances of 2 m planar columns statically coated with dimethyl polysiloxane 5 % phenyl (Sil5%-PH) and acid-treated polyethylene glycol were tested (FFAP-EXT) [1]. The results were comparable to those of reference conventional NB columns, efficiency achieving a number of theoretical plates per meter (N/m) ranging from 6100 for FFAP-EXT to 7200 for Sil5%-PH.

Plant and food volatile fractions are characterized by high complexity and usually consist of components within a widely extended range of volatility and polarity. A reliable chemical analysis therefore requires columns with a high separation power. One of the ways to deal with this issue successfully is to increase column length (i.e. peak capacity), while keeping high efficiency and selectivity. A set of 5 m planar column coated with the same stationary phases was therefore developed. Column performances were tested by analyzing essential oils and headspace of a group of medicinal and aromatic plants as well as standard mixtures of related compounds. The results were compared to those obtained with equivalent narrow-bore (NB) columns (l: 5m, d_c: 0.1 mm, d_f: 0.1 µm) and to the 2m planar columns of the previous study taken as reference. The 5m planar columns provide separations of the components of the investigated samples fully overlapping those of the corresponding conventional NB column. Their chromatographic performances were highly satisfactory achieving efficiency higher than the previous ones with N/m ranging from 7000 for FFAP-EXT to 8300 for Sil5%-PH, and significantly increasing the retention of highly volatile compounds, thereby providing a drastic increase of their separation power (i.e. peak capacity). These results show that 5m planar columns can provide performances that make them able to satisfy all requirements for a reliable analysis of a plant or food volatile fraction (i.e. peak identification and quantitation).

[1] Cagliero C., Galli S., Galli M., Elmi I., Belluce M., Zampolli S., Sgorbini B., Rubiolo, P., Bicchi, C. Journal of Chromatography A 1429 (2016) 329–339