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Authors: Sander Jespers, Frederic Lynen, Gert Desmet

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Numerical study and theoretical performance limit of interconnected multi-capillary gas chromatography columns with perfectly ordered pillar patterns

Sander Jespers[(1)], Frederic Lynen[(2)], Gert Desmet[*,(1)]

[(1)]Vrije Universiteit Brussel, Department of Chemical Engineering, Pleinlaan 2, 1050 Brussels, Belgium

[(2)]Universiteit Gent, Separation Science Group, Krijgslaan 281, B-9000 Gent, Belgium

*Corresponding author e-mail: gedesmet@vub.ac.be

Highlights

- The band broadening in a novel type of microfabricated GC column is calculated numerically
- The column structure performs as a bundle of parallel capillaries with regular intermixing points
- For a system pressure of 8 bar, the optimal inter-pillar distance could be determined to be at 75 μm
- Under non-retained conditions, external-length based plate heights as low as 6 μm can be expected

Abstract

We present the results of a theoretical and numerical study of the chromatographic performance of a novel type of microfabricated GC column. The column consists of an array of rectangular flow diverters (pillars), creating a network of perfectly ordered, interconnected and tortuous flow-through paths. Using van Deemter and kinetic plots of simulated band broadening data, we could demonstrate that the proposed column structure performs as a bundle of parallel open-tubular capillaries with rectangular cross-section, connected by a regular pattern of channel-intermixing points that allow compensating for inevitable channel-to-channel differences in migration velocity without adding any significant dispersion themselves. The established kinetic plots also allowed to