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Authors: Sander Deridder, Gert Desmet, Ken Broeckhoven

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## Numerical investigation of band spreading generated by flow-through needle and fixed loop sample injectors

Sander Deridder <sup>(1)</sup>, Gert Desmet <sup>(1)</sup>, Ken Broeckhoven <sup>(1,\*)</sup>

<sup>(1)</sup> Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussel, Belgium

<sup>(\*)</sup> Corresponding author: email: [Ken.Broeckhoven@vub.be](mailto:Ken.Broeckhoven@vub.be)

tel.: ++3226293781

fax.: ++3226293248

**Declarations of interest:** none

### Highlights

- Injection volume contribution to peak dispersion was studied with CFD
- Delay time between sample load and injection plays a crucial role in band broadening
- Fixed loop injectors produce narrower injection bands than flow-through needles
- Results are generalized to complete parameter space via dimensional analysis
- Nondimensionalization led to the identification of two different injection regimes

### Abstract

The present study reports on a computational fluid dynamics study of the band broadening occurring in injector systems frequently used in contemporary liquid chromatography instruments. The aim of this work is to determine band broadening originating purely from the injection volume in absence of any other possible contribution (e.g. band broadening due to the injection valve) and to unravel the mechanism behind it. Simulations of the dispersion process in flow through needle injectors were performed. In addition, fixed loop injectors were also simulated and comparison with flow through needle injectors was made. The results are also

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