

## KEYNOTE LECTURE &

Multidimensional Separations & Lipidomics Session (Tuesday, March 28, 9:30, Sorbonne 2)

### Microscale online comprehensive two-dimensional liquid chromatography – second thoughts on speed, efficiency and selectivity

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#### Abstract:

Two-dimensional liquid chromatography (2D-LC) is said to be far superior in terms of peak capacity than 1D-LC. There are different variants of 2D-LC like e.g. LC - LC, sLC x LC, LC x LC and LC + LC, which can be executed either offline or online. In this presentation, the potential and limitations of online LC x LC are discussed with an emphasis on miniaturization. Moreover, the possibility to separate isobaric compounds that are difficult or impossible to distinguish by mass spectrometry is evaluated when using LC x LC, 1D-LC and ion mobility spectrometry (IMS).

The experiments have been carried out on a microscale 2D-LC system using nano-LC and micro-LC in the first and second dimension. A set of low molecular weight isobaric compounds has been used as model analytes. The kinetic plot method has been used to gain information about the peak capacity when very fast gradient times are applied in the second dimension. Ion mobility spectrometry and 1D-LC were employed as reference methods.

A very fast analysis cycle for online LC x LC has been developed, where the efficient gradient time in the first dimension was reduced to 12 minutes with a cycle time of 34 minutes. The efficient gradient time for the second-dimension separation was reduced to 17 seconds with a cycle time of 30 seconds. Although this system yielded a higher peak capacity production rate than the 1D-LC reference method, the absolute peak capacity was not sufficient to adequately resolve the isobaric compounds either in the first or second dimension. Although ion mobility spectrometry is said to be very suitable for a separation of structurally related compounds, most peak pairs could not be separated by IMS. To design a better 2D-LC system, the kinetic plot theory was used to determine the minimum peak capacity that is necessary for a chromatographic separation of the isobaric species. In this context, a concept that was recently introduced by Schmitz et al. and is termed LC + LC could be interesting to overcome some limitations of the "classical" LC x LC approach.

To facilitate ultra-fast gradients in the second dimension of an LC x LC system with gradient times of less than 15 seconds, very small particles with a diameter of less than 1.5  $\mu\text{m}$  at temperatures between 80 und 100  $^{\circ}\text{C}$  should be used. However, the requirements on valve technology will be very high to guarantee a robust operation of such a system that can be used for industrial applications.

#### Short Biography:

Thorsten Teutenberg, studied Chemistry at Ruhr University Bochum. He studied for a doctorate in Analytical Chemistry at this institution, submitting a thesis on 'High-temperature HPLC'. In 2004 his career took him to the Institut für Energie- und Umwelttechnik e. V. in Duisburg as a research associate. Since 2012 he oversees the Research Analysis Department, mainly working on the various aspects of high-temperature HPLC, miniaturized separation and detection techniques, and multi-dimensional chromatography processes.

