

Capillary Electrophoresis: Comparison of Hydrodynamically Opened and Closed Systems

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Gold statement

- Learn about advantages of Capillary Electrophoresis in Hydrodynamically Closed System
- Understand how the concentration sensitivity of CE can be increased ca. 20 times
- Learn about how this technique compares with conventional Capillary Electrophoresis
- Demonstrated on analysis of complex samples

Introduction

In this contribution, we carried out a feasibility study aimed at investigating the performance of CE in hydrodynamically closed separation system (CSS). The potential benefits of wide bore tubes were assessed against the expected increase of thermal dispersion due to inherent thermal effects. Some established validation parameters such as repeatability of injection, efficiency, resolution and sensitivity were used to assess its performance.

Body

To compare hydrodynamically open and closed separation system, we carried out CE analysis of two model pharmaceutical compounds, Pindolol (PDL) and Propranolol (PPL). We focused on four criteria: repeatability of migration times, separation efficiency, resolution and sensitivity. Although significant reduction in efficiency was observed, we estimated that approximately 90% of this was due injection contribution to zone broadening. Despite this loss of off efficiency, only minimal impact on resolution of enantiomers of PDL and PPL was observed. This was accompanied by 20-fold increase in concentration sensitivity. These encouraging results obtained on model samples were subsequently confirmed on complex real samples where pharmaceutical compounds were spiked to blood serum. Minimal matrix effects and adsorption elimination due to interaction with blood proteins represents a significant benefit of working in hydrodynamically closed system. This research was funded by the Slovak Research and Development Agency (APVV-17-0318 and APVV-0259-12), and the Slovak Grant Agency for Science (VEGA 1/0787/18).

Conclusion

Approximately 20-fold increase in concentration sensitivity was observed in CSS. The significance of this increase is particularly relevant for pharmaceutical analysis as it brings capillary electrophoresis to the required sensitivity level comparable with modern liquid chromatography.

References

- [1] M. Masár, J. Hradski, M.G. Schmid, R. Szucs, *Int. J. Mol. Sci.* **21** (2020) 6852-6866.