Analysis of Biologically Important Substances by Capillary Electrophoresis Coupled with Mass Spectrometry

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The crutial task of CE-MS instrumentation is to strike the balance between robustness and sensitivity. Generally, the interfaces implementing sheath liquid provide higher robustness, whereas sheathless designs reach better sensitivity.[1] This work is focused on development of the simplest CE-nanoESI/MS interfacing and its use for investigation of metabolic path of drug dexrazoxane.

This novel interface deals with only one power supply defining voltage at the beginning of the separation capillary. Voltage for nanoESI is given by residual voltage at the capillary ending sharpen into the symmetrical tip.[2] The CE separation is run in very narrow capillary of diameter ≤ 15 µm resulting in flow rates of several nL/min leading to higher robustness towards BGE composition, minimal peak broadening and low sample consumption.[3]

Since the quality of the tip influences sensitivity, robustness and life time of the instrumentation, several approaches of the tip fabrication was tested. As the most convenient method grinding was chosen and a laboratory made grinding device was designed and assembled from 3D printed components to precisely control the tip sharpness.[4] Moreover, the stability of the nanospray was boosted by hydrophobic coating.

After demonstration the viability of novel CE-MS interfacing on several standard biological samples, the dexrazoxane metabolism was investigated. Dexrazoxane is an important cardioprotective prodrug used during chemotherapy treatment. In the patient body it is turned by hydrolysis into an active form called ADR-925. However, the kinetic of the metabolic path and distribution to target tissue is still unclear. Currently validated method HPLC-MS brings 20 min long analysis leading to time consuming procedure.[5] The CE-nanoESI/MS in the proposed design was used for successful analysis within 6 minutes providing LOD on ng/mL level. Moreover, preconcentration techniques (e.g. t-ITP) can be during CE implemented leading to further improvement of sensitivity.

Proposed CE-nanoESI/MS interfacing brings significant instrumental simplicity and due to narrow bored capillaries also excelent sensitivity and sample consumption of nL level.

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