

Microchip Devices Coupled with Time-of-Flight MS for High Speed, High Sensitivity Analysis

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A microfabricated microfluidic device coupled with a nanospray tip that can be used for rapid ESI MS analysis has been developed. The device has been interfaced with a TOF mass spectrometer and evaluated for sensitive, high-speed detection of peptides and proteins. The electrospray voltage is applied through the microchip to the nanospray capillary attached at the end of a microfabricated channel. Flow rates of 20 to 30 nL/min are established through the device without any pressure assistance. The effect of the capillary-chip junction on separation efficiency has been examined and different configurations for on-chip application of the electrospray voltage tested. Designs that provide the highest performance in terms of stability, sensitivity, and suitability for successful MS detection of efficient CE separations will be shown. Operating the TOFMS system at spectral generation rates of 4 to 5 kHz and at storage rates of 50 to 100 spectra/s enables high fidelity monitoring of fast microchip-CE separations. Subattomole quantities of compounds from low nanomolar concentration samples have been detected from infusion experiments. The overall simplicity and ease-of-operation of the hybrid microchip capillary source rank it favorable in comparison to previously reported microchip ES devices.

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