MICROCHIP DEVICES FOR TWO-DIMENSIONAL PEPTIDE SEPARATIONS

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Microfabricated, microfluidic devices constructed on planar substrates have been shown to be highly advantageous for manipulating small sample volumes, rapidly processing materials, and integrating sample pretreatment and separation strategies. The dexterity with which materials can be manipulated and the ability to machine structures with interconnecting channels with essentially zero dead volume contribute to the high performance of these devices. These features coupled with the ease of automating all fluidic manipulations make microchips excellent candidates for configuring multidimensional separations. We have recently devised chips which combine micellar electrokinetic chromatography and high speed open channel electrophoresis on a single structure for the rapid two-dimensional analysis of tryptic peptides. Methods for post-separation derivatization have also been examined and labeling agents that provide rapid kinetics and high yields for on-column fluorescence detection have been identified. Structures that incorporate an electrospray element have also been devised and tested for high sensitivity detection of peptides by time-of-flight (TOF) mass spectrometry. Sub-attomole sensitivity has been demonstrated for high nanomolar concentration samples. The high-speed acquisition rates of the TOF instrument allow high fidelity monitoring of fast microchip-CE separations. These data will be presented and the overall utility of the devices for protein mapping discussed.

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