

366e Development of Polymeric Microchips for Use in Binding Studies

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Microfluidic devices are increasingly of interest for high-throughput assay development due to low sample consumption, high sensitivity, high speed, and instrument integration capabilities. These advantages have been exploited by using microchips as a platform for capillary electrophoresis, CE, studies with either fluorescence or mass spectrometric detection. In both cases, fluids are driven by an electroosmotic force, EOF, generated by the application of potentials to these fluids. Plastic is an ideal substrate candidate for microfluidic devices as it is inexpensive and suitable for mass production, but it cannot generate a sufficient EOF on its own. Therefore, we have been investigating various surface modification chemistries for poly(methylmethacrylate), PMMA, to increase the EOF to levels compatible with bioanalytical assays and different detection methods (namely electrospray mass spectrometry).

Binding constants are a measurement of the affinity between a receptor molecule and its ligands. Applications for this information include the study of disease mechanisms and the determination of the presence and amount of contaminants, to name a few. Typical methods that have been used to measure binding constants include electrophoresis, chromatography, NMR, filter-binding assays, immunoprecipitation, and surface plasmon resonance. We have been focused on developing assays amenable to the microfluidic format. Here, we have been examining the use of single lane microchips as platforms to determine binding constants. A potential advantage of microchip CE for such determinations arises from the relatively rapid separation times available, which permits the characterization of systems with K_{off} rates that are too rapid for conventional method studies. We will present the binding constants obtained from the various protein:ligand systems, compare those values to binding constants obtained via other methods, and discuss experimental issues associated with performing such assays on a microchip format.