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MICROFLUIDIC PLATFORMS FOR PROTEIN ANALYSIS USING POLYMERIC MICROCHIPS

An aspect of my project is to develop a microchip-based separation technique with a high peak capacity to sort proteins from real samples such as those present in serum (20,000 proteins)¹. I am also involved in the development of methods to reduce electroosmotic flow and improve the electrophoretic performance of DNA, in which poly (methylmethacrylate), PMMA micro-separation channels were dynamically and covalently coated with methylhydroxyethylcellulose (MHEC) and linear polyacrylamide (LPA),^{2*} respectively.

2-D gel image of FCS separation

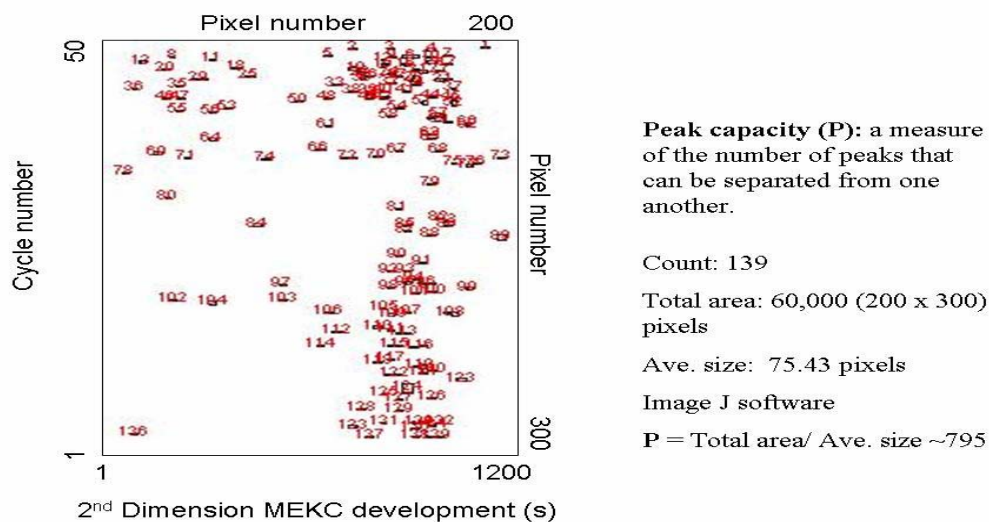


Figure 1 2-D gel image of protein a 2-D microchip separation of FCS proteins mixture. Proteins were labeled with Alexa Fluor 633 for LIF detection. 2 mg/mL of protein samples were loaded for 30 s ($E = 200$ V/cm). SDS μ -CGE development time = 60 s ($E = 260$ V/cm). SDS MEKC development time = 30 s ($E = 260$ V/cm) for 50 cycles. 2-D separation was programmed to begin a 1-s injection from channel C-D (μ -CGE) into channel E-F (MEKC). Image obtained using Image J software. The x-axis represents the MEKC migration time while the y-axis represent the number of cycles. Total pixel area = 60,000 (200 x 300) pixels, ave. pixel size of spot = 75.43 pixels, and a total of 139 spots was counted.

The MHEC coating procedure was also utilized in the separation of fetal calf serum (FCS) proteins on a 2-D format in which proteins were separated in the first dimension by micro-capillary gel electrophoresis and in the second dimension by micellar electrokinetic chromatography. A peak capacity of ~795 was obtained for the FCS separation (see figure 1); as such, I am currently working on increasing the peak capacity of the 2-D system to at least ~5000.

References

1. Regnier, F.; Amini, A.; Chakraborty, A.; Geng, M.; Ji, J.; Riggs, L.; Sioma, C.; Wang, S.; Zhang, X., Multidimensional chromatography and the signature peptide approach to proteomics. *LCGC North America* 2001, 19, (2), 200, 202, 204, 206, 208, 210, 212-213.
- 2.* Llopis, S. D.; Osiri, J.; Soper, S. A., Surface modification of PMMA microfluidic devices for high-resolution separations of single-stranded DNA. *Electrophoresis* 2007, 28, 984-993.

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