154h Microchip Protein Separartion by Electric Field Gradient Focusing

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A microfluidic chip is presented, which separates and focuses charged proteins based on variable electric field. The device operates by physical means involving the independent manipulation of the electrophoretic and electroosmotic forces and velocities in the channel. While electroosmosis is kept constant along the channel, the opposing electrophoretic force varies from one region to another. By this means, the net force on a given protein molecule becomes zero at a unique point while all other solutes are swept away. Like isoelectric focusing, this method concentrates separated molecules into spatially distinct bands. For injection-based methods of separation, the maximum separable quantity of solute is limited by the amount initially present in a single discrete injection plug. In contrast, the stationary zone method investigated here is capable in principle of continuous separation and accumulation up to steric and electrostatic limits. This is of potential benefit in the separation and detection of medically-important trace proteins and metabolites. In this report we present experimental results describing the separation of a binary mixture of bovine serum albumin and phycoerythrin utilizing a chip comprised of intersecting channels in PDMS inlaid with hollow fibers. The results are rationalized by theory and numerical simulations.