Fast Separation of Biomolecules in a Nanofilter Array Chip

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We report here the first microfabricated nanofilter array chip that can size-fractionate SDS-protein complexes and small dsDNA molecules based on the Ogston sieving mechanism [1] without using sieving matrices. Nanofilter arrays with a gap size of 40-180 nm were fabricated and characterized. Complete separation of SDS-protein complexes and small DNA molecules were achieved in several minutes with a separation length of 5 mm. The separation efficiency of the miniature nanofilter array chip is comparable to current state of the art systems (i.e., capillary gel electrophoresis). Our work here is the first direct experimental confirmation of Ogston sieving in a well-defined, regular nanopore system, and the nanofilter array chip is the first microfabricated, regular sieving system that can size-separate small biomolecules, such as proteins.

The nanofilter array chip is chemically and mechanically robust, and can be used over a long period without degradation of its characteristics. The nanofilter array chip allows the use of different buffer systems, and this opens up possibilities for integrating different biomolecule sensors and separation and reaction chambers in one single chip, without the concern of sieving matrix crosstalk and contamination. Therefore, the nanofilter array chip presented here is an important milestone toward a truly integrated proteomic sample-preparation microsystem that includes fully-integrated multiple separation and purification steps.

REFERENCES: