Electronic Supplementary Material (ESI) for Lab on a Chip.

Supplementary Information

Entropic trap purification of long DNA

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COMSOL Modeling

We designed a 3D COMSOL model of the device and compared the electric potential profile from this more detailed model with that predicted by the resistor model. For the comparison between the models, the geometry of the model only contained the filtration region and not the long microchannel connecting the port to the filtration region. The channel dimensions used in these models are shown in Fig S1. The dimensions of the resistor model were also modified to correspond to those in Fig. S1 to provide for a direct for comparison between the two models. The AC/DC physics module in COMSOL was used for the calculations. The fixed potential was applied at 5 ports, as discussed in the main text, while all other boundaries were maintained at no current flux condition. Water was used as the material for modeling ($\epsilon_r = 80.1, \sigma = 5.5\times10^{-6} S/m$). We used the swept mesh feature with free triangular option to adequately mesh the geometry. The model was used to calculate the average potential at the slit areas (Figure S2b) and, in turn, evaluate the electric field in each nanoslit (Figure S2a).

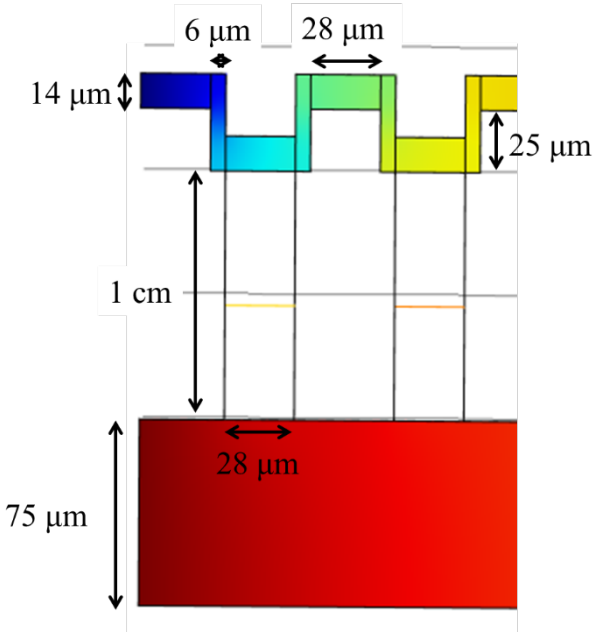


Fig. S1 *Dimensions of the microchannel and nanoslit used in the COMSOL model. Similar dimensions were used for the resistor model for comparison. There are 12 such parallel nanoslits connected by the microchannels as shown in the schematic. The device was modeled with a 90 nm deep nanoslit and microchannel depth of 1 µm.*

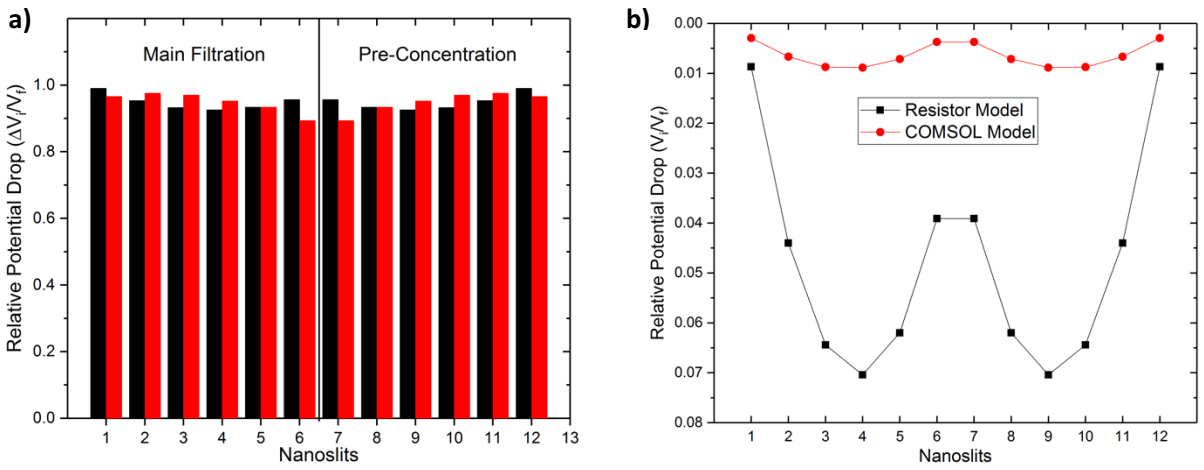


Fig. S2 *2D resistor model and 3D COMSOL model showed similar electric potentials in the microchannels and nanoslits. a) Plot of the potential drop in each slit for both models. b) Plot of the potential at each slit-channel interface in the top channel. The red data correspond to the COMSOL model and the black data correspond to the resistor model. We observe similar trends in both plots. However, the absolute values are different due to the three-dimensional effects that are incorporated into the COMSOL model. The COMSOL model focused on the filtration region and did not have the long microchannel connecting the ports to the filtration region. To make the comparison between the two models, the resistor model was modified from the main text so that it is similar to COMSOL model dimensions. As a result, the absolute values shown here are different from those of Figure 2.*

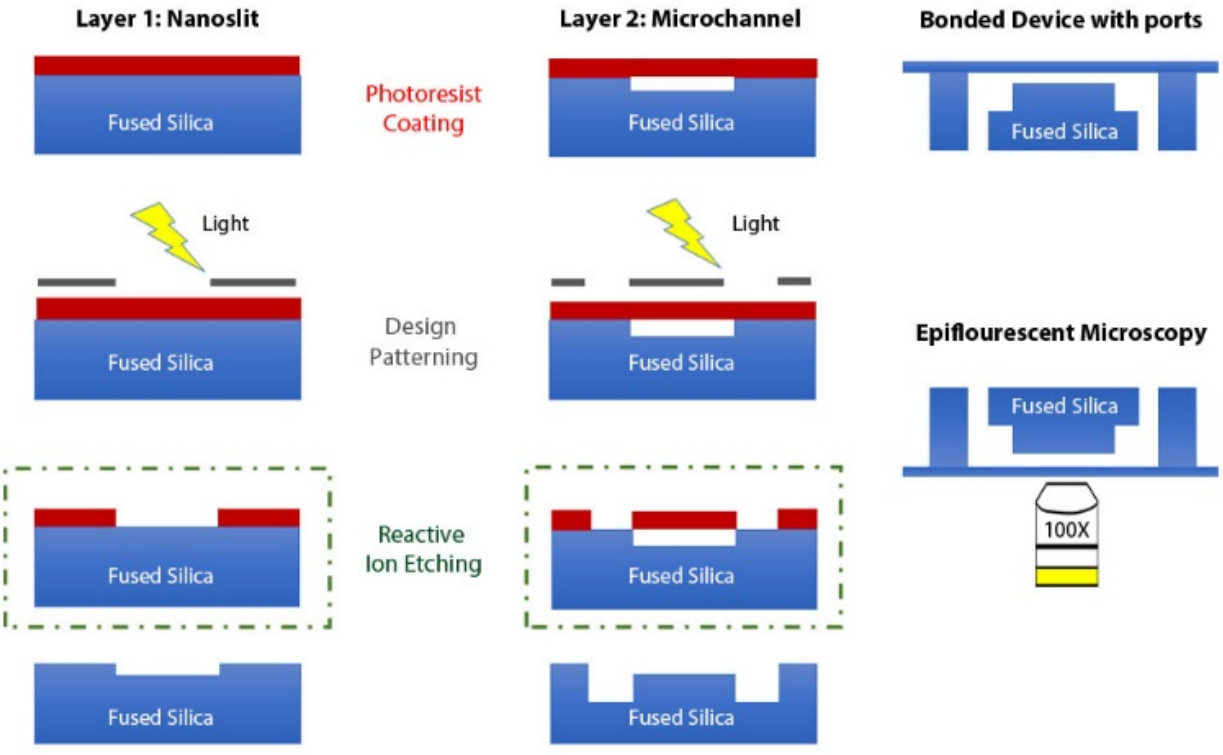
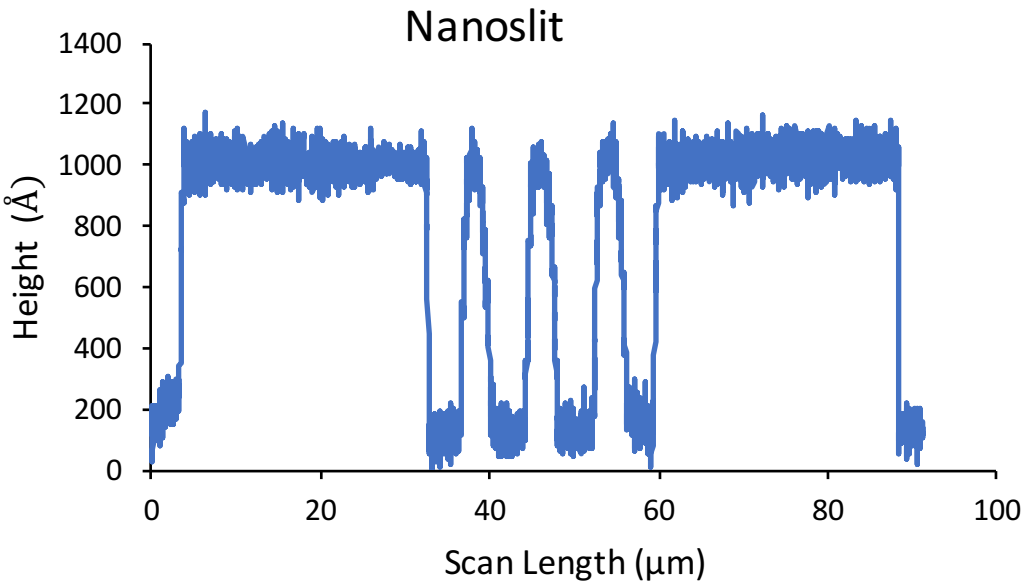


Fig. S3 *Steps involved in the fabrication of the device.*

a)



b)

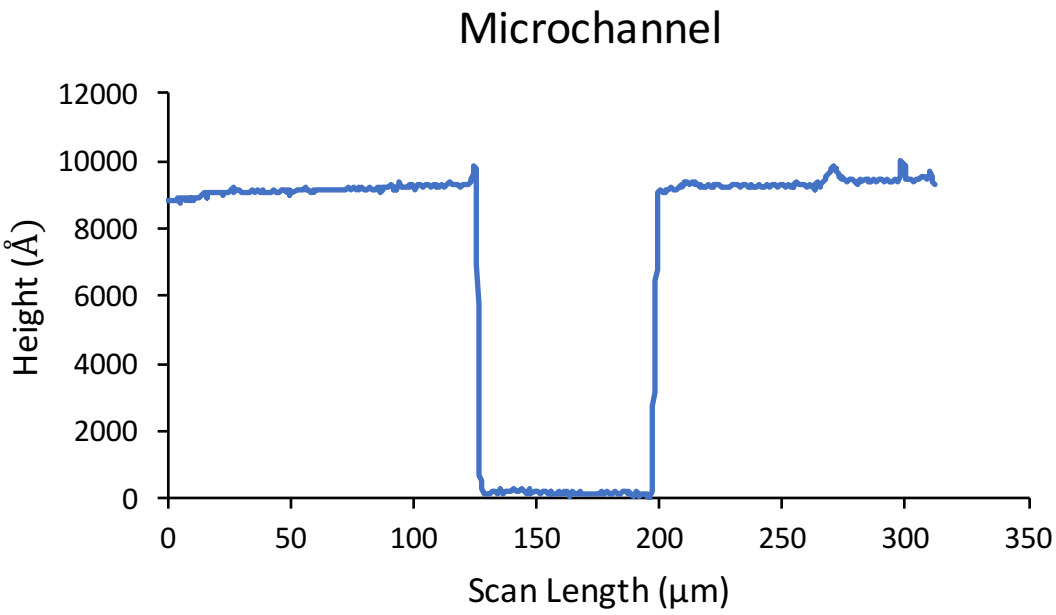


Fig. S4 *Profilometer data for the a) nanoslit and b) microchannels for the device used to produce the separation data in the main text.*

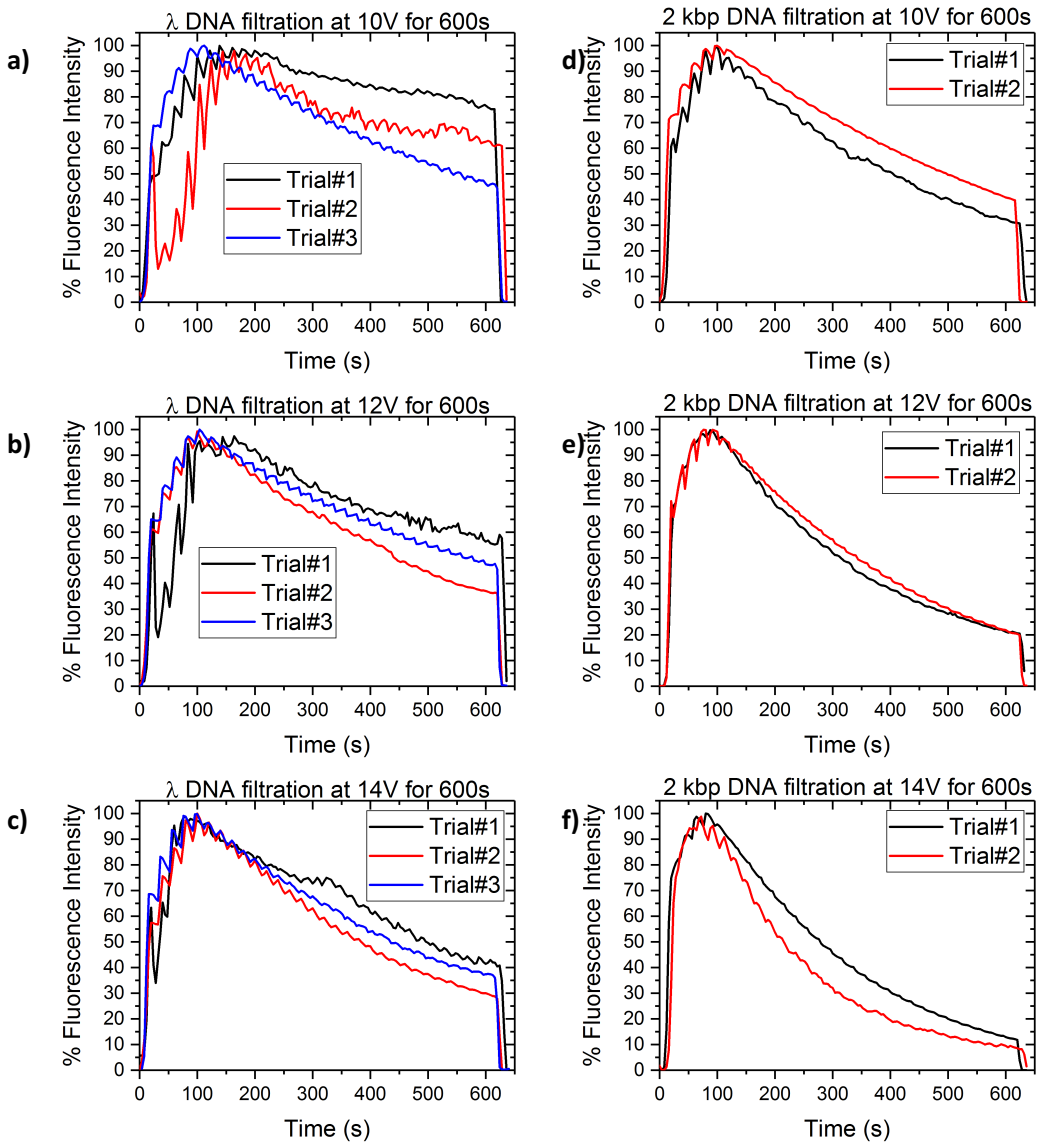


Fig. S5 *Different trials for the filtration of λ DNA (a-c) and 2 kbp DNA (d-f) at 600 s filtration time for various filtration voltages. The final percentage fluorescence intensity of these trials are tabulated in Table 1.*

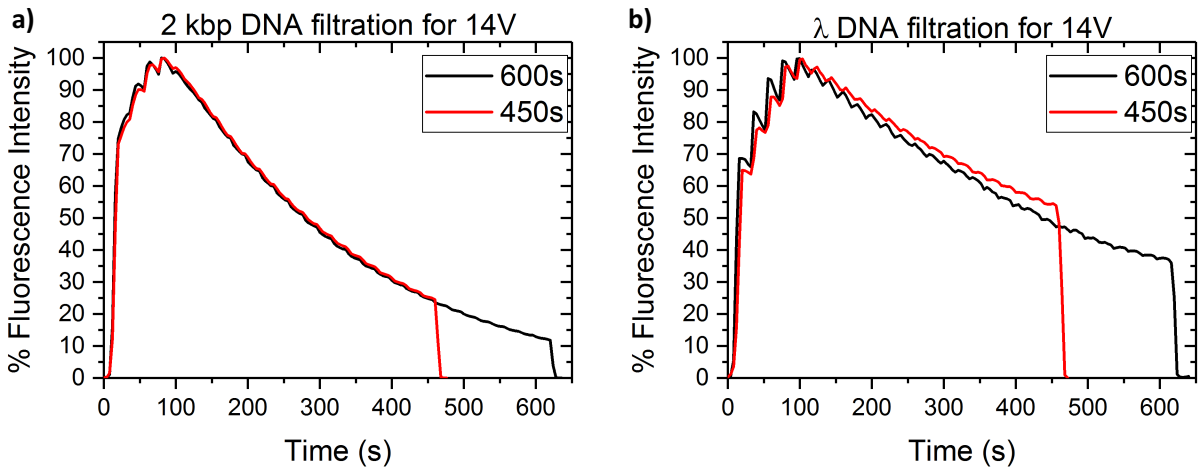


Fig. S6 *Data used to compute the percent recovery of DNA for the filtration voltage of 14 V at different filtration times for a) 2 kbp and b) λ DNA molecules. Each filtration profile is an average of two filtration cycles.*