Efficient Bacteria Trapping and Retrieving via Low Aspect Ratio Nano-Sieve Device

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We report a new fabrication process that is capable of patterning extremely low aspect ratio PDMS nano-sieve device. The device was patterned via standard photolithography and silicon oxide wet etching. By using a positive photoresist (PR) layer as a sacrificial layer, we are able to pattern a nano-sieve device with an aspect ratio of 1:10,000 (height: 200 nm; width: 2 mm) without roof collapsing. This nano-sieve device is used to trap magnetic microbeads in the channel. Bacteria (*Escherichia coli)* was introduced into the nano-sieve device and was captured in the beads array. Increasing the flow rate induces the hydrodynamic deformation of the nano-sieve, thus the effective channel height is significantly enlarged. This allows the rapid release of the captured pathogens into the outlet reservoir. The nano-sieve device shows a very high bacteria capture capacity and is used to concentrate the bacteria sample on-chip. Exploiting the PR pattern transfer technique, we further demonstrate a transparent multi-channel nano-sieve device, enabling highly efficient, multiplexing, and rapid pathogen trapping and retrieving.