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Sheathless, Viscoelastic Circulating Tumor Cell Separation Using Closed-Loop Microfluidics

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Abstract : High-throughput separation is an essential technique for cancer research and diagnosis. Here, we propose a viscoelastic microfluidic device for sheathless, high-throughput isolation of circulating tumor cells (CTCs) from white blood cells. Here, we demonstrate a viscoelastic method for separation and concentration of CTCs using closed-loop microfluidics. Our device is a rectangular straight channel with a low aspect ratio. Also, to achieve high-efficiency, high-throughput processing, we used a polymer solution with low viscosity. At the inlet, CTCs and white blood cells (WBCs) were randomly injected into the microchannel. Due to the viscoelasticity-induced lateral migration to the equilibrium positions, large CTCs could be collected from the side outlet while small WBCs were removed at the center outlet. By recirculating the collected CTCs from the side outlet back to the sample reservoir, continuous separation and concentration of CTCs could be achieved with high separation efficiency (~ 99%). We believe that our device has the potential to be applied in resource-limited clinical settings.

Keywords : circulating tumor cell, closed-loop microfluidics, concentration, separation, viscoelastic fluid
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