A MICROFLUIDIC DEVICE FOR SORTING LIVER CANCER STEM CELL IN A CONTINUOUS BIOLOGICAL FLUID

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Fluid: micro and nano-fluidics
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Other keywords: non-uniform electric fields, dielectrophoretic force

ABSTRACT: In order to make possible the selective sorting of hepatocellular carcinoma stem cells (CD133+ HCCSCs) in biofluids without to use an antigen-antibody reaction to attach antibody-immobilized nanobeads to the surfaces of HCC SCs. The unique dielectric properties of HCC SC has been tested and obtained by the applying AC electrical field with various frequency and strength between an planar microelectrodes. Eventually, the HCC SC can be manipulated and separated from the mixture by applying specific dielectrophoretic force dependent upon unique dielectric properties of HCC SCs. Creating the HCC SCs make this subsequent separation possible. To effect the actual separation, a micro channel with two dimensional electrodes has been designed on a Pyrex glass substrate and fabricated with micro fabrication technology. A local dielectrophoretic force, obtained from non-uniform electric fields, was used for manipulating the unique HCC SCs in a continuous flow. By the experimental studies that the homogenizered tumor cell specimens incur a local dielectrophoresis field when they are suspended in a continuous buffer fluid (flow velocity v = 0.1 cm/s) and exposed to RF electric fields at specific frequency (13.56 MHz). Using this device, the microchannel with planar microelectrodes provides a local dielectrophrosis field strong enough to manipulate the mobility of HCC SCs in a continuous biological fluid.

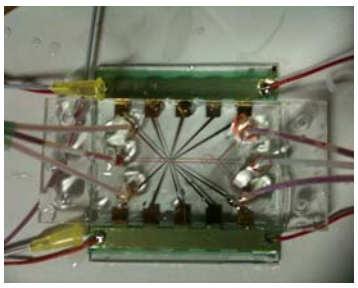

Figure 1 A microfluidic device with microelectrodes was fabricated by bonding a PDMS replica and a Pyrex glass chip.

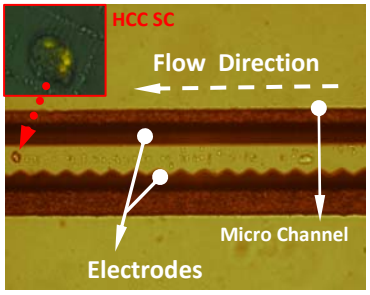

Figure 2 A microchannel with asymmetric plane electrodes provide a strong local dielectrophrosis field to sort the cancer stem cells in a continuous biofluid flow.

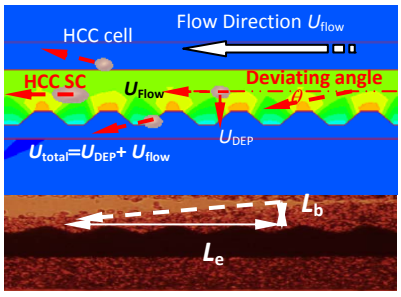

Figure 3 Deviation angle of the normal HCC cells flowing in the micro channel, $\theta \sim \tan^{-1}[U_{DEP}/U_{flow}] \sim \tan^{-1}[L_c/L_e]$.

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