BIO-INSPIRED HIERARCHICAL AND FUNCTIONALIZED SURFACE STRUCTURES FOR EFFICIENT CAPTURE AND RELEASE OF CIRCULATING TUMOR CELLS

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ABSTRACT

Rose petal derived structured and epithelial cell adhesion molecule antibody (anti-EpCAM) functionalized polydimethylsiloxane (PDMS) substrates were fabricated as new three-dimensional hierarchical surfaces for efficient capture of circulating tumor cells (CTCs). Compared to flat PDMS without any surface structures, these hierarchical substrates exhibited higher capture ability. As indicated by the scanning electron microscope (SEM) and immunofluorescent images, this enhancement can be partly attributed to the interaction between nanoscale cell surface components and nanostructures on substrate (topographical interaction). From other side, PDMS with hierarchical structures leads to increased surface area, allowing more anti-EpCAM to be immobilized on the surface, which increases the number of available sites on the surface for cell adhesion. Furthermore, treating the substrates with biocompatible reductant glutathione (GSH), 79%-85% of the captured cells can be released with the disulfide bonds being cleaved. The live/dead cell staining confirmed that the released cells display over 98% cell viability after release. Therefore, this bio-inspired hierarchical structured and functionalized substrates can be successfully applied to capture CTCs, as well as release CTCs for subsequent analysis, providing new prospects for designing cell-material interfaces for advanced cell-based biomedical studies in the future.

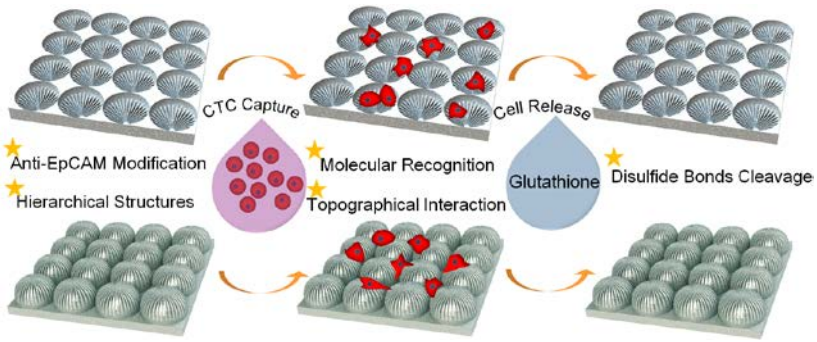

Fig. 1 Schematic illustration of anti-EpCAM modified hierarchical structures used for CTC capture. Cell release can be achieved through disulfide bond cleavage by addition of glutathione reductant.

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