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A responsive thiolated polysaccharide multilayer nanocoating for tuning cell adhesion and cell detachment

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Advanced efforts in the design of responsive biomedical coatings are focused on the decoration of surfaces with functionalities that promote a predetermined biological response such as modulating cell adhesion and proliferation as well as cell detachment. Following this aim, we synthesized a stimuli-responsible cell carrier nano-coating system with multilayers made of thiolated chitosan (t-Chi) and thiolated chondroitin sulfate (t-CS) units. This redox-responsive multilayer system was realized by intrinsic cross-linking triggered by oxidative stimuli, while these bridges were prone to dissociation under reductive conditions. It is remarkable that this chemical changes were fully reversible as demonstrated by repeated oxidation and reduction (Oxi-to-Re) or in opposite from reduction to oxidation (Re-to-Oxi) cycles. The physical properties of multilayers during these treatments were studied by *in situ* spectroscopic ellipsometry and liquid-based atomic force microscopy and surface plasmon resonance showing changes of layer thickness and elastic modulus. Since protein adsorption is a prerequisite of cell adhesion, binding of fibronectin was studied with a fluorescent labeling technique. Correspondingly, the novel multilayer nano-coating was used to define the human dermal fibroblast cell microenvironment and the impact of switching cycles on cell adhesion and detachment events was verified. The latter is presented briefly in figure 1. As this thiolated polymeric system is responsive to the body's internal stimuli like pH and redox, it holds great promise for medical applications and stimuli-sensitive drug delivery systems.

Figure 1. The phase-contrast representative images of fibroblast reversible response to redox-switchable [t-Chi/t-CS] 10 nanocoating system. (Oxi-: oxidation state; Re-: reduction state; 10: number of layers).

Biography

Pegah Esmaeilzadeh researches in the field of synthesis and characterization of single-walled natural protein nanotubes, and their byproduct architectures such as protein nanofibers, nanospheres, and nanoparticles have been successfully developed in nanotechnology section of RIPI of Tehran (Research Institute of Petroleum Industry). She was also active in different research projects on ZnO quantum dots as novel antibacterial, antifungal, or anticancer drugs. She is currently PhD student in Institute of Pharmacy in Martin Luther University Halle Wittenberg in Germany, and receiving new experiences in medical nanocoatings/interfaces/thin films and particularly cell studies.

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