Adsorption-Desorption Study of BSA Conjugated Silver Nanoparticles on Collagen Immobilized Substrates

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Acknowledgement: Dr. Clarence Lee, LSAMP, Howard University

Nanoparticles and proteins, in the formation of biocompatible defensive conjugates, have promising uses in targeted delivery. Despite significant amount of studies performed on the antimicrobial activity of silver nanoparticles, data on the interaction of silver nanoparticles with other proteins or model biological substrates is completely lacking. The primary objective of this study is to evaluate the interaction between protein immobilized substrates with silver nanoparticles by performing adsorption-desorption studies. The adsorption and desorption of BSA coated silver nanoparticles on extracellular matrix (ECM) versus silanized surface free of collagen was compared to provide a description of the underlining binding process between nanoparticles and collageneous substrate. Collagen was chosen as the model biological substrate because it provides mechanical support to cells and tissues in addition to performing various other important physiological functions. The kinetics of nanoparticle adsorption on these substrates was measured by UV-VIS technique over a range of nanoparticle concentrations (0.5 to 8 ppm). UV-Vis results indicate significant nanoparticle retention on collagen immobilized substrate compared to substrate free of collagen layer. Additionally, the Ag-BSA nanoparticle adsorption reached a steady state when the Ag-BSA solution concentration was 16 ppm or higher. For 16 ppm nanoparticle solution, the amount of nanoparticles adsorbed on collagen substrate was estimated to be 2.4 ± 0.53 $\mu g/cm^2$. Analyzing nanoparticle retention on biological/synthetic substrates holds promise in practical implementation of the protein-nanoparticle conjugate for future use in biomedical science.