74b Metallic Nanoparticle as Fluorescence Enhancer for Lowering the Detection Limit of Fluorophore Mediated Immunosensor

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Rapid and accurate quantification of physiological markers in blood plasma is important for disease diagnosis, prognosis, and treatment. Successful sensing tools must provide the high specificity and sensitivity. Fluorophore mediated, fiber optic immunosensor has been recognized as a good tool for detecting various disease representative biomarkers in the bio-/physio- logical samples. The integration of the noble-metallic nanoparticle reagent, an effective enhancer for the fluorescence signal, with the fluorophore mediated sensors has enabled to lower the detection limit significantly. The mechanism of this fluorescence enhancement by metallic nanoparticle could be that nanoparticle, when located at a particular distance from a fluorophore, can retrieve the free electrons involved in self-quenching via its strong plasmon field. The transferring of the lone pair electrons in the fluorophore normally used for self-quenching to the metallic nanoparticle was demonstrated to enhance the emission fluorescence. Organic solvents were also found to enhance the fluorescence in biosensing significantly, possibly by the shifting excitation/emission spectrums of the fluorophore, by shrinking fluorophore tagged proteins, or by their combination. Metallic nanoparticle reagent (MNPR) was studied in the cardiac marker biosensors for rapid heart attack diagnosis and prognosis. Due to the low concentrations of some of these markers in plasma (tens of picomolar level), without enhancers, the sensors did not produce signals sufficient enough to quantify them accurately. Applying these MNPRs to our fluorophore mediated cardiac biosensing system allowed us to accurately quantifying four cardiac markers simultaneously.

To develop the best performing fluorescence enhancing reagent, MNPR, the effects of nanoparticle materials, the nanoparticle size, the length of the surfactant layer on the nanoparticle, and the solvent on the fluorescence enhancement were studied. Also, the enhancing mechanisms were being characterized for the metallic nanoparticle effect and the solvent effect.

Author would like to acknowledge the Kentucky Science and Engineering Foundation (KSEF-148-502-03-55) for their financial support on metallic nanoparticle study, and the National Science Foundation (BES-0330075) for their support on biosensing study.