B3 An Aptamer-Based Fluorescence Biosensor for Salivary Lysozyme Using Localized Surface Plasmon Resonance-Enhanced Fluorescence of Zinc Seledide Sulfide (ZnSSe) -Alloyed Quantum Dots-Gold Nanoparticle Nanohybrid

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Learning Overview: The goal of this presentation is to provide a better insight on the use of nanomaterials in optical biosensor development for body fluid identification. More specifically, the advantages of the novel method over conventional detection technologies will be highlighted.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by introducing a novel analytical strategy based on the detection of saliva. By using lysozyme as a model analyte, this study has constructed an aptamer-based fluorescent nanobiosensor assay that is able to identify real saliva samples. This research has utilized the fluorescence emitting properties of Quantum Dots (QDs) as a signal reporter, the Localized Surface Plasmon Resonance (LSPR) fluorescence-mediating effects of gold nanoparticles (AuNPs), and the receptor binding effect of synthetic DNA aptamers to develop a highly sensitive and selective optical nanobiosensor for saliva. This presentation will open the door for better insight and further research on the use of nanotechnology in forensic science for body fluid identification.

Introduction: Saliva is a type of body fluid that can be collected as an evidence type within a crime scene context and can be used to identify an individual through DNA profiling. The identification of saliva is based on presumptive and confirmatory tests. Presumptive test such as Phadebas test® and SALIgAE® test are based on color change reaction that detects the enzymatic activity of amylase and is based on quick identification of the collected body fluid sample. Confirmatory tests, on the other hand (e.g., RSID™ saliva), are based on immunochromatographic assays to confirm the identity of the saliva fluid detected presumptively. Despite the popularity of both methods, limitations such as poor sensitivity, poor selectivity, high cost, and destruction of DNA limits these methods. There is, therefore, an urgent need to develop new analytical methods to mitigate the limitations of existing detection technologies for saliva identification.

Fluorescent biosensors using nanomaterials that exhibit optical, magnetic, and/or electronic properties and that operate within a physico-chemical transducer interface with embedded bio-recognition elements hold the advantage of generating highly sensitive, highly selective, and rapid signals over conventional analytical tools for saliva identification.

Summary of Results: This study reports on the development of an aptamer-based fluorescence biosensor for saliva using ZnSSe-alloyed QDs and AuNPs hybrid nanostructure. Salivary lysozyme was used as a model enzyme analyte to optimize the biosensor assay for real human saliva sample detection. ZnSSe-alloyed QDs were synthesized and used as a fluorescent-emitting nanoreporter while citrate-capped AuNPs, a component of the hybrid assembly, was used to amplify the fluorescence signal via LSPR metal-enhanced fluorescence. Under optimum reaction conditions, salivary lysozyme was detected within 5min quantitatively and selectively, achieving a limit of detection of 28µg/mL. Application of the fluorescence-based nanobiosensor technology to detect real human saliva samples was successfully achieved.

Nanobiosensor, Saliva Identification, Lysozyme

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