Biocatalytically Triggered Plasmonic Nanoparticle Etching based Fiber Optic Immunosensor for Early Detection of Neurodegenerative Disease Biomarker

Principal Investigator
Dr. Jitendra Satija
Professor
Centre for Nanobiotechnology (CNBT)

Co-Principal Investigator
Dr. S. Senthilkumar
Professor
School of Advanced Sciences (SAS)

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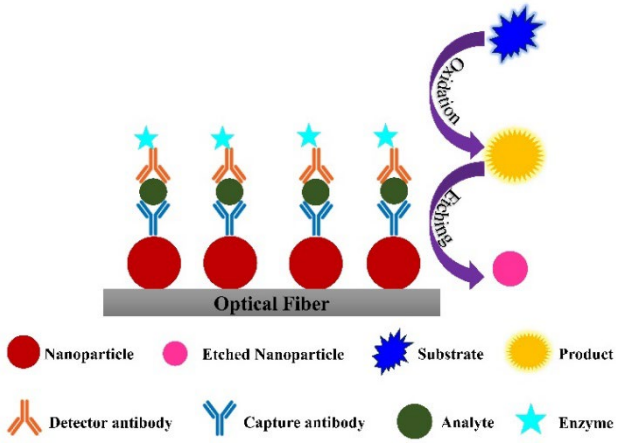
3

Graphical Abstract/ Layout



Project Description

Neurodegenerative diseases (NDs) are the leading cause of long-term disability and the second leading cause of death worldwide. Particularly, Alzheimer's disease (AD) and Parkinson's disease (PD) are the most common that affect cognitive impairment including thinking and memory skills, speech, visuospatial orientation, behavior, and motor system. Almost 50 million and 9.4 million people are living with AD and PD globally and thus making the disease a global health crisis. The increase in the number of people with NDs will place a heavy demand on societies and their healthcare systems. At present, a specific cure is not available for NDs, and only early diagnosis and intervention of the disease can delay the onset and benefit the patients and their carers, which can substantially support the healthcare systems. Currently, $A\beta_{1-42}$ detection and quantification-based early detection approaches, such as ELISA are used in clinical settings for quick diagnosis of NDs. However, these approaches suffer from inadequate detection limit (up to a few ng/mL) and sensitivity, laborious and longer assay procedure, and multiple washing steps.

In this project, we envisage to develop an innovative, ultrasensitive point of care biosensor that is primarily based on biocatalytically triggered etching of the plasmonic nanoparticle immobilized on the fiber-optic sensor probe in response to the binding of the specific analyte. We have established the method for fabrication of U-bent fiber-optic probe and their functionalization with plamoninc nanoparticles and biomolecuels of interests. We are developing immunosaasay reaction using sandwich ELISA and its integration with plamoninc nanoparticle etching. Subsequently, these optimized assay will be utilized for the detection of $A\beta_{1-42}$ detection and the successful developemdnt and realization will help in the for early diagnosis of neurodegenerative disease in the clinical samples. In conclusion, a very promising work proposed herein will lead to the development of an innovative enzymatic-triggered etching-based plasmonic fiber-optic immunosensor for amyloid-beta detection that could be employed in the future for various other disease biomarkers.

Products/ Instruments/ Results/ Outreach Activities (Pictures)