

# Plasmonic fiber optic absorbance biosensor for the diagnosis of infectious diseases

**Divagar Murugan**

Indian Institute of Technology, India

## Abstract

Detection of molecular biomarkers for the early diagnosis of infectious diseases is crucial for timely treatment and the prevention of the spread of infection. Bacterial and viral diseases such as tuberculosis and COVID-19 require faster and simpler tests. Over the past decades, optical sensing technologies have been widely explored and proven to offer sensitive, compact and affordable healthcare diagnostics. In the present work, a plasmonic fiber optic absorbance biosensor (P-FAB) for tuberculosis and COVID-19 was developed. P-FAB involves a sandwich assay, and it exploits the U-bent fiber optic sensor platform with high evanescent wave absorbance (EWA) sensitivity, and gold nanoparticles (AuNP) labels with high optical extinction coefficient, in addition to a simple LED-photodetector based optical instrumentation. In the process of realizing a P-FAB for these applications, novel surface functionalization strategies for polymeric optical fiber (POF) by means of graphene oxide (GO) and dendrimers were also established. Optimum conditions for the realization of sensitive assays, including fiber probe geometry (fiber core and bend diameters), AuNP size, their bioconjugation, and their concentration, have been investigated in detail. Subsequently, the P-FAB for mannose-capped lipoarabinomannan (ManLAM or Mtb-LAM) and SARS-CoV-2 N-protein detection towards urine-based tuberculosis and saliva-based COVID-19 diagnosis, respectively, was established. Finally, the overall research resulted in the development of a compact point-of-care (PoC) P-FAB device for diagnostic applications.

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## Biography

Divagar M was born in Chennai, Tamil Nadu, India, in 1993. He received the B. Sc. Degree in Biotechnology from SRM university in 2014 and M.Sc. degree in Nanoscience and Nanotechnology from the University of Madras, Chennai, in 2016. Now, he is pursuing his PhD degree through the Department of Science and Technology (DST) - Innovation in Science Pursuit for Inspired Research (INSPIRE) research fellowship at IIT Madras, in the field of fiberoptic biosensors. He is the author of 11 research articles and 1

invention. His research interests include fiber-optics, biosensors, spectroscopy, medical diagnostics, Infectious diseases, nanomaterials, and nanostructures. Mr. Divagar M was a recipient of the Science Academies summer research fellowship award (2015), Newton-Bhabha PhD placement award (2020-21), Gandhian Young Technological Innovation award (2020), Indian Institute of Technology Madras Research Award (2021), and Advanced research opportunity program (2021-2022) - scholarship sponsored by RWTH Aachen University, Germany.