SEMI-DISTRIBUTED INTERFEROMETERS FOR EARLY DETECTION OF LUNG CANCER BIOMARKERS

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Background: Lung cancer is the second most common type of cancer around the globe and in Kazakhstan. Elevated concentrations of Carcinoembryonic antigen (CEA) and Anterior gradient protein 2 (AGR-2) in serum are associated with Non-Small Cell Lung Cancer (NSCLC), making them highly versatile markers for early diagnostics. Currently, there are many assays for quantification of blood biomarkers that are based on labeled reagents but they are usually costly and time consuming. As an alternative, we propose use of optical fiber biosensors. Biosensors are made of single mode fibers (SMF) spliced with enhanced backscattering fiber (EBF) with Si and Ge nanoparticles in the core. This configuration creates a highly sensitive semi-distributed interferometer which is later functionalized with antibodies.

Materials and methods: SMF was spliced with EBF and calibrated with sucrose solution. The fiber tip was treated with piranha solution for 15 minutes, then immersed in a 1% APTMS solution in methanol and heat treated for 1 hour. Next, the sensor was incubated in 25% glutaraldehyde for 1 hour. Then, it was incubated with antibodies for 1 hour, and finally blocked with 1% BSA for 30 minutes. The functionalized biosensor was used to detect the target protein concentrations from 10 aM to 1 nM.

Results: We developed a biosensor for detection of CEA and AGR2 proteins with a limit of detection (LoD) of 10aM.

Conclusion: Proposed biosensor allows high specificity and sensitivity, allowing potential usage for quantitative detection of cancer biomarkers in clinical settings. For the practical application, we aim to integrate a biosensor into a syringe-based packaging system to further detect biomarkers in serum.

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