Detection of Cellular Stress Biomarkers Using Plasmonic Sensors with Potential Application in Organ-on-a-Chip Platforms

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Abstract

Plasmonics provides a powerful toolbox for sensitive and label-free detection of biomolecules[1]. In this study, a plasmonic sensor is pursued for the detection of Matrix Metalloproteinase-3 (MMP3), a key cellular stress biomarker and a crucial indicator in the diagnosis of diseases such as rheumatoid arthritis [2,3,4]. MMP3 plays a significant role in extracellular matrix remodeling and inflammation, making its accurate and sensitive detection essential for both cell stress response and arthritis diagnosis.

We characterized a sandwich assay format for MMP3 detection using surface plasmon resonance biosensor with the gold sensor surface coated with a thiol self-assembled monolayer for covalent coupling of anti-MMP3 capture antibody. After introducing MMP3-containing samples to the sensor surface, a detection antibody specific to a different epitope of MMP3 was added and specificity in the analysis of cell-culture medium is evaluated.

A dedicated optical setup will enable sensitive and specific real-time analysis of MMP3 detection by using a miniature sensor elements through surface plasmon-enhanced fluorescence when integrated into organ-on-chip platforms. This tool wills serve for detecting biomarkers related to cell stress studies in tendon-on-chip applications. This approach will offer label-free continuous protein detection with spatial interrogation. In the future, its incorporation into broader biosensing platforms could set a new standard in clinical diagnostics and precision medicine.

References

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