Localized Surface Plasmon Resonance (LSPR) Optofluidic Biosensor for Cellular Immunophenotyping

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Real-time quantitative measurement of the immune cell secreted protein is critical in disease diagnosis and prognosis. A label free detection Localized Surface Plasmon Resonance (LSPR) technique has advantages for real time quantitative detection of cell secreted cytokine with a simple optical set up. With this real-time LSPR detection technique, we are expecting to monitor cell conditions or patient conditions promptly for clinical use. In this study, we developed an optofluidic biosensor by integrating a microfluidic device into a LSPR detection system to detect cell secreted cytokine TNF-alpha. Our LSPR sensor chip surface was fabricated with gold nanoparticles to induce localized surface plasmon effect around metal nanoparticles. The TNF-alpha was immobilized on the detection surface by antibody-antigen binding, and the change of the refractive index near the sensing surface was monitored by LSPR wavelength shift. During the 2 hour incubation of THP-1 cells, we monitored real-time LSPR wavelength shift by TNF-alpha binding on the detection surface. The quantitative level 100~500ng/mL concentration of TNF-alpha gradually increased during monitoring. These results successfully demonstrated that gold nanoparticle deposited LSPR sensor performed real-time cell secreted cytokine monitoring. This approach is promising for developing a LSPR technique for biomolecule detection in order to monitor cell condition and diagnose disease.