

Molecular Sensor Using Aptamers in Precision Ellipsometry

Kee, Jin Wen (School: National Junior College)

Biosensors are of quintessential importance in optimizing industrial production of biomolecules such as antibiotics. Optical biosensors have therefore received considerable attention due to their potential to provide on-line monitoring data of processes in bioreactors. However, the current benchmark for optical techniques, Surface Plasmon Resonance (SPR), provides label free and real-time monitoring but requires costly gold films and utilizes antibodies which are susceptible to pH and temperature changes. In this work, I report an innovative approach for a label-free, fast and cost-effective detection of antibiotics using Precision Ellipsometry (PREL) with aptamers. The system uses rotation of light polarization reflected off cheap and recyclable silicon substrates to measure the thickness of molecular layers in real-time. Aptamers are short stranded oligonucleotides, which change conformation at presence of target molecules in solution: ampicillin in this case. This change is detected using reverse complimentary aptamers. The complimentary couples are usually fabricated one with biotin end, the other with a thiol end to immobilize on gold substrate for SPR. An inverse procedure for PREL is developed to immobilize biotin-ended strand on silicon substrate using (3-aminopropyl)trimethoxysilane (5mM), glutaraldehyde (25mM) and neutrAvidin (10mg/mL). Ampicillin-responsive aptamer was supplied in solution at concentration 0.5 μ M. The PREL biosensor proved to be specific in measuring attachment of ampicillin at 10mg/mL and signal of binding was measurable within 25 minutes. The use of aptamer instead of antibody in PREL system, which is 30 times cheaper than SPR, proved to have great potential in the field of biosensors and molecular sensors in general.

Awards Won:

Spectroscopy Society of Pittsburgh: First Award of \$1500

Third Award of \$1,000