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Real-time monitoring of bacterial growth and antimicrobial susceptibility by oligonucleotide aptamer-based capacitance sensor

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As sepsis is one of the most serious infectious diseases, rapid detection of pathogens in the blood is crucial in establishing the diagnosis, prognosis, and treatment of infection. In this research, we have monitored bacterial growth and identification and antimicrobial susceptibility test (AST) by aptamer-based capacitance sensor. Bacteria may be regarded as dielectric particles, so bacterial growth is expected to be monitored in real-time by measuring the capacitance change. In bacterial growth, substrate functionalized with aptamer and we put the bacteria solution into the capacitance sensor. By measuring the capacitance change in bacterial growth from the bacteria concentration 10 to 10^6 cfu/mL. In identification, we confirmed the channel functionalized identical aptamer corresponding bacteria has the greatest change of capacitance. Consequently, we could selectively identify the bacteria species, *Escherichia coli (E. coli), Staphylococcus aureus (S. aureus), Acinetobacter baumanii (A. baumanii), Enterococcus faecalis (E. faecalis)*. In antimicrobial susceptibility, we treated antibiotics with different concentration of gentamicin and confirmed antimicrobial susceptibility. When *E.coli* or *S. aureus* were treated with gentamicin above the MIC (minimum inhibition concentration), the capacitance decreased over time since dead bacteria are no more recognized by aptamers. In contrast, when the concentration of gentamicin is below MIC, the capacitance increased while the increasing rate of capacitance decreased with increas in the gentamicin concentration. These results indicate that the aptamer-functionalized capacitance sensor array may be applied for rapid AST. To sum up, this highly sensitive and real time monitoring capacitance biosensor could measure bacterial growth range from 10 to 10^6 cfu/mL and rapidly identify pathogen species and specific bacterial antimicrobial susceptibility.

Biography

Namgyeong Jo has completed Bachelor's degree from Yonsei University in Department of Physics and currently, pursuing his MS course from the same graduate school

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