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Abstract (oral session)

Nanomechanical sensors for micro-organism growth detection

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Objectives: Fast detection of viable microorganisms is of great importance in several different fields of Microbiology. Due to an increase in antibiotic resistant microorganisms, fast growth detection methods are needed in a clinical environment for antibiotic susceptibility testing. Existing culture methods are time consuming, material heavy and Live/Dead cell discrimination is difficult. The use of microcantilever arrays for microbial growth detection provides a rapid technique for monitoring growth in clinical and industrial applications. Methods: This biological sensor is based on oscillating cantilevers (Dynamic mode). The resonance frequency response of a cantilever array (CLA) is tracked using the laser beam deflection method (Figure 1.). Frequency shifts are caused by additional mass loading onto the cantilevers. The cantilevers are functionalized with an agarose layer supplemented with culturing medium. Aspergillus niger spores were seeded on the cantilever surface using the ink-jet printing technique. During microbial growth microorganisms assimilate nutrition and water from the nutritive layer and humid air, which results in an increase in the mass on the cantilever. Results: The use of CLA's allows Aspergillus niger growth to be detected within a few hours. Different magnitudes of frequency response due to a different number of viable spores on cantilevers were observed. Initial resonance frequency decrease was detected during fungal growth. The subsequent hypha growth along the cantilevers longitudinal axis resulted in a resonance frequency increase. The use of a reference cantilever allows a differential signal to be recorded. Thus, the true change in resonance frequency can be extracted from the data. The currently used cantilever arrays (8 cantilevers per array) provide the opportunity to perform parallel measurements of different growth conditions (eg.antibiotic susceptibility testing). Conclusion: The growth of various microorganisms can be detected and monitored by using microcantilever sensors. When compared to conventional methods, cantilever sensors use less culturing medium and the functionalisation and detection can be automatized. The technique is label free and the use of multiple cantilevers provides the opportunity to test various antimicrobial agents in parallel. In collaboration with CalTech and Novartis we will further develop our device to provide a user-friendly multiplexed portable version for industrial and hospital measurements.