

A novel optical sensing platform for rapid detection and evaluation of *Brucella* bacteria

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The overall goal of this project is to develop an integrated optical biosensing platform for highly specific on-site *Brucella* detection in livestock samples. The first stage of the project was to fabricate a biosensing scaffold comprised of individual components designed for target analyte detection. P_{SiO₂} optical transducers were constructed by electrochemical anodization of Si wafer, producing distinct monolayer nanostructure. The Fabry-Pérot thin-films surfaces were successfully functionalized using synthetic grafting approaches. The resulting platforms were thoroughly characterized using spectral techniques (reflectivity measurements and ATR-FTIR). Next, changes in the reflectivity spectrum (amplitude intensity) were monitored in real-time by the acquisition of the reflectivity spectra of the porous thin film upon explicit target capturing. Herein, a biochemical amplification approach was utilized to augment the optical sensitivity resulting in an optimized detection limit of 3 CFU/mL in less than 30 min of reaction. The selectivity and specificity were confirmed through interfering pathogens (*i.e.*, *Listeria*, *Salmonella*, and *S. aureus*). These results further confirm the applicability of the presented biosensing concept for practical applications while sensing target pollutants in real matrices. Indeed, the optical system depicted recovery values of 90-111% in spiked samples, indicating the maturity of this method for the immediate realization of any microorganism detection in field conditions. Future use will allow identifying the sources of infection (Brucellosis) by sensing samples obtained from an individual animal or bulk container representing the entire herd and thus will indicate as an early detection indication prior to the next outbreak. Overall, in the last three years, we have progressed according to our specific aims for the development of an integrated optical biosensing platform specific pathogen detection.