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# (POS-48) Developments in the Rapid Diagnosis of Bacterial Pathogens Using Laser-Induced Breakdown Spectroscopy

*Tuesday, 7 June 2022 17:36 (2 minutes)*

Our lab has been investigating the use of laser-induced breakdown spectroscopy (LIBS) for the rapid detection and diagnosis of bacterial pathogens. LIBS is a spectrochemical technique that utilizes a laser to produce a near instantaneous elemental assay of a substance. The laser interacts with the substance to produce a high-temperature microplasma. As the plasma cools it emits light, which is collected by an Echelle spectrometer to give a high-resolution time-resolved spectrum.

Currently we prepare bacteria samples by depositing them on a nitrocellulose filter through a custom fabricated centrifuge device and custom fabricated cone. The resulting thin film of bacteria is ablated in our LIBS apparatus. Using this sample preparation method, we have collected several hundred spectra of five species of bacteria: *Staphylococcus epidermidis*, *Escherichia coli*, *Mycobacterium smegmatis*, *Pseudomonas aeruginosa*, and *Enterobacter cloacae*. We have also analyzed the spectra of control specimens, including blank nitrocellulose filters and sterile water deposited on those filters.

Detection and diagnosis of bacterial specimens based on a spectrochemical signal relies on the use of chemometric algorithms. Our work uses discriminant function analysis (DFA), partial least-squares discriminant analysis (PLSDA), and we are investigating the use of artificial neural networks (ANN). In the past, we have achieved reliably high discrimination accuracy with pelletized bacterial targets containing high numbers of cells. However, detection and diagnosis of bacteria becomes increasingly more difficult as bacterial suspension concentrations decrease. In this poster we present ways to achieve reliable detection and diagnosis with lower and more clinically relevant concentrations of cells. One such method is increasing the intensity of plasma emission by co-ablating silver with the cells. We investigated the deposition of silver with two methods including the use of microparticles as well as laser-sputtered thin films. Sensitivities and specificities achieved with methods focusing on optimizing discrimination will be reported for both the detection of cells in sterile fluids using PLSDA and the discrimination between bacterial species using DFA. Lastly, the use of an ANN algorithm trained using a large set of pseudodata created to resemble the bacteria spectral data will be discussed.

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