LASER-INDUCED BREAKDOWN SPECTROSCOPY FOR THE DETECTION AND DIAGNOSIS OF BACTERIAL PATHOGENS IN BLOOD, URINE, AND CEREBROSPINAL FLUID.

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In this work, laser-induced breakdown spectroscopy, or LIBS, has been utilized to detect and diagnose common bacterial pathogens in clinically obtained specimens of whole blood, urine, and artificial cerebrospinal fluid (aCSF). A custom-fabricated centrifuge insert allowed bacteria to be easily collected from a fluid specimen and concentrated at the center of a disposable nitrocellulose filter prior to LIBS testing. The measured intensities of emission lines from five elements were used as independent variables in a partial least squares discriminant analysis to classify specimens as either bacteria-negative or bacteria-positive, achieving sensitivities and specificities greater than 96%. A diagnosis of the species of bacteria present in the specimens was accomplished by performing a principal component analysis on the entire LIBS spectrum from 200 nm to 590 nm. The first 10 principal component scores from that analysis were used as independent variables in a single hidden layer artificial neural network analysis, resulting in classification accuracies in excess of 80%. These results indicate the potential usefulness of LIBS for rapidly detecting and possibly diagnosing blood infections (sepsis), urinary tract infections, and bacterial meningitis in a clinical setting.