Middle Tennessee State University

Biosensor Research

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Prevent, Protect, Respond, Recover

Homeland Security Challenge:

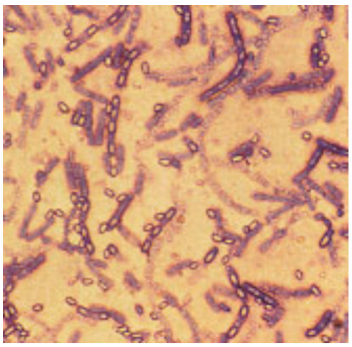
The ability to detect trace amounts of specific infectious agents and/or environmental contaminants following a natural or man-made disaster is essential to emergency and disaster response and recovery. Early detection of these agents is of critical concern for the safety of first responders and for addressing cascading public health issues such as water quality, food safety, medical diagnostics, and the threat(s) of lingering and residual hazards.

Research Project Solution:

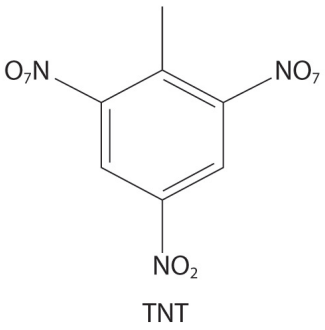
An interdisciplinary research team at Middle Tennessee State University has developed a novel optical sensor based on surface electromagnetic waves (SEW) generated in photonic band gap multilayer (PBGM)-coated substrates. Sensing is accomplished by measuring the shift in the SEW resonance when dielectric conditions at the PBGM surface change, e.g. though antibody-antigen binding. The technique is similar to sensors based on the phenomenon of surface plasmon resonance, but is expected to have higher sensitivity, flexibility in detection wavelength and design, as well as robust surface chemistry. The key features of this sensor platform are high sensitivity and label-free operation which lead to speed and flexibility. Through design, prototyping, and testing of a compact, portable sensor instrument, a flow-cell based sensor will be developed that has ability to target a number of important public health and/or bio-threat concerns.

National Implications:

MTSU's photonic sensor technology has the promise to perform sensing of specific biological and chemical targets without the need to send materials to conventional laboratories or consider utilization of the complex "lab-on-a-chip" technology. The biosensor being developed through this research has a wide range of applications for multiple homeland security operations and practitioners. It will be capable of detecting a broad range of bacteria that cause food- and water- borne illnesses and those listed as potential biological weapons. The device can be used to support chem/bio defense operations in border security, law enforcement, fire and rescue, and emergency/disaster response operations.

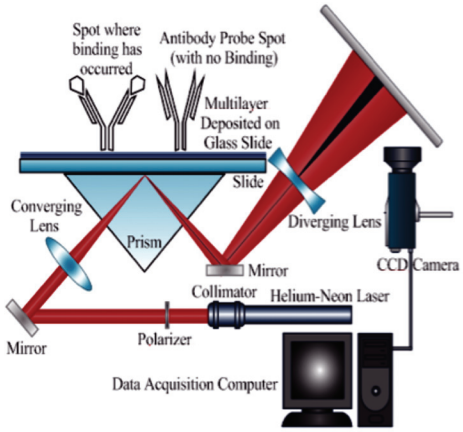


Anthrax spores



TNT

The ability to quickly identify biological agents, such as anthrax spores, and common explosives, such as TNT, is critical for first responders and other homeland security stakeholders.



This research project team has developed a unique optical sensor that can be used both in the laboratory (pictured here) and in the field to accurately and rapidly detect infectious agents and/or environmental contaminants.

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SERRI is managed by the Department of Energy's Oak Ridge National Laboratory for the U.S. Department of Homeland Security