SPIE/Sec. Def. 2018 Abstract

Title

Optical detection and classification of microbial powders using solar blind standoff detection in the deep UV

Authors: (2018)

William F. Hug[1], Rohit Bhartia[2], Kripa Sijapati[1], Quoc Nguyen[1], Prashant Oswal[1], and Ray D. Reid[1]

[1]Photon Systems, Inc., Covina, CA. [2]Jet Propulsion Laboratory, Pasadena, CA.

Short Abstract:

This paper describes a rapid, non-contact, reagentless, method of detection & classification of microbial powers on natural surfaces using deep UV excitation and detection. Detection is accomplished in less than 100 microseconds. The detection method is solar blind and can be employed at standoff distances up to 5 m or more without interference from natural or man-made sources.

Unknown suspicious powders are sequentially triaged using an iteration of PCA methods to determine whether the sample is: bio or non-bio; microbial, protein, or plant; bacterial cell or spore, yeast, fungi, or fungal spore; and the approximate genera of the bacterial cell.

Long Abstract:

This paper describes a rapid, reagentless, method for non-contact detection & classification of microbial powders on natural surfaces using deep UV excitation and detection. No sample handling or processing is required, and sample is not disturbed or spread. The detection method is solar blind and can be employed at standoff distances up to 5 m or more without interference from natural or man-made sources.

Unknown suspicious powders are automatically triaged using a four-step iteration of Principal Component Analysis methods using pre-determined eigenvector sets to:
1) detect and differentiate whether a sample is bio or non-bio; 2) whether the sample is microbial, protein, or plant; 3) whether the sample is a bacterial cell or spore, yeast, fungi, or fungal spore; and 4) to identify the approximate genera of the bacterial cell.

The method and related instrument employs sample excitation at 248.6 nm and detection over a spectral range from 252 nm to 310 nm, a spectral region blind to solar and man-made light sources. Detection is accomplished in less than 100 microseconds and data are processed in less than 10 milliseconds to detect and classify the unknown sample. Sample detection and classification rates are typically up to about 40 per second. The fully integrated and self-contained hand-held instrument is expected with weight less than 5 lbs, including a battery for over 8 hours of typical use. The brass-board instrument used in the present experiments was a short-range, 10 cm, version and a 5 m standoff version is presently in development.

Key Words: deep UV Raman & native fluorescence, detection & classification, chemical detection, biological detection, standoff detection, hand-held