Investigating Bacterial Agents and Human Response to Bacterial Agents via IR Spectroscopy

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Abstract

Defence against the use of bacterial biological warfare agents (BWAs) is becoming an increasingly important concern, which is reflected in the National Security Strategies of the USA and UK. The UK has highlighted international terrorism affecting the UK or its interests, including a chemical biological, radiological or nuclear attack by terrorists as a tier one risk[1]. The USA specifically mentions countering the biological threat to strengthen resilience across the spectrum of high-consequence biological threats[2].

This paper will first of all discuss the use of spectroscopy combined with pattern recognition algorithms and its use for detecting surface deposited BW simulants and the impact of environmental conditioning of these simulants on the spectroscopic signatures and pattern recognition models. The temperature and humidity conditions used are within the ranges prescribed in the Ministry of Defence Standard on Natural Environments and measurements from Camp Bastion, Afghanistan.

A major consequence of bacterial infection is the development of sepsis within humans. Sepsis is traditionally defined as a systemic inflammatory response syndrome (SIRS) in response to infection which, when associated with acute organ dysfunction, may ultimately cause severe life-threatening complications [3]. It is a major cause of morbidity and mortality with over 19 million cases worldwide. Current diagnosis of sepsis is based on non-specific clinical signs (e.g. body temperature, heart rate) and positive identification of the causative agents of infection. Rapid pre-symptomatic detection of sepsis would enable the early administration of therapeutics, maximising their effect and minimising the impact of the serious disease caused by BW agents. We will also discuss the use of Fourier transform infrared to examine and discriminate patients diagnosed with sepsis, SIRS and control samples over different time periods.

References

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