Stand-Off Tissue-Based Biosensors For The Detection Of Chemical Warfare Agents Using Photosynthetic Fluorescence Induction

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Tissue biosensors made from immobilized whole cell photosynthetic microorganisms have been developed for the detection of airborne chemical warfare agents and simulants. The sensor read-out is based on well-known principles of fluorescence induction by living photosynthetic tissue. Like the cyanobacteria and algae from which they were constructed, the sensors are robust and mobile. The fluorescence signal from the sensors was stable after 40 days storage and they can be launched or dropped into suspected danger zones. Commercially available hand-held fluorometric detector systems were used to measure Photosystem II photochemical efficiency of green algae and cyanobacteria entrapped on filter paper disks. Toxic agents flowing in the gas stream through the sensors can alter the characteristic fluorescence induction curves with resultant changes in photochemical yields. Tabun, sarin, mustard agent, tributylamine (a sarine stabilizer) and dibutylsulfide (a mustard agent analog) were tested. Upper threshold limits of detectability for tabun, tributylamine and dibutylsulfide are reported. With additional research and development, these biosensors may find application in stand-off detection of chemical and perhaps biological warfare agents under real world conditions.

Keywords:
photosynthetic biosensor, algae, fluorescence, cyanobacteria, chemical warfare