

Portable Bacteria Sensors for Environmental and Multidrug-Resistant Pathogen Surveillance

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The presence of harmful bacteria in soil, water, air, and food can cause disease in humans and animals. In a hospital environment, multidrug-resistant pathogens are the major sources of hospital-acquired infections (HAIs). Molecular tests and bacterial culture are commonly used for bacteria detection. They both require sophisticated laboratory settings for the tests to be conducted with prolonged turnover time. To address the demand of rapid and on-site detection for bacteria surveillance, we have developed a “Filtration and Staining” (F&S) sensing technology for counting bacteria from various environmental samples. Our technology exploits affinity ligand-conjugate nanoparticles to stain bacterial cells entrapped on a filter membrane. The affinity ligands (antibody, aptamer, charged polymer) on the particle can be customized according to the targeted bacteria cells, e.g. total bacteria, *E Coli*, and *MRSA* etc. For water samples, a direct filtration, followed by the application of nanoparticles, can generate stained filters, of which the intensity is qualifiable using a home-built handheld detector, correlating to bacteria count at a limit of detection (LOD) of 100 CFU/ml.^{1,2} For air samples, commercial air sampler, e.g. SKC biosampler, is coupled with our sensor for airborne bacteria detection at a LOD of 100 CFU/m³ (Figure 1). A test chamber has been developed for testing airborne bacterial detection.³ For samples from solid surfaces, e.g. hospital sink, a flocked swab device was developed for efficient sample collection, followed by the F&S detection. Our technology is enzyme- and culture-free, rapid (30 min turnover time), and requiring minimal hands-on, allowing for on-site detection. Results have been validated with bacteria culture.

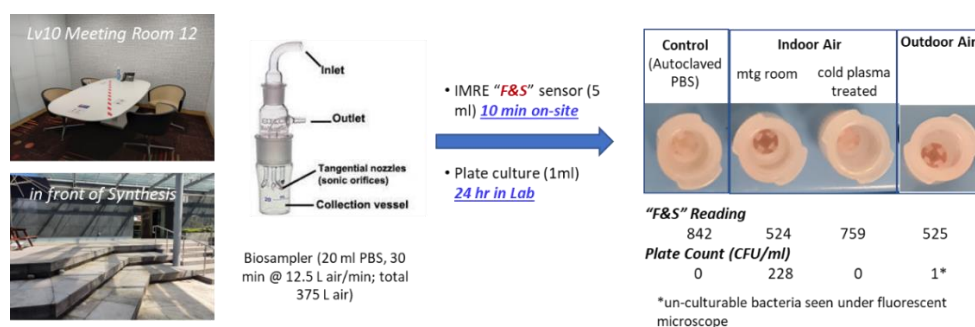


Figure 1: Filtration and Staining (F&S) test of airborne bacteria, following air sampling

References:

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