Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

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Advanced Portable Pathogen Detection System Utilizing Electroflotation

Food borne pathogens have devastating impacts on public health and consumer safety assurance. For example, in the United states, where detection technology can be considered advanced and common, each year an estimated 48 million Americans are stricken ill as the result of one food-borne pathogen or another (e.g., listeria, E. coli, salmonella), equivocating to an annual 55.5 billion dollar industry. One of the most direct ways to eradicate contamination is to be able to detect pathogens on site, and in the field using point-of-care (POC) testing.

Detecting microbial pathogens directly in the environment, can be like finding a needle in a haystack. Trace contaminations of pathogens on food and in the environment remain notoriously difficult to detect, eluding the most sensitive molecular methods. Gene-based assays typically test sample volumes of 1-5 µL, so that a single replicate of even a robust assay is statistically unlikely to detect pathogens at levels below 103 colony forming units/mL. This limit exceeds regulatory levels for many high-consequence pathogens.

Sample preparation to enrich and concentrate bacteria or other biological contaminants can provide sufficient target for amplification in gene based assays. However, traditional techniques such as centrifugation, immunogenic separation, or filtration are not optimized for field application, requiring a lab facility, thus delaying time to detection.

Dr. Daniel Jenkins and Lena Diaz, of the University of Hawai'i College of Tropical Agriculture and Human Resources have developed portable, Android-based electroflotation system for rapid concentration of suspended particles such as bacteria. Portable molecular diagnostics bring detection and diagnostics out of the lab and into the field, enabling POC testing which facilitates quicker responses and more specific treatments. Electroflotation separates suspended solids from liquid media using the adhesive and buoyant forces of electrolytically generated gaseous microbubbles. These 20-40 µm sized bubbles are ideal to separate particles 10-200 µm in size.

Biological contaminants adsorbed to the microbubbles concentrate at the chamber surface. Once concentrated, the biological contaminants are displaced from the collection chamber through a dispensing tube where it is recovered in user defined volume fractions.

Applications

• POC biological contamination detection for:

• Food Safety

• Water quality

• Agricultural applications

• Gene based detection of trace contamination

• In-field concentration of bacteria

Advantages:

• POC contaminant detection

• Self-contained electroflotation system

• Concentrates extremely small quantities of biological contaminants from large, dilute samples

• Eliminates requirement for traditional laboratory facility

• User friendly Android control interface

• Fully Automated

• Affordable

• Durable platinum coated titanium electrodes

• Extremely portable

• Can be coupled to isothermal amplification detection methods for in-field results in under 3 hours

For more information about this opportunity, please see

Diaz et al, Transactions of the ASABE 2018