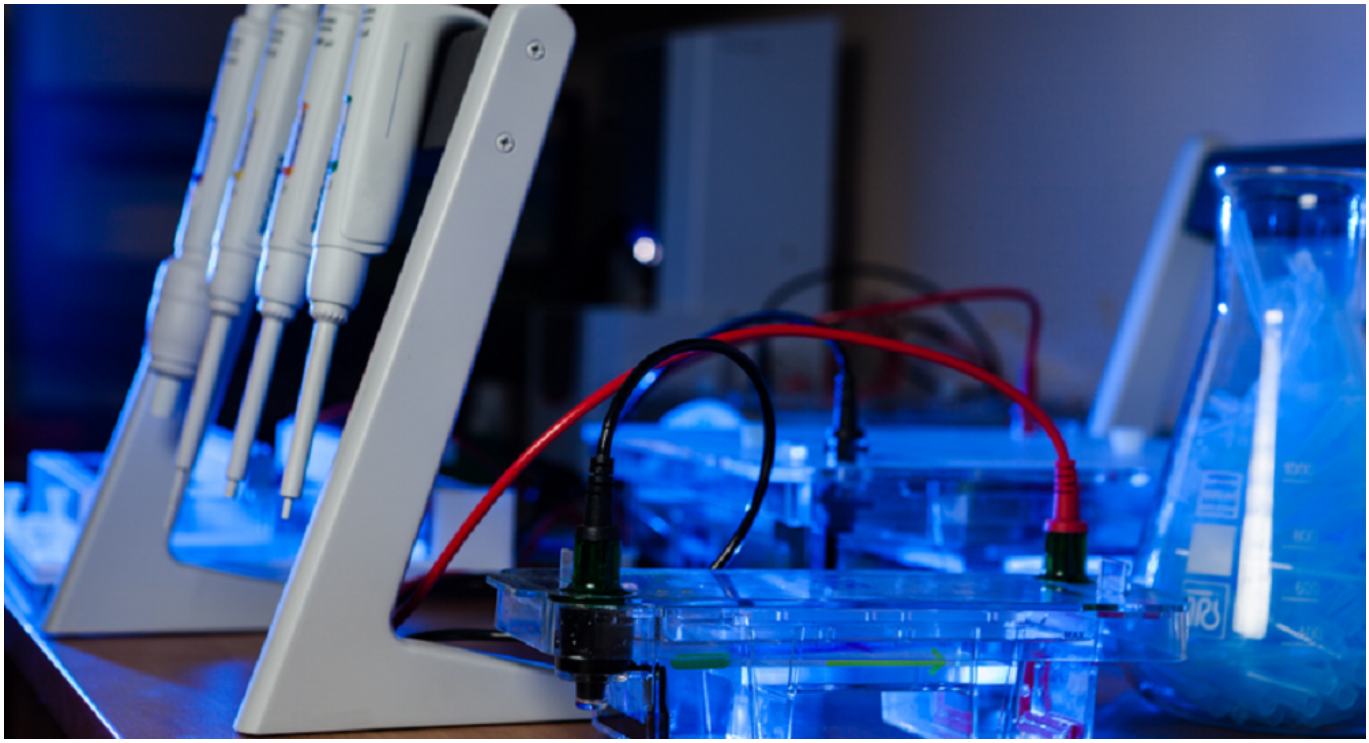
TECH OFFER

Electrochemical Detection Of Microorganisms



KEY INFORMATION

TECHNOLOGY CATEGORY:
Environment, Clean Air & Water - Sensor, Network, Monitoring & Quality Control Systems
Foods - Quality & Safety
Life Sciences - Biotech Research Reagents & Tools

TECHNOLOGY READINESS LEVEL (TRL): TRL5
COUNTRY: SINGAPORE
ID NUMBER: TO174583

OVERVIEW

Microbial detection is the key in public health protection. Faecal indicator bacteria (FIB) such as *E. coli* and *Bacillus spp.* are used as indicators of water quality as a proxy for pathogenic faecal contamination of water, along with risk assessment techniques that correlate the frequency of a specific health hazard with a given level of FIB exposure. Chromogenic and fluorogenic enzymatic techniques are mainstays of water quality monitoring for both public health agencies and regulated utilities. However, together with traditional culture techniques, enzymatic enumeration of FIB is favoured for evaluating microbial water quality under most regulated jurisdictions.

This technology utilises bioelectroanalytical approaches to FIB enumeration as it is a near universal property of microbes to indirectly reduce an electrode via soluble redox mediators.

For more information, contact techscout@ipi-singapore.org

This bioelectrochemical sensor detects E. coli in the range 5.0 x 10^2 to 5.0 x 10^5 CFU/mL and provides a 22–54% faster detection than commercially available FIB detectors to detect, quantify, and track contamination of water to ensure water quality meets sanitary guidelines.

The technology provider is looking for licensing partners to commercialise this technology.

TECHNOLOGY FEATURES & SPECIFICATIONS

This technology uses an electrochemically active reporter that can be reactivated and recycled by E. coli amplifying the detection signal. In contrast, colorimetric compounds contribute to the detection signal via addition.

1. The electrochemically active reporter can be reactivated and recycled by E. coli, amplifying the detection signal, which is different from colorimetric compounds where contribution to the detection signal is additive
2. *E. coli* detection in the range 5.0 x 10^2 to 5.0 x 10^5 CFU/mL 22–54% faster than commercially available resorufin glycosides.
3. Near universal property of microbes to indirectly reduce an electrode via soluble redox mediators, although specialist microbes can reduce electrodes directly. Potential for bespoke applications.
4. Compatible with open source and electrochemical components to enable an inexpensive hand-held, multianalyte detection systems to be developed.
5. For analysis of environmental samples, it presents an increased durability and less interference from deeply coloured or fluorescent matrices.

POTENTIAL APPLICATIONS

This technology is mainly applied for FIB detection, but can be extended to the following applications:

1. Specific microorganism detection for environmental, biological, and food applications
2. Waste management through monitoring faecal contamination of water bodies and sewage systems
3. Proof of concept for detection of lactic acid bacteria, compatible for food applications.
4. *Escherichia coli* detection as faecal indicator bacteria (FIB) for microbial water quality monitoring.
5. Molecular approach to faecal indicator bacteria (FIB) monitoring.
6. Routinely testing environmental and biological samples in search for microorganisms.
7. Public health protection measure, monitoring of recreational and potable water for microorganisms that are indicators of faecal contamination.
8. Monitoring of faecal contamination of water bodies in urban environments caused by inadequate waste management in, for example, developing countries, or from failure of water management systems, such as leakage from compromised or overburdened sewerage networks.
9. Monitoring of faecal contamination in drinking water distribution systems from sewage or drainage ingress when water mains experience transient depressurization, such as during maintenance or pump failure.
10. Detecting, quantifying, and tracking instances of faecal contamination of water bodies to ensure drinking water meets sanitary guidelines and that recreational waters remain safe for primary and secondary contact activities such as swimming and boating respectively.
11. Monitoring of microbial water quality routinely to control public access to recreational facilities and water resources.

UNIQUE VALUE PROPOSITION

1. The molecular design of the naphthoquinone glycosides requires fewer synthetic steps allowing them to be produced for more economically than available counterparts
2. Process is highly scalable, and automation is possible to suit specific industrial needs
3. Low tendency for abiotic interference for environmental microorganism detection
4. Specificity maintained between b-glucuronidase and b-galactosidase, although accurate enumeration of target organism will necessitate development of a selective medium.
5. Higher performance at high organism concentrations, detecting 500 organisms in 9 h compared with 13.5 h for the commercial method in comparison to a commercially available detection method which has U.S. Environmental Protection Agency (EPA) approval. Greater than > 1000 organisms can be detected in just a few hours.
6. A recent trend for low-cost open-source hardware means that automated, potentiostatically controlled *E. coli* detection systems could be constructed for less than US$100 per channel