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LABORATORIES OF AMERICA, INC.



Research & Development Cooperation between SLA and CMOP

Biological monitoring using indicator microbial species is widely used to assess environmental pollution. Since 1976, *Escherichia coli* and enterococci have been recommended by the US Environmental Protection Agency (EPA) as the indicators of choice for improper discharge of sewage and agricultural waste that directly contaminates environmental water with pathogenic microorganisms. Another widespread environmental problem is agricultural pollution of water with chemical nutrients that stimulate harmful algal blooms, oxygen depletion, and profound changes in composition of aquatic microbial communities. Recent analyses of microbial diversity provide an increasing number of potential candidates for novel microbe indicators of environmental pollution that need to be further field-tested. The highly dynamic Columbia River coastal margin, which is the focus of an NSF Science and Technology Center for Coastal Margin Observation and Prediction (CMOP), is an ideal testing ground for new tools aimed at elucidating microbial responses to changing environmental conditions.

An ideal technology for field monitoring of microbial indicators requires a combination of (i) sensitivity achieved by amplification of nucleic acid targets, (ii) selectivity provided by specific hybridization of nucleic acid targets to complementary probes, (iii) low costs associated with direct label-free assays and mass industrial manufacturing of sensor devices, and (iv) portability, ease-of-use essential for field deployment. All these characteristics are achievable with the new technology based on impedance spectroscopy for fast and label-free measurements in real time that has been developed by SHARP Labs of America (Camas, WA).

Since 2007 CMOP has been using the SLA technology for microbial gene detection. First goals to generate 'proof-of-principle' data, and to determine specificity, sensitivity, and the dynamic range of the platform for detection of nucleic acid hybridization have been achieved. Currently, we are working on establishing applicability of the platform for indicator microbial species detection in various pure and mixed samples.

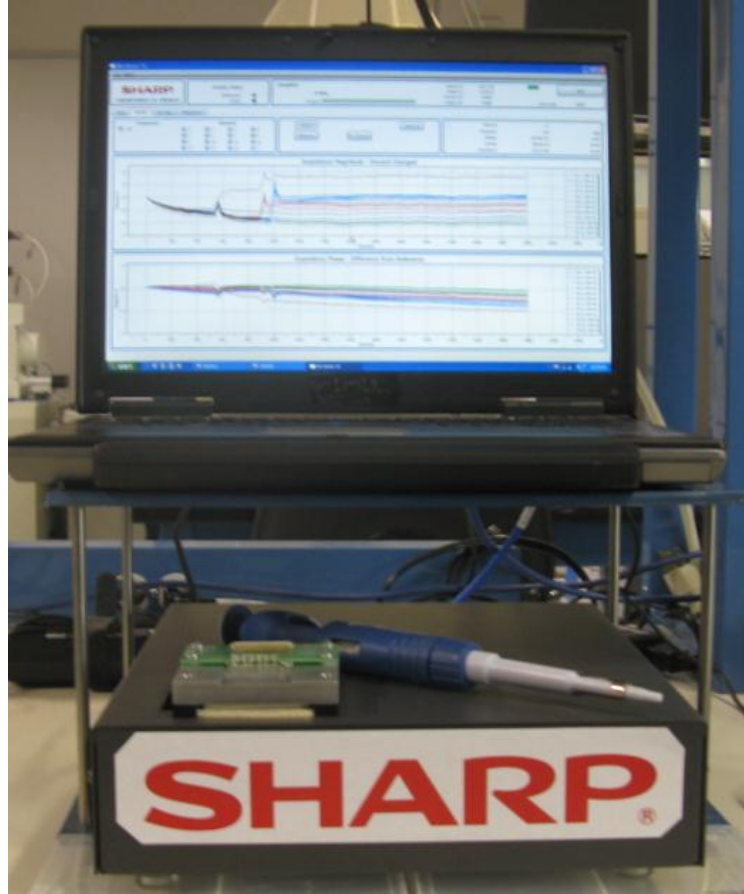
Reference:

A. L. Ghindilis, M. W. Smith, K. R. Schwarzkopf, C. Zhan, D. R. Evans, H. M. Simon. [Impedimetric label-free sensing of DNA hybridization in real time for rapid microorganism detection: Applicability to assay in the field](#). *Electroanalysis* (2009) , 21, No. 13, 1459 – 1468

Accomplishments

An integrated impedance spectroscopy platform for wide range of biological assays has been developed. The platform includes: (i) multiplexed array capable for different types of bio-functionalization; (ii) instrument capable for parallel reading of multiple electrode pairs; (iii) software package for data analysis.

The ability of the developed platform to perform DNA assays has been demonstrated for oligonucleotides and DNA amplicons from different *E. coli* strains.



Impedimetric reader

- ❖ Stimulation voltage: 0-212 mV.
- ❖ Stimulation frequency: 10-3000 Hz.
- ❖ Load impedance: up to 500K ohms.
- ❖ Measures 16 channels **simultaneously**.
- ❖ Eight impedance measurements per second per channel.
- ❖ Sensor temperature control.
- ❖ Ethernet connection to host computer.

SLA impedimetric arrays

