Abstract

Water pollution is a major problem worldwide and has great negative and far reaching consequences to both aquatic and terrestrial life. Sources of water pollution include agricultural, industrial and municipality wastes. One of the biggest threats to human health is faecal contamination of environmental waters. Waterborne diseases result from the ingestion of water contaminated by faecal material that contains pathogenic microorganisms. Standard methods are time consuming, labor intensive and unable to be employed for continuous monitoring.

Introduction

The microbiological quality of water is measured using indicator bacteria. These are bacteria, which themselves are not necessarily pathogenic, but indicate the presence of pathogenic bacteria due to the faecal contamination of water. With the implementation of Directive 2006/7/EC by 2015, the EU is changing the way the microbiological contamination of water is measured, interpreted and classified. The directive includes the change of faecal indicator bacteria to Intestinal Enterococci and E. coli.

Eschericia Coli (E.coli)

• Best indicator for faecal contamination according to EPA and WHO.
• Almost exclusively associated with faecal sources.

Current work

• Continuous monitoring of water quality in Poolbeg Marina, collect and process the data.
• Investigate the impact of weather, tides, and ship movement on the measured water parameters: temperature, optical dissolved oxygen, pH, specific conductance, turbidity and salinity.

Future Work. Sensor Concept

Enzyme Based Method

The assay of the marker enzymes can be suitable for continuous monitoring; 97% of E.Coli strains are Beta-D-glucuronidase (GUD) positive, therefore in this study GUD is used as a marker enzyme for E. coli.

Advantages

• High sensitivity and selectivity;
• Able to detect viable but non-culturable cells (VBNC);
• Cost-effective;
• Enzyme mediated reactions are rapid and time saving;
• Circumvents the time consuming culturing period;
• Enables the exploitation of a range of enzyme substrates.

Working Principle

Measurement of E. coli in a water sample is achieved using Beta-D-glucuronidase fluorogenic (Scheme 1) or chromogenic substrates (Scheme 2); GUD catalyses the hydrolysis of β-D-glucuronides based substrates to corresponding aglycons and D-glucuronic acid.

Detection: LED-LED System

Figure 6: A schematic of an LED-LED system used for detection of fluorescein in a conventional flow-through cell (L. Tyrmezki, R. Koncki, Analyst. 2011. 136:73).

Figure 7: A schematic of the integrated paired emitter-detector diode flow analysis device used for colormetric detection (M. O’Toole, D. Diamond, Sensors 2008, 8, 2453-2479).

Objectives

• Develop an in-situ sensing platform for continuous monitoring of faecal pollution in water. (Assess sensor robustness and test different strategies for the reduction of biofouling).
• Investigate for correlations between E.Coli counts and the data collected from the YSI 6 series sondes.

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