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Micro-incubator for bacterial biosensing applications

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ABSTRACT:

The presence of *Escherichia coli* (*E. coli*) is a commonly used indicator micro-organism to determine whether water is safe for human consumption. This paper discusses the design of a micro-incubator that can be applied to concentrate bacteria prior to environmental water quality screening tests. High sensitivity and rapid test time is essential and there is a great need for these tests to be implemented on-site without the use of a laboratory infrastructure. In the light of these requirements, a mobile micro-incubator was designed, manufactured and characterised. A polydimethylsiloxane (PDMS) receptacle has been designed to house the 1-5 ml cell culture sample. A nano-silver printed electronics micro-heater has been designed to incubate the bacterial sample, with an array of temperature sensors implemented to accurately measure the sample temperature at various locations in the cell culture well. The micro-incubator limits the incubation temperature range to 37 ± 3 °C in order to ensure near optimal growth of the bacteria at all times. The incubation time is adjustable between 30 minutes and 9 hours with a maximum rise time of 15 minutes to reach the set-point temperature. The surface area of the printed nano-silver heating element is 500 mm². Electrical and COMSOL Multiphysics simulations are included in order to give insight on micro-incubator temperature control. The design and characterization of this micro-incubator allows for further research in biosensing applications.