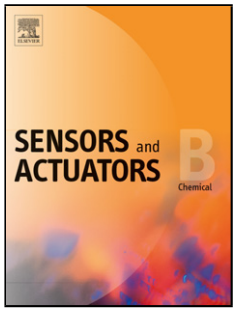

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PII: S0925-4005(18)30616-6
DOI: https://doi.org/10.1016/j.snb.2018.03.118
Reference: SNB 24403

To appear in: *Sensors and Actuators B*

Received date: 17-1-2018
Revised date: 15-3-2018
Accepted date: 19-3-2018

Please cite this article as: Aditya Sharma Ghrera, Chandra Mouli Pandey, Bansi Dhar Malhotra, Multiwalled Carbon Nanotube Modified Microfluidic-Based Biosensor Chip for Nucleic Acid Detection, Sensors and Actuators B: Chemical https://doi.org/10.1016/j.snb.2018.03.118

Multiwalled Carbon Nanotube Modified Microfluidic-Based Biosensor Chip for Nucleic Acid Detection

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Research Highlights

- Fabrication of microfluidics-based chip for electrochemical sensing.
- Electrophoretic deposition of MWCNT onto patterned ITO coated glass substrate.
- Fabricated MWCNT based chip can detect complementary DNA upto femtomolar concentration range.
- This platform is self–contained, easy–to–operate and has the potential to achieve rapid, simple, and specific detection of DNA.

Abstract

An impedimetric microfluidic–based biosensor was fabricated and investigated for quantification of the DNA sequence specific to chronic myelogenous leukemia (CML). The sensor chip was constructed by electrophoretic deposition of carboxyl-modified multiwalled carbon nanotubes (MWCNT) on the patterned (via wet chemical etching method) indium–tin–oxide (ITO) coated glass substrate. The MWCNT surface was immobilized with CML specific deoxyribonucleic acid probe, followed by sealing of the biochip with poly (dimethylsiloxane) microchannel for fluid control. This integrated miniaturized system was used to monitor complementary target DNA concentration by measuring the interfacial charge transfer resistance via hybridization. The presence of complementary DNA in buffer solution resulted in significant decrease in electrical conductivity of the interface thereby presenting a barrier for transport of the redox probe ions. Under optimal conditions, this microfluidic biochip exhibited good calibration range from 1 μM to 1 fM and a response time of 60 s.