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An impedance biosensor for accurate and rapid detection of foodborne

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An impedance biosensor for rapid detection of low concentration Escherichia coli O157:H7 was designed, fabricated and tested. The biosensor has the following innovative features: (1) A focusing region consisting of ramped down vertical (electroplated) gold electrode pair made along with 45° tilted thin film finger pairs. This configuration generates p-DEP force to concentrate the bacteria into the center of the microchannel, and direct them toward the sensing microchannel which has a diameter smaller than one-third of the first channel. The bulk fluid flows into the outer channel towards the waste outlets. (2) Bacteria sensing region consists of three interdigitated electrode arrays (IDEA) with varying number of fingers (30, 20 and 10 pairs respectively) coated with anti-*E.coli* antibody. As *E.coli* reaches the sensing region it binds to the antibody on IDEA surface, and results in impedance change. This has enabled detection of a very low concentration of bacteria with a very high sensitivity and rapidly. Fabrication of the biosensor was performed on a glass substrate using SU8 negative photoresist to form the microchannel, gold electroplating to form the vertical focusing electrode pair, thin gold film to form the detection electrode, the finger electrodes, traces and bonding pads, and PDMS to seal the device. Various low concentration *E.coli* samples were tested to determine the sensitivity of the biosensor and the lowest detection limit of the biosensor was found to be 14 CFU/ml. The total turnaround time, from antibody immobilization to pathogen detection was about 2 hours.

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Graphene-based composite biosensors for continuous glucose monitoring

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Diabetic complications, especially cardiovascular disease and renal disease, make diabetes the seventh leading cause of death in the USA in 2007. Close monitoring and timely correction of elevated blood sugar can reduce the risk of diabetes-related complications. Portable glucometers, which measure blood glucose levels by finger pricks, may fail to detect rapid glucose changes. Continuous Glucose Monitoring (CGM) sensors using electrochemical detection are intended to address this, however, enzyme-catalyzed CGM have significant drawbacks, including (1) detection errors from irreversible consumption of glucose of the tissue, (2) drift over time, due to H_2O_2 production as a byproduct, affecting device accuracy, reliability, and longevity, and requiring repeated calibration (2-5 times/day), (3) need for frequent replacement (every 3-5 days), due to H_2O_2, and O_2 mediators, (4) intermediate reactions that delay detection with possible false signals, due to interference with ascorbic and uric acids. Therefore, there is a dire need for non-enzymatic, mediator-free electrochemical glucose detectors which provide rapid response, better stability, and allow full implantation and wireless detection. In this work, we introduce non-enzymatic, mediator free glucose sensors by growing CVD graphene on a nanostructured platinum/silicon Schottky junction. Non-enzymatic detection is achieved by the adsorption of glucose molecules on the graphene surface, glucose OH^- groups interact with O_2 on the graphene surface. This interaction p-dopes the graphene layer, shifting the Dirac point to positive potential, thus varying the Schottky barrier's height (SBH) and width, resulting in a detectable current change. The results indicated that the proposed sensor provided a highly sensitive, more facile method with good reproducibility for continuous glucose detection.

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