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A Novel Current to Voltage DNA Biosensor: Cervical Cancer Eradication by early detection of Human Papillomavirus (HPV) strain 16

U. Hashim, N. Azizah
Universiti Malaysia Perlis (UniMAP), Malaysia

The development of novel sensors towards diagnosis of infection disease causing agents was been promoted by nanoparticle-mediated bio-sensing. Cervical cancer infection is one of the severe issues, was stimulated by high risk types of Human Papillomavirus (HPV) strains especially HPV 16. Mostly 70% of cervical cancers are caused by infection of this genotype. This paper presents optimization and characterization of HPV DNA probe immobilization on Interdigitated Electrodes (IDEs) sensor using 3-Aminopropyl trimethoxysilane [APTES; NH_2-$(CH_2)_3$-Si $(OC_2H_5)_3$] to produce a thin, stable silane layer on the sensor device. The sensor was fabricated using conventional photolithography integrated with an inductively dry etching process. The effect of APTES concentration and silanization time on the formation of silane layer is studied using Fourier transform infrared spectroscopy (FTIR) and atomic force microscopy (AFM). Surface analytical techniques such as FTIR and atomic force microscopy (AFM) are employed to characterize the biochemically modified surfaces at each step of the biomolecule immobilization process. A uniform, homogenous and highly dense layer of biomolecules are immobilized with optimized on IDEs substrate. The complement of the target DNA of HPV 16 to the carboxylate-probe DNA could be translated into electrical signals and confirmed by the increased conductivity in the current-to-voltage curves. The specificity experiments indicate that the biosensor can discriminate between the complementary sequences from the base-mismatched and the non-complementary sequences. After duplex formation, the complementary target sequence can be quantified over a wide range with a detection limit of 1.0 x 10-12 M.With its excellent detection capabilities, this sensor technology is promising for early detection of cervical cancer, presented a sensitive platform for HPV detection and would become a powerful tool for pathogenic microorganisms screening in clinical diagnosis.

Biography

Uda Bin Hashim received BSc Hons. degree in Physical and Applied Physics from Universiti Kebangsaan Malaysia, in 1987, and Ph.D in Microelectronic Engineering from the same university in 2011. Since 1988, he has been serving MIMOS Berhad for 14 years and experienced in the CMOS wafer fabrication foundry. In 2002, he joined Universiti Malaysia Perlis, Malaysia as a lecturer in the School of Microelectronics Engineering. Currently, he is a Senior Professor in Universiti Malaysia Perlis and Director to the Institute of Nano Electronic Engineering, Universiti Malaysia Perlis. His research interest includes Nanobiosensor, DNA Chips, Microfluidic and Nano Lab-On-Chip devices for medical, food and agriculture applications. Under Scopus database, his current H-Index is 18 with 1624 citations from the total number of 539 papers. He also has successfully supervised 3 Post-Doctoral students, 24 PhD students and 36 MSc students, while 5 PhD and 4 MSc are still working towards completion.

Recently in 2014, Prof. Dr. Uda Hashim has been awarded as Top Research Scientist Malaysia (TRSM) by Academic of Sciences Malaysia. He is one of the recipients of ISESCO Laureate in 2012. He also obtained National Patent Award in 2013 from Perbadanan Harta Intelek Malaysia (MyIPO). He was a former Vice President of Malaysia Nanotechnology Association and a Fellow to The Malaysian Solid State Science & Technology Society. Recently, he has been appointed as a main committee member for national nanotechnology under Nanotechnology Directorate MOSTI and also serves as deputy committee cluster Nanotechnology under National Professor Council. On top of that, he has been appointed as Visiting Professor to Universiti Teknikal Melaka Malaysia, Academic Adviser to AIMST University and Visiting Research Scientist to Wayamba Universiti of Sri lanka.

uda@unimap.edu.my