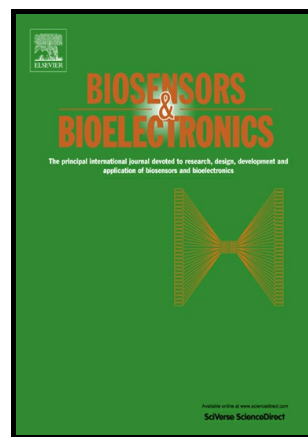


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Detection of early stage prostate cancer by using a simple carbon nanotube@paper biosensor

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Abstract

This study is an investigation for an inexpensive, simple and sensitive biosensor to detect prostate cancer using bioactivated-multi wall carbon nanotubes (MWCNTs, diameter of 20 nm, length of 5 μm) and a micro-pore filter paper (pore size of 0.45 μm). For the immunoassay of prostate specific antigen (PSA), which is a biomarker of prostate cancer, MWCNTs were activated with PSA antibody (monoclonal antibody of the prostate specific antigen) by using N-(3-dimethylaminopropyl)-N'-ethylcarbodiimide hydrochloride (EDC) and N-hydroxysulfosuccinimide sodium salt (NHSS). The activated MWCNTs were deposited on the micro-pore filter paper to use as a biosensor. The prepared biosensor can assay from 0 to 500 ng/mL of PSA level within 2 h with the detection limit of 1.18 ng/mL by the measurement of resistance change. The resistance change was caused by site selective interaction between PSA and PSA-antigen with an inexpensive bench top digital multimeter (5 1/2 digits). The detection range and sensitivity of the prepared sensor are good enough to diagnose the early stage of prostate cancer (> 4 ng/mL of PSA). This paper-based biosensor is about 20 times cheaper (fabricated biosensor price: 2.4 \$) and over 10 times faster than enzyme-linked immunosorbent assay (ELISA), which is a general method for the detection of a specific protein in the modernized hospitals. Furthermore, the maximum detection limit is about 50 times higher than ELISA.

Keywords: MWCNT, Paper, Biosensor, Prostate, Cancer, Easy detection

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