Carbon nanotube-based electrochemical signal amplification for breast cancer gene detection

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Abstract: Carbon-nanotubes (CNT) represent an important group of nanomaterials with useful properties that enable their use for many important applications and made them extremely attractive for the task of electrochemical detection. Here, the author uses CNT to enhance the sensitivity of a multi-enzyme-based electrochemical bioassay for breast cancer gene (BRCA1) detection. Giant enzyme-based electrochemical nucleic acids hybridisation assay for detecting specific segments related to the breast-cancer gene is described. The 'giant' enzyme tag is a DNA-streptavidin coated polystyrene sphere loaded with many biotinylated alkaline phosphatase enzyme molecules based on the strong affinity of the streptavidin-biotin complex. The overall performance along with factors influencing the signal amplification of hybridisation signals are assessed and optimised. Such amplified electrical transduction allows the detection of breast cancer related nucleic acids segments down to 16 amol levels with 20 minutes hybridisation time and offers a great promise for early, accurate, simple and fast disease diagnosis.

Keywords: carbon nanotubes; CNT; electrochemical signal amplification; breast cancer gene detection; graphite carbon electrodes; DNA hybridisation; alkaline phosphatase.

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