

Pencil-based renewable biosensor for label-free electrochemical detection of DNA hybridization

Joseph Wang*, Abdel-Nasser Kawde

Department of Chemistry and Biochemistry, New Mexico State University, Las Cruces, NM 88003, USA

Received 25 July 2000; received in revised form 21 November 2000; accepted 21 November 2000

Abstract

The characteristics and advantages of a renewable DNA hybridization biosensor based on a pencil electrode transducer are described. The surface of this biosensor can be renewed rapidly, by a simple mechanical extrusion, hence, obviating the need for an additional regeneration step. The sensor, thus, responds rapidly to the 'switching' between target and non-complementary oligonucleotide solutions, with the use of fresh surfaces erasing memory effects. The intrinsic redox activity of the target DNA is employed for detecting the duplex formation. Relevant experimental parameters were examined and optimized. The selectivity of the new device was demonstrated for the detection of a single-point mutation in the BRCA1 breast cancer gene. Such low-cost, renewable graphite transducers provide an attractive alternative to conventional carbon electrodes used for transducing DNA hybridization. By eliminating the needs for a regeneration step and an external indicator, the device offers a greatly simplified operation and holds promise for decentralized genetic testing. © 2001 Elsevier Science B.V. All rights reserved.

Keywords: DNA hybridization; Mutation detection; Biosensor; Pencil electrode; Breast cancer gene