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Moving Enzyme-Linked ImmunoSorbent Assay to the Point-of-Care Dry-Reagent Strip Biosensors

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Abstract

In this work, we described a point-of-care (POC) dry-reagent strip biosensor (DRSB) based on enzyme tracers and portable strip reader for simple, low-cost and sensitive assay of protein detection in minutes. Horseradish Peroxidase (HRP) and Rabbit IgG (R-IgG) were used as a model system for the demonstration of the proof-of-concept. The sandwich-type immunoreactions were performed on the DRSB and the HRP tracers were captured on the test zone of the biosensor. The excess of HRP tracers were captured on the control zone of the biosensor through the immobilized secondary antibody. Subsequent enzymatic reaction in the presence of the substrate produced insoluble enzymatic products, which deposited on both test and control zones of the DRSB and formed two characteristics blue bands. While qualitative tests are realized by observing the color change of the test zone, quantitative data are obtained by recording the intensities of the test zone with a portable "strip reader". The quantitative response of the optimized DRSB over the range of 0.1-50 ng mL^{-1} IgG in association with a 10-min assay time is obtained, and the limit of detection is estimated to be 0.05 ng/mL, which is ten times lower than that of the gold nanoparticle (GNP)-based DRSB. The enzyme-based DRSB was used to detect Carcinoembryonic Antigen (CEA) biomarker in human plasma successfully. Such enzyme-based DRSB offers a simple and fast tool for point-of-care protein assay and a potential substituent for the traditional Enzyme-linked Immunosorbent Assay (ELISA).

Keywords: ELISA; Biosensor; Enzyme; Point-of-care; Dry-reagent strip.

