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Construction of a Biosensor Operating on the Combined Principles of Electrochemical Analysis and Localized Surface Plasmon Resonance for Multiple Detection of Antigen-Antibody and Enzymatic Reactions on the Single Biosensor

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In this paper, we describe the construction of a biosensor operating on the combined principles of electrochemical analysis and localized surface plasmon resonance (E-LSPR) using a core-shell nanoparticle-layer substrate for medical applications. The biosensor thus constructed enabled the multiple detection of antigen-antibody and enzymatic reactions on the single biosensor. In addition, we used the biosensor to detect glucose and hemoglobin A1c (HbA1c) for application in diabetes diagnostics. Antigen-antibody reactions were detected on the basis of the principle of LSPR-based optical detection, and enzymatic reactions were detected on the basis of the principle of electrochemical detection using the single biosensor. The E-LSPR biosensor was characterized on the basis of these optical and electrochemical detection principles and the biosensor construction procedure. We found that this biosensor could be used to specifically detect glucose and HbA1c and that the detection of these target molecules using this biosensor was simpler, requiring smaller sample volumes than those required by conventional biosensors. Thus, the E-LSPR biosensor has potential for use in cost-effective, simple, and highly sensitive test kits for medical applications.

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