

Title	銀ナノ粒子と電気化学計測法を用いたバイオセンサに関する研究
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Abstract

The electrochemical immunosensor was developed based on a silver-nanoparticle-labeled sandwich-type metalloimmunoassay. After immunoreaction, the quantity of silver nanoparticle captured on the working electrode was measured, as follows. The silver nanoparticles were electrically oxidized to silver ions, and then, the silver ions were electrodeposited on the electrode. The amount of silver was determined using differential pulse voltammetry (DPV). The analytical performances of the immunosensor were evaluated using Hepatitis B surface (HBs) antigen as the model antigen. The detection limit was 0.78 IU mL^{-1} (estimated from three times the standard deviation for 0 IU mL^{-1}).

To fabricate a more sensitive immunosensor based on a silver-nanoparticle-labeled sandwich-type metalloimmunoassay, the dual working electrodes (W1 and W2) in which the area of W1 was one-tenth the total working electrode area were developed. After immunoreaction, the quantity of silver nanoparticles captured on W1 and W2 was measured, as follows. The silver nanoparticles were electrically oxidized to silver ions on W1 and W2. The silver ions were electrodeposited on only W1. The amount of silver concentrated on W1 was determined using DPV. Under optimized conditions, the detection limit for HBs antigen was 0.09 IU mL^{-1} , which was nine times lower than the detection limit using the conventional immunosensor (see the above).

To fabricate a more simplified and user-friendly immunosensor based on a silver-nanoparticle-labeled sandwich-type metalloimmunoassay, the pH-controlled detection solution was developed, which could act as the washing and the detection solution and reduce the number of steps in the metalloimmunoassay. Using a pH-optimized detection solution, the detection limit for HBs antigen was 0.78 IU mL^{-1} . Although the detection limit was slightly higher compared to the conventional one, the complicated steps such as washing steps using dedicated solutions and drying step were not required. Therefore, the simplified immunosensor is user-friendly and suitable for unskilled users.

Keywords;

Electrochemical biosensor, immunosensor, silver-nanoparticle, metalloimmunoassay, Hepatitis B surface antigen