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Research Article

Electrochemical Determination of Japanese Encephalitis Virus Antigen Using Silver Nanoparticles Modified Screen-Printed Carbon Electrode

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Abstract

In this study, we aim to fabricate a silver nanoparticles (Ag NPs) based electrochemical biosensor for Japanese Encephalitis virus antigen detection. Ag NPs were deposited onto screen-printed carbon electrode (SPCE) and the electrochemical properties of the Ag NPs modified SPCE were investigated via electrochemical impedance spectroscopy (EIS) and cyclic voltammetry (CV). It was observed that the deposition of Ag NPs onto electrode surface has significantly enhanced the conductivity up to 20.5% than that of bare SPCE. The EIS data indicated limit of detection (LOD) of 2.60 ng/mL (at S/N = 3) towards JEV antigen, with an analysis assay time of 20 min. This presented Ag NPs modified SPCE has demonstrated a promising and rapid alternative to conventional biosensing techniques towards JEV antigen.

Keywords: Silver nanoparticle; Screen printed carbon electrode; Electrochemical impedance spectroscopy; Japanese encephalitis virus antigen

Introduction

Japanese encephalitis virus (JEV) is a type of *flaviviruses* that is transmitted by *Culex tritaeniorhynchus* mosquito to human. This disease has an incubation period of two weeks but could cause mortality rate as high as 40%, and nearly 50% chance of permanent neurologic damage after recovery [1]. As such, early and rapid detection of JEV disease is crucial for timely diagnosis and treatment of JEV patients, as well as for effective control of JEV outbreak. JEV detection methods reported in clinical assays include enzyme-linked immunoglobulin assay (ELISA) [2], reverse transcriptase droplet digital PCR (RT-ddPCR) [3], plaque reduction neutralization test (PRNT) [4] and virus isolation [5]. However, these methods have the drawback of being time-consuming, tedious and complicated analyses procedures [6]. The costs of specific instruments and reagents also limit their wide application in clinical laboratories. Therefore, there is a need to develop an alternative diagnostic method which offers low-cost instrumentation, rapid and portable for on-site testing.

Biosensors are gaining great attention in clinical