Fabrication of label-free immunoprobe for monkypox A29 by molybdenum oxide-graphene quantum rods

Kyusik Yun
Murugesan Chandran, Saravanan Govindaraju,
Department of Bionanotechnology, Gachon University, Gyeonggi-do 13120, Republic of Korea
ykyusik@gachon.ac.kr

Abstract
Monkeypox is a zoonotic viral infection caused by the monkeypox virus (MPXV), which belongs to the Poxviridae family of the Orthopoxvirus (OPXV) genus. Monkeypox is transmitted from animals to humans and humans to humans; therefore, the accurate and early detection of MPXV is crucial for reducing mortality. A novel graphene-based material, graphene quantum rods (GQRs) was synthesized and confirmed using high-resolution transmission electron microscopy (HR-TEM) and atomic force microscopy (AFM). In this study, molybdenum oxide was electrodeposited and one-pot electrodeposition of MoO_3-GQRs composite on carbon fiber paper (CFP) enabled by an antibody (Ab A29)/MoO_3-GQRs immunoprobe was developed for the early diagnosis of MPXV protein (A29P). Several studies were conducted to analyze the MoO_3-GQRs composite, and the prepared Ab A29/MoO_3-GQRs immunoprobe selectively bound to the A29P antigen that was measured using differential pulse voltammetry (DPV) analysis and impedance spectroscopy. The antigen–antibody interaction was analyzed using X-ray photoelectron spectroscopy. DPV analysis showed a wide linear range of detection from 0.5 nM to 1000 nM, a detection limit of 0.52 nM, and a sensitivity of 4.51 μA in PBS. The prepared immunoprobe was used to analyze A29P in serum samples without reducing electrode sensitivity. This system is promising for the clinical analysis of A29P antigen and offers several advantages, including cost-effectiveness, ease of use, accuracy, and high sensitivity.

Reference

[1] Murugesan Chandran, Gayathri Chellasamy, Mekala Veerapandian, Barkavi Dhanas ekaran, Shiva Kumar Arumugasamy, Saravanan Govindaraju, Kyusik Yun, Journal of Colloid and Interface Science, 660 (2024) 412-422

Figures

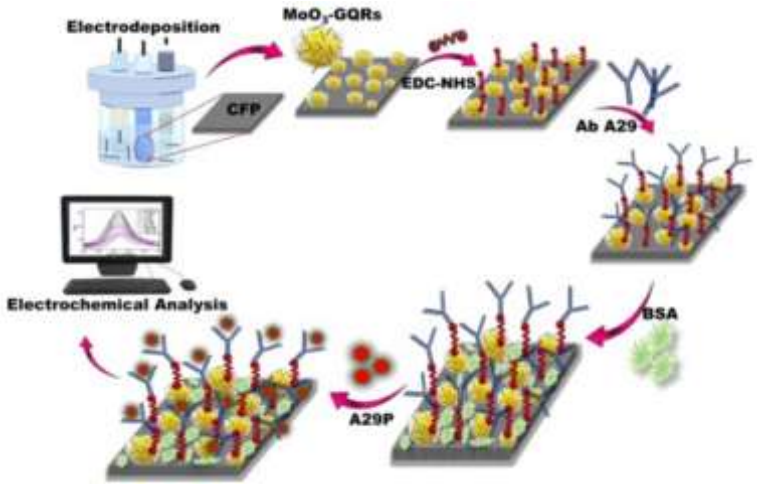

Fig. 1. Schematic representation of developed immunosensor.