MoS_2-PEDOT:PSS Nanocomposite-Based Electrochemical Sensor for Epirubicin Detection in Biological Samples

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Cancer is a group of deadly diseases that can begin in almost any part of the body, where cells grow uncontrollably and spread to other areas [1]. Among cancer treatment methods, chemotherapy, which uses antineoplastic agents, is considered the most effective approach. However, it is well known that chemotherapy affects both cancerous and healthy cells due to the high doses of drugs intake, which results in significant side effects throughout the body [2]. As a result, tracking the dosage of anticancer drugs in biological fluids like human blood or urine is crucial for evaluating potential side effects and the overall effectiveness of the chemotherapy treatment. Epirubicin (EPB), a widely known antineoplastic drug from the anthracycline antibiotics group, is commonly used to treat certain types of cancer, including breast and lung cancer [3]. Chemically exfoliated molybdenum disulfide (CE-MoS_2) nanosheets were successfully synthesized through a metal intercalation method and subsequently modified their surfaces with Poly(3,4-ethylenedioxythiophene):polystyrene sulfonate (PEDOT:PSS), a conductive polymer. The structural, morphological, and electrochemical characterizations of the CE-MoS_2/PEDOT:PSS nanocomposite were conducted using X-ray photoelectron spectroscopy (XPS), thermogravimetric analysis (TGA), transmission electron microscopy (TEM), and electrochemical impedance spectroscopy (EIS). A portable electrochemical sensing platform was developed by modifying a screen-printed carbon electrode (SPCE) with the CE-MoS_2/PEDOT:PSS nanocomposite. The electrochemical behaviour of EPB was investigated on the SPCE modified with the CE-MoS_2/PEDOT:PSS nanocomposite using cyclic and differential pulse voltammetry. The CE-MoS_2/PEDOT:PSS/SPCE exhibited promising electrocatalytic activity for the oxidation of EPB, showing an analytical performance in the concentration range of 0.06 to 9.30 µM, with a low detection limit of 44.3 nM. Additionally, it was successfully analysed human plasma samples containing EPB using the CE-MoS_2/PEDOT:PSS/SPCE, achieving satisfactory recovery rates.

References

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