Optimization of Biochemical Sensitivity of Screen-Printed Electrodes for Monitoring Traces of Anticancer Drugs

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Anticancer drugs can cause serious health hazards such as organ toxicity and drug resistance because of their high potency if not properly dosed. Have a reliable method for concentration monitoring and detection of trace amounts of anticancer drugs in biological samples is of great importance for narrowing the gap between the therapeutical and toxic doses. The need for rapid and sensitive in-situ detection of biochemical entities finds a promising solution in the application of screen-printed electrode (SPE) based electrochemical nanosensors.

SPE-based electrochemical nanosensors modified with various techniques (gamma irradiation, polymer and composite drop casting etc.) for screening of pharmaceutical ingredients and products in biological matrices are presented in this work. Three commercial electrodes are used as a modification substrate – one polymer (polyaniline, PANI) and two carbon systems (graphene, G and carbon nanotubes, CNT). All obtained electrodes are tested in 0.1 M phosphate buffer saline of Doxorubicin Hydrochloride (DOX) with pH 6.8. The electrochemical activity of the commercial and modified electrodes is followed by cyclic voltammetry, as an electrochemical characterization technique. Fourier-transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM) are used for electrode's physical characterization, whereas ultraviolet-visible spectroscopy (UV-Vis) is used for structural changes following of the used buffer solution before and after current exposure. The modified electrodes show excellent response in terms of lower electrical resistance and higher electrical conductivity, compared to the commercial electrodes. The best performance is shown by PANI modified electrodes, especially by the polyaniline/carbon nanotubes-polyacrylic acid (PANI/CNT-PAA) modification.

Keywords: nanomaterials, electrochemical nanosensor, screen-printed electrode, anticancer drugs, Doxorubicin hydrochloride