



Área: ANA

PORTABLE VOLTAMMETRIC SENSOR MODIFIED WITH NANOMATERIALS FOR THE ELECTROCHEMICAL DETECTION OF MDA

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Highlights

Development of a portable voltammetric platform for the detection of MDA using screen-printed electrodes modified with nanomaterials
Systematic evaluation of Britton–Robinson, phosphate, and perchlorate/phosphate buffers, and pH optimization for enhanced electrochemical responses.
Nanomaterial-modified electrodes exhibit superior catalytic activity and sensitivity toward MDA oxidation.
Provides a rapid, cost-effective, and portable electrochemical approach suitable for on-site forensic screening of illicit substances.

Resumo/Abstract

Electrochemical sensors, particularly screen-printed carbon electrodes (SPEs) modified with nanomaterials, have become established as accessible, rapid, and effective alternatives for the detection of various analytes, including substances of forensic interest such as drugs of abuse. In this work, the electrochemical behavior of 3,4-methylenedioxyamphetamine (MDA) was investigated using square wave voltammetry (SWV) with a portable DropSens/Metrohm® potentiostat. SPEs modified with Pd/rGO, Ir/rGO, Pd₃₀Ir₇₀/rGO, and Pd₇₀Ir₃₀/rGO were evaluated, correlating the metallic composition with the electrocatalytic activity toward MDA oxidation. Experiments were carried out in Britton–Robinson buffer (pH 2, 4, 6, and 8), showing that pH directly influences the electrochemical response: in acidic media (pH 2 and 4), oxidation currents were more intense and peaks better defined, indicating dependence on the protonation of the MDA amine group. Comparison among the modifiers revealed that the Ir/rGO electrode exhibited the best performance at pH 4, with the most intense and well-defined voltammetric signal. These results indicate that iridium acts as the predominant active center in MDA oxidation, enhancing electron transfer and reducing the activation energy of the process. Thus, modification of SPEs with Ir/rGO provides superior performance in terms of sensitivity and signal definition, demonstrating the potential of this approach as a practical and efficient tool for in situ screening of illicit drugs, offering a portable, rapid, and low-cost alternative for forensic applications.

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