PÔSTER - RESUMO - DISPOSITIVOS ELETRÔNICOS, ELETROQUÍMICOS, SUPERCAPACITORES E BATERIAS

ELECTROCHEMICAL DETECTION OF HYDROXYZINE ADULTERANT USING CARBON-BASED ELECTRODES: A COMPARATIVE STUDY BETWEEN CYCLIC VOLTAMMETRY AND SQUARE WAVE VOLTAMMETRY

Leticia Pasquenelli Senna Goncalves Correa (leticiapasquenelli@aluno.ufsj.edu.br)

Rafael Mafra De Paula Dias (rafaelmafra@ufsj.edu.br)

Vagner Fernandes Knupp (vfk@ufsj.edu.br)

Dane Tadeu Cestarolli (dane.cestarolli@ufsj.edu.br)

Elidia Maria Guerra (elidiaguerra@ufsj.edu.br)

The detection of adulterants in pharmaceutical and illicit preparations is a growing demand in forensic chemistry, requiring analytical methods that are rapid, sensitive, and cost-effective. Hydroxyzine, a first-generation antihistamine, has been identified as a potential adulterant due to its sedative properties, which can mimic or potentiate the effects of controlled substances. Electroanalytical techniques offer a promising alternative to conventional methods by enabling the direct investigation of electroactive species with minimal sample preparation. In this study, we investigated the electrochemical behavior of hydroxyzine using a carbon-based working electrode in synthetic urine medium to simulate forensic conditions. Cyclic Voltammetry (CV) and Square Wave Voltammetry (SWV) were employed to evaluate the sensitivity and analytical performance of the sensor. The electrochemical cell consisted of

a carbon working electrode, Ag/AgCl reference electrode, and platinum wire as counter electrode, connected to a μ-Autolab Type III potentiostat controlled by NOVA software. CV measurements were performed at a scan rate of 50 mV.s?¹ over a potential range where hydroxyzine oxidation was observed. The voltammetric profiles revealed a well-defined anodic peak corresponding to the oxidation of hydroxyzine, with peak current increasing proportionally to analyte concentration. A calibration curve was constructed from the CV data, yielding a linear correlation coefficient (R^2) of 0.88, indicating good linearity within the concentration range investigated. To improve sensitivity and detection limits, SWV was also employed due to its ability to minimize capacitive currents and enhance faradaic signals. The SWV analysis resulted in a calibration curve with an R^2 of 0.86, confirming the suitability of both techniques for quantitative applications. Although the correlation coefficients were slightly lower than those observed in ideal conditions, they demonstrate the feasibility of using unmodified carbon electrodes for hydroxyzine detection in complex matrices such as synthetic urine. The results suggest that carbon-based sensors can effectively distinguish hydroxyzine responses even in the presence of potential interferents commonly found in biological fluids. The electrochemical oxidation mechanism is believed to involve the piperazine ring, which is electroactive at the carbon surface under acidic conditions. Comparative analysis between CV and SWV indicates that while CV provides straightforward mechanistic information, SWV offers better peak resolution and lower detection limits, making it more suitable for trace analysis. The sensitivity observed in both methods supports the potential application of these sensors for rapid screening in forensic laboratories. Future work will focus on validating the method in real seized samples, investigating common interferents such as caffeine, lidocaine, and other adulterants, and exploring electrode modifications to enhance selectivity and stability. Additionally, studies will include the determination of key analytical figures of merit, such as limit of detection (LOD), limit of quantification (LOQ), and repeatability. This preliminary investigation establishes a foundation for the development of portable electrochemical sensors for on-site forensic analysis of hydroxyzine and related adulterants.

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Palavras-chave: hydroxyzine; electrochemical sensor; cyclic voltammetry; square wave voltammetry; forensic analysis; adulterant detection.