PÔSTER - RESUMO - SENSORES E BIOSSENSORES

EXPLORING NON-FARADAIC APPROACHES IN APTAMER-BASED ELECTROCHEMICAL BIOSENSORS

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The analysis of interfacial responses in electrochemical biosensors using Electrochemical Impedance Spectroscopy (EIS) is inherently complex, as traditional data fitting via equivalent electrical circuits often encounters physical ambiguities due to time-constant dispersion on the electrode surface. Furthermore, these methods typically rely on external redox mediators, which increase experimental complexity and requires the use of toxic agents.[1] To overcome these obstacles, a model-free mathematical approach is proposed, utilizing a differential analysis in the frequency domain to evaluate a generalized capacitance (Cgpe), which directly converts impedance spectra into effective capacitance spectra.[2] This study applies this non-faradaic approach to a biosensing system to detect saxitoxin (STX), a very harmful cyanotoxin. Screen-printed electrodes (SPEs) are functionalized with aptamers, focusing on mapping the intrinsic capacitive changes at the electrode-electrolyte interface during molecular recognition. When STX binds to the immobilized aptamers, a conformational restructuring alters the electrical double layer properties,

allowing the method to rigorously isolate these interfacial variations. Consequently, the use of generalized capacitance confirms the feasibility of non-faradaic STX aptasensors by providing a robust, direct, and highly sensitive thermodynamic metric, which eliminates the need for toxic mediators as well. Preliminary results demonstrate that Cgpe offers a good analytical signal when compared to traditional impedance analysis, aligning with findings that alternative electrical parameters significantly enhance the accuracy and sensitivity of impedimetric sensors.[3] By capturing dielectric shifts in a non-faradaic regime, this approach facilitates the development of sensing platforms highly suitable for point-of-care applications.

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Palavras-chave: saxitoxin (stx); non-faradaic eis; biossensors; organic electronics.