PÔSTER - RESUMO - SENSORES E BIOSSENSORES

# HYBRID LANGMUIR-BLODGETT FILMS OF 1,2-DIPALMITOYL-SN-GLYCERO-3-PHOSPHOTHIOETHANOL AS A PLATFORM FOR ENZYMATIC BIOSENSORS

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This doctoral project proposes the development of a novel enzymatic biosensor platform based on hybrid Langmuir-Blodgett (LB) films. The system utilizes the lipid DPPTE (1,2-dipalmitoyl-sn-glycero-3-phosphothioethanol) as a structured matrix, combined with octadecylamine-functionalized carbon nanotubes (CNT-ODA) to enhance electron transfer and analytical signal, as demonstrated in nanocomposite systems for biosensing (Kumar et al., 2019). The films will be transferred onto solid supports, including low-cost electrodes fabricated from gold leaf, which offer a cost-effective and high-performance alternative to commercial electrodes (Santos et al., 2018), as well as traditional ITO substrates. The incorporation of enzymes, primarily oxidoreductases, will be achieved via adsorption from saline subphases (salting-out effect) directly into pre-formed Langmuir monolayers of DPPTE. A comprehensive interfacial and morphological characterization will be conducted. Langmuir monolayers will be studied using surface pressure-area and surface potential-area isotherms, Brewster angle microscopy, and polarization-modulation infrared reflection-absorption spectroscopy (PM-IRRAS). The transferred LB films will be analyzed via quartz crystal microbalance nanogravimetry, UV-vis and fluorescence spectroscopy, and atomic force microscopy to confirm deposition efficiency,

molecular organization, and enzyme incorporation. The core of the project involves evaluating the biosensing capability of these architectures. The catalytic activity of the immobilized enzymes will be assessed using electrochemical techniques such as cyclic voltammetry, with a focus on sensitivity, detection limit, and operational stability. The unique combination of DPPTE—a thiolipid capable of chemisorption to metal electrodes—with the LB technique aims to create a more fluid and controllable film compared to self-assembled monolayers (SAMs), potentially preventing excessive packing that hinders electron transfer. This research seeks to establish a robust and tunable platform for enzyme immobilization, contributing to advancements in bioelectronics and nanobiotechnology for the detection of biomolecules in complex matrices.

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References:

Kumar, A. et al. (2019). SiO2 microparticles with carbon nanotube-derived mesopores as an efficient support for enzyme immobilization. Chemical Engineering Journal, 359, 1252–1264.

Santos, M. S. F. et al. (2018). Gold leaf: From gilding to the fabrication of disposable, wearable and low-cost electrodes. Talanta, 179, 507–511.

Palavras-chave: langmuir-blodgett films; enzymatic biosensors; dppte; carbon nanotubes; low-cost electrodes; nanobiotechnology.