PÔSTER - RESUMO - SENSORES E BIOSSENSORES

TUNABLE LANGMUIR–BLODGETT ARCHITECTURES FOR IMMOBILIZATION OF ENZYME HYBRID NANOFLOWERS

Cléber Gomes De Jesus (cjesus11@unifesp.br)

Kevin Figueiredo Dos Santos (kevin.santos@unifesp.br)

Luciano Caseli (lcaseli@unifesp.br)

Laura Péres (laura.peres@unifesp.br)

The catalytic properties of enzymes have been extensively exploited in biosensing and biocatalysis applications [1]. Over the past decade, enzyme hybrid nanoflowers (EHNs), which integrate enzymatic activity with metallic nanoparticles, have emerged as promising catalytic platforms due to their hierarchical porous architecture and high surface area, often resulting in enhanced catalytic efficiency and optoelectronic properties [2]. Despite these advantages, the use of EHNs remains largely restricted to aqueous dispersions, which can limit their integration into solid-state optoelectronic devices. In this work, urease/copper EHNs were successfully immobilized onto conjugated polymer Langmuir–Blodgett (LB) films. A fluorene/phenylene-based conjugated polymer was combined with EHNs using lipid-assisted monolayers composed of either dimyristoyl phosphatidic acid (DMPA) or dioctadecyldimethylammonium bromide (DODAB), enabling stable monolayer formation and efficient transfer onto solid substrates. Surface pressure–area isotherms revealed expansion and contraction effects for the DMPA- and DODAB-based systems, respectively, indicating distinct interaction mechanisms between the EHNs and the lipid polar

headgroups. Quartz crystal microbalance measurements showed a higher mass transfer for DMPA-based films, suggesting increased EHN incorporation. Catalytic assays yielded a Michaelis–Menten (Km) constant of 7.96 mM for the DMPA-containing system, compared to 3.24 mM for the DODAB-based 7-layers film. Although the DMPA system exhibited a higher Km, it presented a superior catalytic rate, which can be attributed to the higher EHN loading within the film. Furthermore, desorption studies analyzed using the Avrami model revealed a greater mass loss for the DODAB-based system, indicating stronger EHN–film interactions in the DMPA-containing architecture. Overall, these results demonstrate the feasibility of immobilizing EHNs onto solid supports while preserving enzymatic activity, highlighting Langmuir–Blodgett films as versatile and tunable matrices for the development of hybrid catalytic and biosensing devices.

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References:

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Palavras-chave: enzyme; nanoflowers; langmuir-blodgett; conjugated polymer.