PÔSTER - RESUMO - SENSORES E BIOSSENSORES

SILSESQUIOXANE-STABILIZED AUNPS FOR MIRNA ELECTROCHEMICAL DETECTION

Amanda Loos Vargas Zinser (amandaloosv@yahoo.com.br)

Ariane Caroline Ribicki (arianeribiki@gmail.com)

João Paulo Winiarski (joneswnk@gmail.com)

Christiana A Pessôa (capessoa@uepg.br)

Karen Wohnrath (karen.woh@uepg.br)

Among noninvasive biomarkers, miRNAs show a promising potential. They are found in circulatory biofluids, such as blood and saliva, and their diagnostic properties have been highlighted in several studies. Although all the mechanisms underlying neurodegenerative diseases (NDs) remains unclear, deregulated expression of miRNAs has been observed in several NDs, including Alzheimer's Disease (AD) [1]. The use of electrochemical devices for detecting potential biomarkers associated with NDs is promising regarding response time and sensitivity of the technique. Due to their characteristics, such as high conductivity, biocompatibility and electrocatalytic properties, AuNPs have been widely employed in electrochemical biosensing systems. Furthermore, the high affinity between sulfur-containing functional groups in biomolecules and gold allows the fabrication of stable biosensors [2]. Additionally, silsesquioxane-based polyelectrolytes have demonstrated potential as efficient capping agents for AuNPs synthesis [3]. In the present study, we propose a construction of an electrochemical biosensor employing AuNPs

stabilized by 3-n-propyl(4-dimethylaminopyridinium) silsesquioxane chloride (named here as SiDMAPy+Cl-) for the detection of miRNA-29a, a potential biomarker for early diagnosis of neurodegenerative diseases, such as AD. The obtained nanohybrid, AuNPs-SiDMAPy+Cl- was applied in a glassy carbon electrode (GCE) for the detection of miRNA-29a. The synthesis of the SiDMAPy?Cl? was carried out from the organo-functionalization of the xerogel with 4-DMAP, adapting the procedure reported by Winiarski et al. (2020) [4], and the synthesis of the nanohybrid was performed based the preparation of AuNPs stabilized in similar silsesquioxanes [5]. The SiDMAPy+Cl- demonstrated high solubility and it was characterized using RMN, FTIR and UV-Vis. The formation of AuNPs was confirmed by UV-Vis and morphological characterization was performed by FEG/SEM. The characterization steps for the construction of the biosensor were performed using square wave voltammetry and electrochemical impedance spectroscopy. The nanohybrid was applied onto the GCE surface, followed by the immobilization of the anti-miRNA-29a thiolated probe and subsequently by the miRNA-29a target. It was observed that the nanohybrid significantly enhanced the electrochemical response and charge transfer processes, also proving to be effective in immobilizing the anti-miRNA-29a and its respective target.

Acknowledgments: To the organizing committee of this Workshop, to INEO (Proc. nº 2025/27044-5 and 408449/2024-1), Capes, CNPq, Fundação Araucária, GDEM and CLabMu from UEPG.

[1] C. A. Juzwik, S. S. Drake, Y. Zhang, N. Paradis-Isler, A. Sylvester, A. Amar-Zifkin, C. Douglas, B. Morquette, C. S. Moore, A. E. Fournier. microRNA dysregulation in neurodegenerative diseases: A systematic review. Prog. Neurobiol. 182 (2019) 101664.

[2] Hua, Z., Yu, T., Liu, D., & Xianyu, Y. Recent advances in gold nanoparticles-based biosensors for food safety detection. Biosensors and Bioelectronics, v. 179, p. 113076, 2021.

[3] M. Steinmetz, D. Lima, A. G. Viana, S. T. Fujiwara, C. A. Pessôa, R. M. Etto, K. Wohnrath. A sensitive label-free impedimetric DNA biosensor based on silsesquioxane functionalized gold nanoparticles for Zika Virus detection. Biosens. Bioelectron. 141 (2019) 111351.

[4] J. P. Winiarski, M. R. de Barros, G. S. Wecker, G. R. Nagurniak, R. L. T. Parreira, R. F. Affeldt, R. A. Peralta, C. L. Jost. A novel hybrid organic–inorganic silsesquioxane and cobalt(II) tetrasulphophthalocyanine material as an efficient electrochemical sensor for the simultaneous determination of the anti-hypertensive nifedipine and its metabolite. J. Mater. Chem. C. 8 (2020) 6839-6850.

[5] D. Lima, A. Ribicki, L. Gonçalves, A. C. M. Hacke, L. C. Lopes, R. P. Pereira, K. Wohnrath, S. T. Fujiwara, C. A. Pessôa. Nanoconjugates based on a novel organic-inorganic hybrid silsesquioxane and gold nanoparticles as hemocompatible nanomaterials for promising biosensing applications. Colloids Surf. B: Biointerfaces 213 (2022) 112355.

Palavras-chave: electrochemical biosensor; microrna; gold nanoparticles.