Analyzing the in situ generation of H_2O_2 for the degradation of caffeine in aqueous medium

Heloisa Nicoletti[1*], Raul J. A. Felisardo[1], Marcos R. V. Lanza[1]

[1] Institute of Chemistry of São Carlos (IQSC), University of São Paulo (USP)

**e-mail: heloisa.nicoletti@usp.br*

This study aims to synthesize gas diffusion electrodes (GDEs) based on Printex-L6 carbon for the in situ electrochemical generation of hydrogen peroxide (H_2O_2), applied to the degradation of caffeine in aqueous medium, and to present an analysis of the optimal parameters for H_2O_2 production. GDEs containing Printex-L6 carbon were synthesized following the standard method established by the research group [1], and H_2O_2 generation was evaluated under different pH conditions and current densities for 90 minutes, using UV-Vis spectrophotometry for quantification. Based on the results obtained, the best condition was selected by evaluating energy consumption and H_2O_2 production. Caffeine degradation was investigated in potassium sulfate (K_2SO_4) solution using UV-Vis spectrophotometry for H_2O_2 quantification and High-Performance Liquid Chromatography (HPLC) for monitoring the degradation process. The results indicate higher H_2O_2 generation in aqueous solutions at elevated pH values and current densities. Thus, the applied parameters proved effective for degrading the emerging contaminant in aqueous medium, achieving partial mineralization of caffeine within the studied time frame. These findings highlight the potential of electrochemical degradation of recalcitrant compounds through advanced oxidation processes.

Acknowledgments: This study was financed, in part, by the São Paulo Research Foundation (FAPESP), Brazil (Process Number #2022/12895-1, #2023/13260-2) and the Brazilian National Council for Scientific and Technological Development – CNPq (grant #127507/2024-8).

References: [1] Souto, R.S., Souza, L.P., Cordeiro Junior, P.J.M., Ramos, B., Teixeira, A.C.S.C., Rocha, R.S., Lanza, M.R. V, 62, Ind. Eng. Chem. Res. (2023).