76th Annual Meeting

of the International Society of Electrochemistry

7 - 12 September 2025

Mainz, Germany

PROGRAM

https://annual76.ise-online.org

e-mail: events@ise-online.org

UVC/e-H_2O_2 technology using gas diffusion electrodes with low La loadings on Printex L6 for the removal of emerging contaminants

F. Escalona-Durán[a,b], C.H.M. Fernandes[a], W.R.P. Barros[c], M.A.R Rodrigo[b], M.R.V. Lanza[a]

[a]São Carlos Institute of Chemistry, University of São Paulo, Avenida João Dagnone, 1100 – Jardim Santa Angelina, São Carlos/SP, 13563-120, Brazil.
[b]Chemical Engineering Department, Faculty of Chemical Sciences and Technology, University of Castilla - La Mancha, Ciudad Real 13071, Spain.
[c]Federal University of Grande Dourados, Rodovia Dourados-Itahum, Km 12, Dourados /MS, 79804-970, Brazil.

florymarduran@usp.br

This study explored the application of UVC combined with electrogenerated hydrogen peroxide (UVC/e-H_2O_2) for the degradation of benzotriazole (BTA) at pH 6, using Printex L6 (PL6C) carbon-based gas diffusion electrodes (GDEs) modified with trace amounts of lanthanum oxide, La_2O_3 (1.0–10.0% La/PL6C). Oxygen reduction reaction (ORR) studies using the rotating disk electrode technique identified 5% La/PL6C as the optimal condition for H_2O_2 electro-generation. Both modified and unmodified GDEs were tested in a non-divided cell to evaluate H_2O_2 production at different current densities (10, 20, and 30 mA cm^{-2}), with 0.05 mol L^{-1} K_2SO_4 as the supporting electrolyte.

The degradation of 10 mg L^{-1} of BTA at a current density of 30 mA cm^{-2} was analyzed using different processes: anodic oxidation (AO), e-H_2O_2, only UVC, UVC/AO and, UVC/e-H_2O_2. The UVC/e-H_2O_2 process achieved 98.2% removal of BTA in 15 minutes of electrolysis, while mineralization rates reached 62.9% after 1 hour of treatment. The UVC/e-H_2O_2 process was also applied to assess BTA removal in a river water sample, monitoring contaminant mineralization under exhaustive treatment, which reached 83.3% after 5 hours.

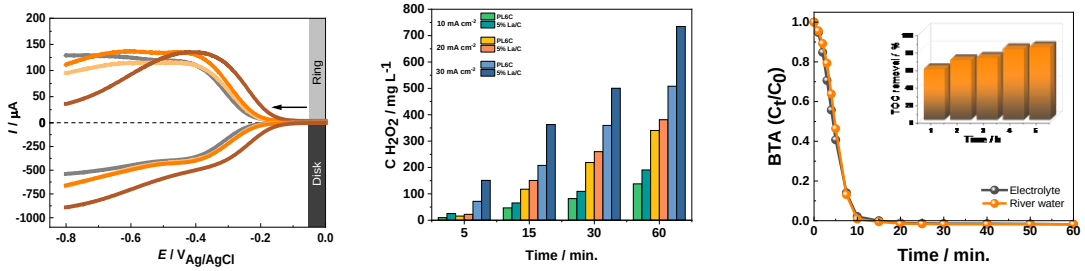

Figure 1. (A) LSV curves for the ORR at 1.0 – 10.0% content of La/PL6C in a 0.05 M K_2SO_4 solution, saturated with $O_{2(g)}$. Electrode rotation speed: 900 rpm. **(B)** Concentration of H_2O_2 electrogenerated as a function of the applied current density. **(C)** BTA degradation by AO, e-H_2O_2, only UVC, UVC/AO and, UVC/e-H_2O_2 process at 30 mA cm^{-2}.

The low percentages of La_2O_3 used to modify the PL6C-GDEs demonstrated outstanding performance in both H_2O_2 electro-generation and the degradation of emerging contaminants, confirming its effectiveness for water treatment applications [1,2].

Acknowledgments

This study was financed by the São Paulo Research Foundation (FAPESP) - Brazil, grants: #2018/22211-7, #2018/22210-0, #2018/22022-0, #2019/06650-3, #2024/06300-0, #2023/05895-8, #2023/06558-5 and #2022/12895-1) and by the National Council for Scientific and Technological Development (CNPq), grant #303943/2021-1.

References

[1] J. Wang, C. Li, M. Rauf, H. Luo, X. Sun, Y. Jiang,. Sci. Total Environ. 759 (2021) 143459.
[2] J. Xie, J. Jing, J. Gu, J. Guo, Y. Li, M. Zhou,. J. Environ. Chem. Eng. 10 (2022) 107882.