# EAAOP 7

## The 7th International Conference on Environmental Applications of Advanced Oxidation Processes

## PROGRAMME BOOKLET

**10th-13th June, 2025**
**Paestum (SA), Italy**

# ACTIVATED CARBON FROM SUGARCANE BAGASSE: *IN SITU* $H_2O_2$ GENERATION FOR ANXIOLYTIC DECONTAMINATION (Poster)

C.H.M. Fernandes[1]*, F.E.Durán[1], R.J.A. Felisardo,
J.C. Lourenço[2], R.S. Rocha[2], M.R.V. Lanza[1]

[1]*São Carlos Institute of Chemistry, University of São Paulo, 13563-120, São Carlos, Brazil.*
[2]*Lorena School of Engineering - University of São Paulo, 12602-810 Lorena, São Paulo, Brazil*

The contamination of natural aquatic systems by synthetic organic pollutants has emerged as a critical environmental challenge in the 21st century. This growing concern is fueled by the increasing scarcity of freshwater resources and the expanding urban population, which exacerbate the vulnerability of water systems to pollution (Munkittrick et al, 2023). Research on the identification, detection and remediation of contamination of surface and groundwater with so-called pollutants of emerging concern has been extensive worldwide, with significant efforts in Europe, Asia and North America (Miguel et al, 2024; Lee et al, 2005 & Kajbafvala). The problem is relevant when we consider that conventional effluent treatment processes are incapable of eliminating these pollutants (Subedi et al.11). In this scenario, advanced oxidation processes (AOP) emerge as competitive technologies capable of efficiently degrading and mineralizing these compounds, especially when equipped with gas diffusion electrodes used to electrogenerated hydrogen peroxide ($H_2O_2$) in situ. A major advantage associated with the use of GDE is that the use of carbonaceous materials from renewable and/or low-cost matrices, capable of generating significant amounts of $H_2O_2$, makes the process viable and applicable in different contexts. Therefore, the general objective of this study was to synthesize GDE from activated carbon obtained from sugarcane bagasse (SCB-GDE) to apply it in the treatment of aquatic matrices contaminated with the anxiolytic drug Sertraline (STN).

The activated carbon derived from sugarcane bagasse (SCB) was prepared using a solution with phosphoric acid in the ratio of 1:10 in different concentrations of 0%, 5%, 10%, 20%, and 30% . This solution was kept under magnetic stirring for 72 h and then dried at 150ºC for 3 h. The pyrolysis process was executed at varying temperature from 450ºC to 950ºC, with the application of a ramp rate of 30 °C $min^{-1}$ and retention time of 0 min to 180 min (under pyrolysis). After calcination, the materials were washed with ultra-pure water until neutral pH was obtained and then dried at 150ºC for 30 min and ground to thin powder. After that, the SCB-GDE electrode was prepared following the standard method established by the research group in previous works (Silva *et al*., 2023; Marques Cordeiro-Junior *et al*. 2022).A three-electrode system was used, with

an SCB-GDE as the working electrode, a DSA® electrode as the counter electrode, and an Ag/AgCl (3M KCℓ) electrode as reference. The working volume was 350 mL and $K_2SO_4$ at 0.05 M was used as the supporting electrolyte.

The electrogeneration of $H_2O_2$ was quantified at different current densities (5, 7.5 and 10 mA $cm^{-2}$) using UV-vis spectrophotometry, by the peroxylybdate method. Oxygen gas was injected directly into the SCB-GDE at a flow rate fixed at 40 mL $min^{-1}$. The concentration of STN was monitored by high-performance liquid chromatography (HPLC) of SHIMADZU 20A, equipped with a C-18 Phenomenex® column and a UV detector (λ = 246 nm). The mobile phase was a mixture of acetonitrile-water 75:25:0.1 (V/V/V) at a flow rate of 1.0 $mL.min^{-1}$. The column temperature was maintained at 30 °C. The injection volume was 10 µL. To evaluate the mineralization processes, Total Organic Carbon (TOC) analysis was performed using a Shimadzu TOC-VCPN analyzer.

The results showed that the synthesized SCB-GDE was efficient for the electrogeneration of $H_2O_2$, and at low current densities it was able to generate up to 380 $mg.L^{-1}$ in 10 $mAcm^{-2}$ in 90 min of electrolysis. Under these conditions, this amount of $H_2O_2$ was able to efficiently degrade the anxiolytic STN to 100 $mg.L^{-1}$ in the process assisted by a light source (UVC lamp, NUCHONG 9W). Under specific conditions, high mineralization rates were achieved, requiring low energy costs.

**ACKNOWLEDGMENTS:**

São Paulo State Research Support Foundation - FAPESP (grants #2023/06558-5; #2023/05895-8; #2023/13260-2; #2021/12053-8; #2023/12207-0 and #2022/12895-1).

**REFERENCES**

**[1]** Maricor J. Carlos, Victoria I. Arnold, J. Ruecker, Kelly R. Munkittrick. W. Research. 244 (2023)120454.

**[2]** Miguel A. Sandoval, Jorge Vidal, Enric Brillas, Ricardo Salazar- G. Env. Pollution. 345 (2024)123397.

**[3]** G.Z. Shen, Y. Bando, C.J. Lee. J. Phys. Chem. B 109 (2005)10578–10583.

**[4]** A. Kajbafvala, H. Ghorbani, A. Paravar, J. P. Samberg, E. Kajbafvala,51 (2012) 512–522.

**[5]** R. A. Ismail, A. K. Ali, M. M. Ismail, K. I. Hassoon. Appl Nanosci 1 (2011).