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A novel $FeSe_2$-modified carbon gas diffusion electrode for bifunctional application: in-situ H_2O_2 generation and degradation of venlafaxine under photo-electro-Fenton treatment (Poster)

Fausto Eduardo Bimbi Júnior[1], Robson da Silva Souto[1], Oswaldo Costa Junior[1], Maria Clara Vieira Felipe[1], Larissa Fernandes[1], Isabela Fiori Araujo[1], Igor Gabriel Silva Oliveira[4], Carlos Henrique Magalhães Fernandes[1], Renata Colombo[2], Valmor Roberto Mastelaro[3], Willyam Roger Padilha Barros[4], Marcos Roberto de Vasconcelos Lanza[1]

[1] *São Carlos Instiute of Chemistry, University of São Paulo - USP, Avenida Trabalhador São Carlense 400, São Carlos, SP, 13566-590, Brazil*

[2] [2]*School of Arts, Sciences and Humanities, University of São Paulo - EACH-USP, Rua Arlindo Béttio 1000, São Paulo, SP, 03828-000, Brazil*

[3] São Carlos Institute of Physics, *University of São Paulo - USP, Avenida Trabalhador São Carlense 400, São Carlos, SP, 13566-590, Brazil*

[4] *Faculty of Exact Sciences and Technology, Federal University of Grande Dourados – UFGD, Rodovia Itahum Km 12, Dourados, MS, 79804-970, Brazil*

This work investigates the electrocatalytic activity of a gas diffusion electrode (GDE) composed of Printex L6 carbon (PL6C) modified with iron selenide ($FeSe_2$) nanoparticles (NPs) for application to H_2O_2 electrogeneration and venlafaxine degradation. This PL6C-$FeSe_2$-GDE acts as a heterogeneous photo-electrocatalyst in electrochemical processes to enhance the activity and selectivity of electrogenerated *in situ* of H_2O_2 through the oxygen reduction reaction (ORR) process via 2 electrons-pathway [1]. Electrochemical characterization revealed significant improvements in H_2O_2 production at the PL6C-$FeSe_2$-GDE compared to unmodified PL6C-GDE in both alkaline and acidic media, with 2.0-fold and 3.15-fold increases, respectively. Photoelectrochemical measurements demonstrated a further enhancement in H_2O_2 yield under UV-C radiation in alkaline media, attributed to the narrow bandgap of $FeSe_2$ NPs, which facilitates charge carrier separation and enhances catalytic activity. In acidic media, competitive hydroxyl radical (•OH) formation through the Fenton-like reaction limited H_2O_2 accumulation. The catalytic performance of the PL6C-$FeSe_2$-GDE was evaluated by monitoring the degradation of venlafaxine in different conditions. Complete mineralization of 15 mg L^{-1} venlafaxine was achieved within 180 minutes of electrolysis , demonstrating the high oxidative capacity of the generated reactive oxygen species (ROS). These findings highlight the potential of PL6C-$FeSe_2$-GDE as efficient and versatile platforms for sustainable H_2O_2 production and advanced oxidation processes, with significant implications for green energy conversion and environmental remediation applications.

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