
Sensitive electrochemical detection of carbendazim using a MXene and carbon nanomaterial modified glassy carbon electrode

Ademar Wong^{1*}, Anderson M. Santos², Willyam R. P. Barros³, Marcos R. V. Lanza², Maria D. P.T. Sotomayor¹

¹São Paulo State University (UNESP), ²University of São Paulo (USP), ³Federal University of Grande Dourados (UFGD)

*e-mail: ademar.wong@unesp.br

Carbendazim (CBZ) is a widely used benzimidazole-based fungicide, known for its effectiveness in protecting crops like fruits, vegetables, and cereals. Despite its ban in Europe due to high toxicity, persistence, and bioaccumulation potential, it remains in use elsewhere, posing risks to human and animal health, including testicular damage and infertility at high doses [1,2]. Aiming to monitor this pesticide, an electrochemistry sensor was proposed for the detection of carbendazim utilizing a glassy carbon electrode modified with hydrothermal carbon black and MXene. The electrochemical behavior of CBZ was studied using cyclic voltammetry in a potential range of 0 to 1.2 V. An oxidation peak was observed during the anodic scan at a potential of 0.75 V. Under optimized conditions, the square wave voltammetry technique exhibited a linear concentration range from 5.0×10^{-7} to 3.8×10^{-5} mol L⁻¹ for CBZ, with a detection limit of 3.4×10^{-8} mol L⁻¹. The proposed method was successfully applied to environmental samples at two concentration levels, achieving recoveries close to 100%.

Acknowledgments:

The authors gratefully acknowledge the financial support granted by CNPq (Proc. 102213/2024-0 and 405916/2023-0) and FAPESP (Proc. 2022/12895-1).

References:

- [1] Zhou et al., *New Journal of Chemistry*, 43 (2019) 14009–14019.
- [2] Singh et al., *Environmental Chemistry Letters*, 14 (2016) 317–329.