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A Química Age e Reage!

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Innovative approaches to monitoring emerging pollutants using screen-printed electrodes based catalytic modifiers

Ademar Wong (PQ)[1*], Anderson M. Santos (PQ)[2], Maria H. A. Feitosa (PQ)[3], Fernando C. Moraes (PQ)[3], Marcos Lanza Vasconcellos (PQ)[2] and Maria D.P.T. Sotomayor (PQ)[1]

ademar.wong@unesp.br

[1]São Paulo State University (UNESP), Institute of Chemistry, 14801-970, Araraquara, SP, [2]São Carlos Institute of Chemistry, University of São Paulo (USP), 13566-590, São Carlos, SP; [3]Department of Chemistry, Federal University of São Carlos (UFSCar), 13560-970, São Carlos, SP, Brazil

Palavras Chave: Screen-printed electrode, acid red, carbaryl, MXene, carbon nanowire, emerging pollutants.

Highlights

- ✓ Screen-printed disposable electrodes based on MXene and carbon nanowires.
- ✓ A cost-effective and simple analytical method for the simultaneous detection of emerging pollutants.

Resumo/Abstract

Emerging pollutants (EP) are a diverse group of chemical and biological agents whose effects are causing growing concern due to the inability of traditional wastewater treatment plants to remove them, as well as the wide diversity of chemical structures present (pharmaceuticals, pesticides, heavy metals, dyes, among others)[1]. The effects of EP on human health are related to genotoxicity and cytotoxicity, causing obesity, diabetes, cardiovascular and reproductive disorders, and cancer. Several analysis methods have been found in the literature, and among them, electrochemical sensors based on discarded electrodes have shown excellent results in the analysis of analyses of interest[2]. Screen-printed disposable electrodes based carbon ink modified with MXene and carbon nanowires were used as a cost-effective and simple analytical method for the simultaneous detection of acid red and carbaryl in environmental samples. The electrochemical properties of the analytes were examined using cyclic voltammetry with a potential range of 0 to 1.2 V and a scan rate of 0.05 V s^{-1}, using a 0.1 mol L^{-1} phosphate buffer solution (pH 7.0) as the supporting electrolyte. During the anodic potential scan, two oxidation peaks appeared at potentials of 0.6 V and 1.0 V. Under optimized square wave voltammetry conditions, the screen-printed sensor produced an analytical curve with a linear concentration range of 6.2×10^{-7} to 7.2×10^{-6} mol L^{-1} for acid red and 5.6×10^{-6} to 3.9×10^{-5} mol L^{-1} for carbaryl. The detection limits of acid red and carbaryl were determined to be 9.5×10^{-8} and 9.0×10^{-7} mol L^{-1}, respectively. The screen-printed sensor proved to be highly selective, sensitive, stable, reproducible, and repeatable, while also being cost-effective and free from interference in the experiments. The proposed sensor successfully performed in environmental sample analysis, achieving recovery rates close to 100%.

References

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