Electrochemical determination of pesticides using Ni-rGO printed sensors

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This study presents the development and optimization of laser-scribed reduced graphene oxide (rGO)[1] and nickel-functionalized rGO (rGO@Ni) electrodes for the electrochemical detection of imidacloprid, a widely used neonicotinoid pesticide[2]. Differential pulse voltammetry (DPV) was employed in phosphate-buffered saline (PBS, pH 7) to evaluate sensor performance. Key fabrication parameters, including laser engraving speed, power settings, and pressing force, were systematically optimized to improve electrode sensitivity and reproducibility. Preliminary studies suggest that the rGO@Ni electrodes exhibit significantly enhanced analytical performance, achieving a sensitivity of 0.74 µA/ppm, a linear detection range of 1–10 ppm, and a low detection limit (LoD) of 0.33 ppm. In comparison, unmodified rGO electrodes showed lower sensitivity and a higher LoD. Although the rGO@Ni sensors had a narrower linear range, their improved sensitivity and lower detection limits make them more suitable for trace-level detection. However, some electrode degradation was observed after multiple uses, likely due to the use of identical materials for all electrode components. Additionally, preliminary results indicate that rGO@Ni electrodes may also be effective in detecting other pesticides, such as paraquat and thiamethoxam, and in mitigating interference effects, highlighting their potential for broader applications in pesticide monitoring. Future research will aim to further enhance the electrodes' stability, sensitivity, and selectivity.

References

[1] A. Scroccarello, et al., ACS Sens. (2023), 8, 598−609.
[2] D. Bahamon-Pinzon, *et al.*, *Microchim Acta.* (2022), 189, 254.