ELECTROCHEMICAL SENSORS BASED ON REDUCED GRAPHENE OXIDE (R-GO) FOR ENVIRONMENTAL MONITORING

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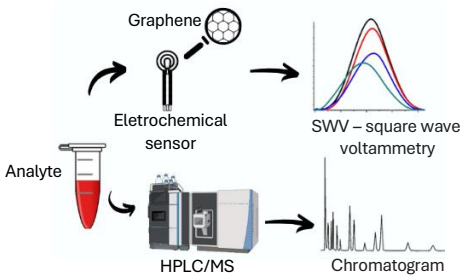
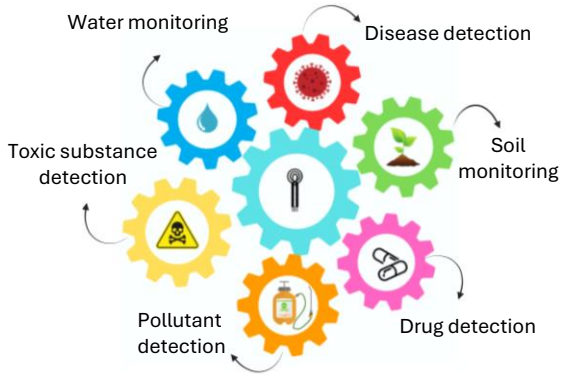
ABSTRACT

This study focuses on the development of electrochemical sensors that are simple, efficient, sustainable, and cost-effective for detecting environmental pollutants. Enhanced with graphene and its derivatives, these sensors offer superior sensitivity, conductivity, and mechanical resistance. The fabrication process employs screen-printing technology, aligning with the principles of waste minimization and resource efficiency while enabling scalable production. Furthermore, the sensors support real-time monitoring, facilitating on-site detection and rapid response to contamination, which aligns with the principle of pollution prevention by addressing issues at the source. Finally, the sensors' performance is validated through a comparison with the LC-MS technique, ensuring accuracy and reliability.

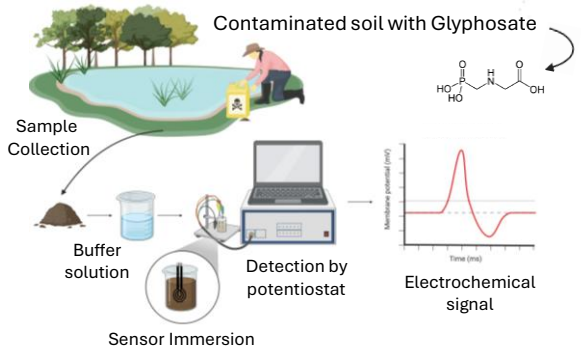


APPLICATIONS

Electrochemical biosensors represent a promising alternative to meet the demand for rapid, real-time monitoring environmental contamination.



EXAMPLE



The sensor interacts with the sample for a few minutes, measuring the electrochemical signal in real time, making it possible to identify and determine the concentration of pollutants.

ADVANTAGES

- **High Sensitivity:** Graphene has excellent electrical conductivity properties, increasing the sensitivity of biosensors to detect analytes at very low concentrations, in addition to the low production cost making them accessible.
- **Real time monitoring:** Sensors can be fabricated in flexible and portable formats, facilitating field applications.

CHALLENGES

- **Lack of Standardization:** Manufacturing protocols are not yet widely standardized, which can hinder the comparability of results.
- **Detection Interferences:** The presence of similar compounds in the environment can cause interferences in electrochemical signals.

GREEN CHEMISTRY PRINCIPLES

Graphene-based biosensors promote **waste prevention**, enable **real-time analysis for effective pollution prevention**, and improve **energy efficiency** through sustainable and simplified production methods aligned with green chemistry.

METHODOLOGY AND INNOVATIONS

- The methodology focuses on optimizing the carbon electrode by exploring two approaches: r-GO electrodeposition and conductive ink modification. The original ink is formulated with 48% graphite powder and 52% enamel and it is modified by incorporating reduced graphene oxide (r-GO).
- The modified electrodes are characterized using techniques such as **Scanning Electron Microscopy (SEM)** and **X-ray diffraction (XRD).**
- The innovative aspect of this study lies in comparing the r-GO-modified biosensor's performance with the gold standard technique, LC-MS, to validate the efficiency of the sensor.

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