ELECTROCHEMICAL PROPERTIES OF Au/MWCNT NANOCOMPOSITES FOR SUSTAINABLE SENSING APPLICATION

Aanuoluwa Eunice Adegbola[1,2], Omolola Esther Fayemi[1,2]

[1]Material Science Innovation and Modelling (MaSIM), Research Focus Area, Faculty of Natural and Agricultural Sciences, South Africa

[2]Department of Chemistry, Faculty of Natural and Agricultural Sciences, North-West University, Private Bag

Commonwealth Chemistry Posters – Building the Partnership

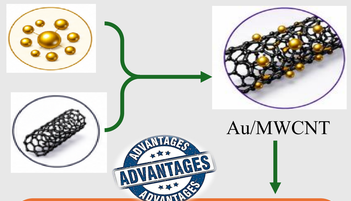
Bridging Chemistry Across the Commonwealth to Tackle the SDGs

INTRODUCTION

Electrochemical sensors have application in environmental monitoring, food safety, and biomedical diagnostics due to their sensitivity, rapid response, and low cost. Developing sustainable and high-performance sensing materials remains an important research focus.

Gold nanoparticles (AuNPs): A noble metal nanomaterial, with excellent electrical conductivity, catalytic activity, and biocompatibility[3]. AuNPs can be synthesised through environmentally friendly routes using *Allium cepa* (onion) extracts[1,2].

Multi-walled carbon nanotubes (MWCNTs): Carbon nanostructures composed of concentric graphene layers of sp^2-hybridized carbon, exhibiting high conductivity, chemical stability, and efficient electron-transfer properties[4]

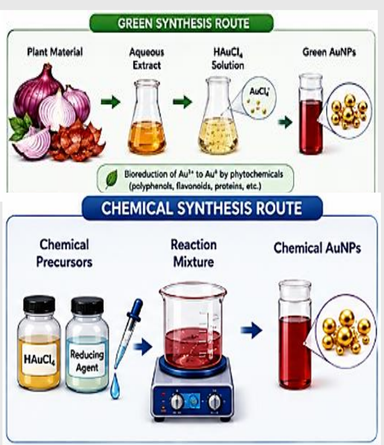


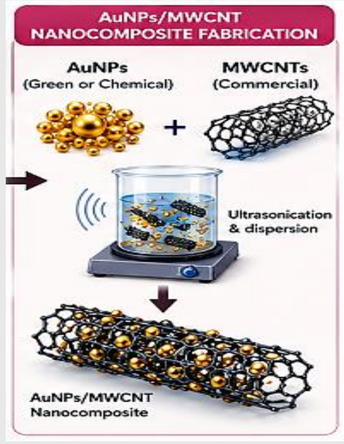
- ❑ Effective synergism and stability
- ❑ High electrocatalytic properties
- ❑ High specific surface area
- ❑ High conductivity and antifouling potential

In electrochemical sensing, combining AuNPs with MWCNTs creates synergistic platform that enhances electron transfer, increase electroactive surface area[4,5], and improve sensing performance making, Au/MWCNT nanocomposites promising materials for sustainable sensor development[6].

The study aims to investigate the electrochemical performance of the synthesised nanoparticles and nanocomposites for sustainable sensing applications

STUDY WORKFLOW

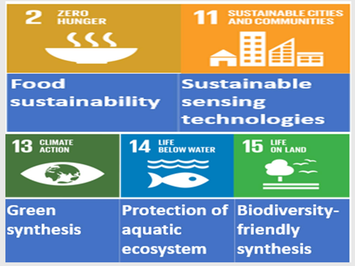




CHARACTERIZATION

- ❑ ELECTROCHEMICAL
- ❑ SPECTROSCOPIC
- ❑ MORPHOLOGICAL

TARGETED SDGs



RESULTS

1. Physicochemical Characterization of Au/MWCNT Nanocomposites

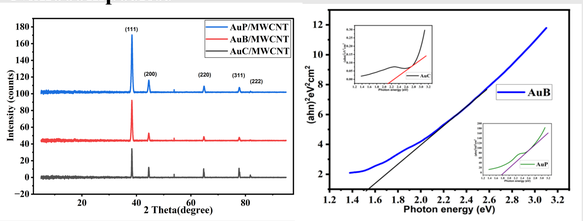


Figure 1: XRD (A) and Tauc plot from UV (B)

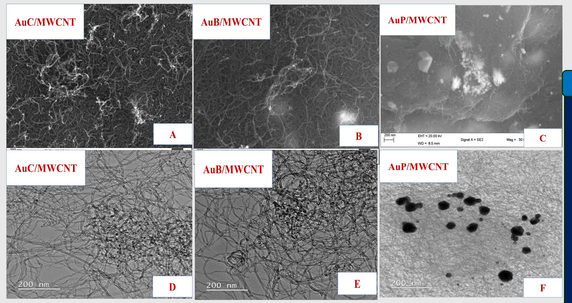


Figure 2. Morphological characterization of AuNP/MWCNT nanocomposites: SEM images (A–C), TEM images (D–F)

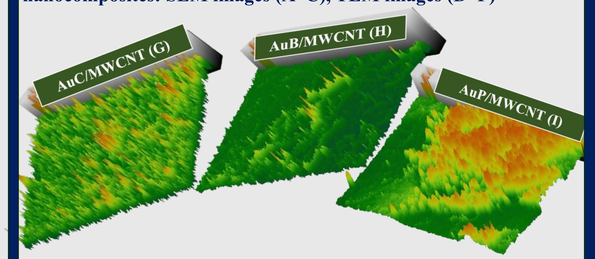


Figure 3. 3D Surface Topography of AuNP/MWCNT nanocomposites(SEM Images)

NB:
AuB: AuP from onion bulb
AuC: AuP: AuC by chemical synthesis
AuP: AuP from onion peel

2. Electrochemical Characterization of Au/MWCNT Nanocomposites

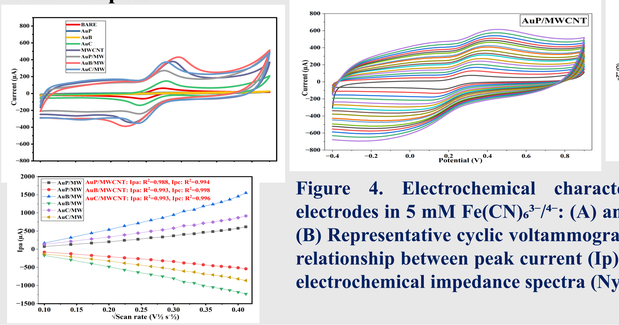
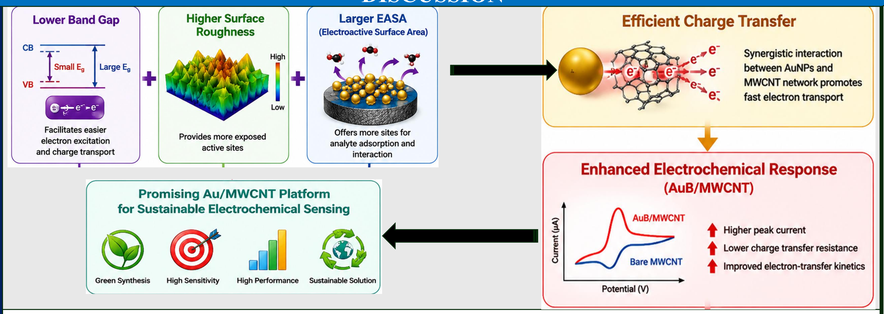


Figure 4. Electrochemical characterization of the modified electrodes in 5 mM $Fe(CN)_6^{3-/4-}$: (A) anodic peak current responses, (B) Representative cyclic voltammograms at varying scan rates, (C) relationship between peak current (Ip) and √scan rate (√v), and (D) electrochemical impedance spectra (Nyquist plots).

DISCUSSION



CONCLUSION

AuNP/MWCNT nanocomposites exhibited enhanced electron transfer and increased electroactive surface area compared to AuNPs alone. These findings demonstrate their potential as sustainable electrode materials for future electrochemical sensing applications.

FUTURE WORK

Develop AuNP/MWCNT-based sensors for monitoring food quality, environmental pollutants, and biologically relevant analytes, supporting sustainable agriculture, environmental protection, and public health initiatives.

SELECTED REFERENCES

1. Pattnayak, S., Choudhury, S., & Hota, G. (2025). Green chemistry mediated and biogenic synthesis of gold nanoparticles: Prospects and challenges. *Gold Nanoparticles, Nanomaterials and Nanocomposites*, 81-111.
2. Adegbola, A. E., Abolarinwa, T. O., & Fayemi, O. E. (2026). Green-mediated gold nanoparticles from Allium cepa: Synthesis, characterization and antimicrobial properties. *Biotechnology Notes*, 7, 44-57.

ACKNOWLEDGEMENT

The authors acknowledge the North-West University, FNAS and MaSIM, for their financial support.