

Green Synthesis of Copper Oxide Nanoparticles and its Efficiency in Degradation of Rifampicin Antibiotic

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Abstract

- ❖ Copper Oxide Nanoparticles (CuO NPs) successfully synthesized using aqueous extracts of *Parthenium hysterophorus* plant
- ❖ CuO NPs showed to be promising in degradation of rifampicin antibiotic
- ❖ Hence green approach to reduce water pollution from active pharmaceutical ingredients such as antibiotics

Introduction

- ❖ 26% of worlds population lack access to safe drinking water
- ❖ Water scarcity affecting about 3 billion people globally
- ❖ Water pollution from Active Pharmaceutical Ingredients (APIs) continues to rise
- ❖ Antimicrobial resistance from these antibiotics, threatens human health
- ❖ Limitations of conventional wastewater treatment plants in removing these pollutants
- ❖ Nanoparticles attractive in removing the pollutants
- ❖ Cost effective, energy efficient, simple and environmentally friendly synthesis of CuO NPs using *Parthenium hysterophorus* plant for antibiotic removal from water systems

Methodology

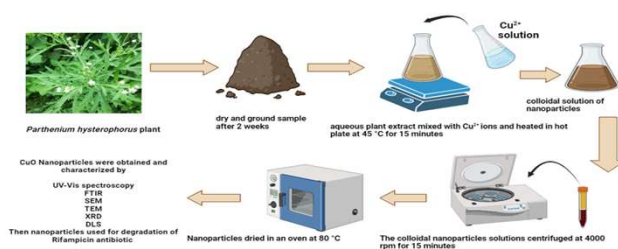


Figure 1. Schematic diagram for green synthesis of CuO NPs to characterization

Results

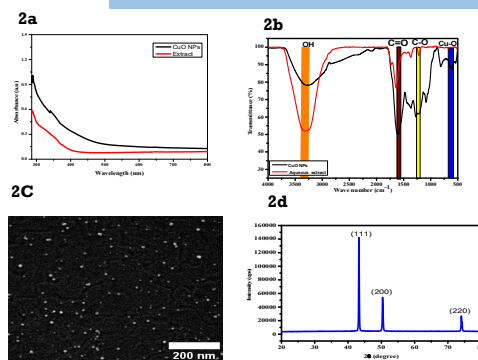


Figure 2. (2a) UV-Vis spectra of extract and CuO NPs, (2b) IR spectra of extract and CuO NPs, (2c) SEM micrograph of CuO NPs, (2d) XRD pattern of CuO NPs

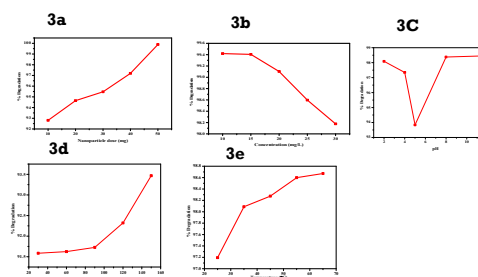


Figure 3. (3a) effect on CuO NPs dose, (3b) effect of Rifampicin concentration, (3c) effect of pH, (3d) effect of time, (3e) effect of temperature

- ❖ UV-Vis analysis showed SPR peak associated with CuO NPs at 337 nm
- ❖ Cu-O characteristic peak in IR observed at 522 cm⁻¹
- ❖ SEM micrograph revealed that CUO NPs were spherical in shape with average particle size of 59.99 nm
- ❖ XRD pattern showed that CuO NPs had monoclinic crystalline structure with crystallite size calculated to be 31.58 nm

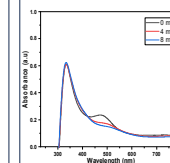


Figure 4. Showing degradation of rifampicin at optimal conditions

Kinetics of Degradation

Degradation of rifampicin experimentally fitted pseudo-second-kinetic model

Conclusion

- ❖ In this study, we demonstrated a successful synthesis of CuO NPs using aqueous extracts of *Parthenium hysterophorus* plant
- ❖ Highest degradation efficiency (>98%) of rifampicin antibiotic was observed using 50 mg CuO NPs, 10 mg/L rifampicin, pH 2, at 65 °C within 8 minutes
- ❖ Therefore, green prepared CuO NPs are promising in removing antibiotics from water systems, increasing water safety.

Acknowledgments

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Reference

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