

Synthesis, Characterization and Application of *Azadirachta Indica* Based Silver and Zinc Oxide Nanoparticles Against Drug-Resistant Bacteria

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INTRODUCTION

Infectious diseases are a leading cause of global deaths, further complicated by the rise of drug-resistant microbial strains due to antibiotic misuse or mutations¹. Over the years, researchers have been in the race to come up with alternative antimicrobial drugs to curb these ever-changing strains. However, alternative methods of managing infections from these drug-resistant strains remain very limited. Results from numerous trials have indicated that nanotechnology provides a better alternative and greater potential antimicrobial agents¹.

EXPERIMENTAL

Azadirachta indica (neem leaves plant) a medicinal plant known for its broad range of phytochemicals, is being studied for its antimicrobial properties when combined with nanoparticles². Its phytochemicals can both reduce and stabilize nanoparticles, making it a strong candidate for this purpose. The project aims to investigate the effectiveness of *Azadirachta indica* synthesized silver nanoparticles (Ag NPs) and zinc oxide nanoparticles (ZnO NPs) against selected strains drug-resistant bacteria^{3,4}. Extraction of the bioactive compounds was done through maceration using methanol as a solvent followed by column separation for purification of the neem leaf extract⁴. The NPs were synthesized using these neem extracts.

RESULTS AND DISCUSSION

The Ag NPs and ZnO NPs were characterized using XRD, ICP-MS, FTIR, SEM, TEM, and UV-VIS spectroscopy^{2,3,4}. Figure 1 (a) and (b) compare the size, shape and crystallinity of ZnO NPs synthesized at different times where the crystallinity reduced with the size while (c) shows the size of Ag NPs prepared at 20 mins. The efficacy of these NPs as potential antimicrobial agents is being evaluated in the laboratory using the agar disk diffusion method to evaluate the minimum inhibitory concentrations against drug-resistant microbes^{5,6}. The results of this study will provide valuable insight into possible alternative methods of managing microbial infections.

CONCLUSION

The study demonstrates the potential of using nanoparticles, specifically silver and zinc oxide, synthesized from *Azadirachta indica* (neem leaves), as effective agents against drug-resistant bacterial strains. While further research is needed to fully understand their effectiveness and applications, these findings offer valuable insights into nanotechnology's potential as a powerful tool in combating microbial infections.

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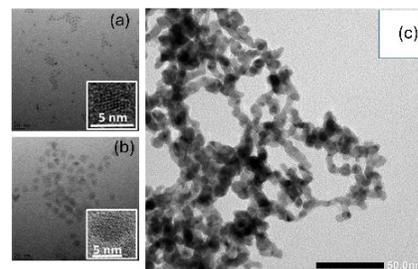


Figure 1: TEM images of (a) ZnO NPs after 3 min of the reaction and (b) after 20 min of the reaction. (c) Ag NPs after 20 min.