Review of: "Synthesis of Nickel Nanoparticles Using Ionic Liquid-Based Extract from Amaranthus viridis and Their Antibacterial Activity"

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Potential competing interests: No potential competing interests to declare.

The manuscript presents a study on the green synthesis of nickel nanoparticles (Ni NPs) using an extract from *Amaranthus viridis* and its evaluation for antibacterial activity. The work aims to contribute to the field of nanomaterial synthesis with a focus on environmentally friendly methods, using ionic liquids and microwave assistance to reduce energy consumption and improve efficiency. The antibacterial potential of the synthesized Ni NPs is tested against three bacterial strains.

Novelty and Green Synthesis Approach: The use of *Amaranthus viridis* extract as a natural source for synthesizing Ni NPs via ionic liquids and microwave assistance is innovative and aligns with green chemistry principles.

Comprehensive Characterization: The study employs a variety of advanced techniques for nanoparticle characterization, including UV-Vis, FTIR, XRD, FESEM, and DLS, which ensures that the synthesized nanoparticles are thoroughly examined in terms of size, morphology, and stability.

Antibacterial Activity: The manuscript provides valuable insights into the antibacterial properties of the synthesized Ni NPs, which are relevant in addressing the growing issue of bacterial resistance.

Use of Ionic Liquids: Ionic liquids as a medium for extraction and nanoparticle synthesis are presented as an efficient and environmentally friendly alternative to conventional solvents.

Major Concerns

Lack of Detailed Mechanistic Insight The paper could benefit from a deeper exploration of the specific mechanisms through which the Ni NPs exert antibacterial effects. The role of the ionic liquid in influencing the nanoparticle properties, and hence their antibacterial activity, should be better explained.

Antibacterial Assay Details: The description of the antibacterial assay lacks some details. The concentration of nanoparticles used in the antibacterial tests (in µg/mL) should be specified, as this directly impacts the interpretation of the results. Additionally, the methodology for determining the zone of inhibition could be more clearly outlined.

Comparative Analysis: The manuscript would benefit from comparing the antibacterial activity of the synthesized Ni NPs

to that of other nanoparticles or commercial antibiotics to provide a broader context of its effectiveness.

English Language and Clarity: The manuscript requires further editing for grammar, sentence structure, and clarity in some sections. For instance, some parts of the discussion on the FTIR and XRD results are unclear and need more precise language.

Statistical Analysis: The results presented, particularly in the antibacterial activity section, lack statistical analysis. Including statistical significance testing would strengthen the findings and provide more robust conclusions.

Recommendations

Enhance the discussion on the synthesis mechanism and the specific role of ionic liquids in the formation of Ni NPs.

Include more detailed experimental conditions for the antibacterial tests, such as the concentrations of nanoparticles used.

Improve the clarity of some descriptions, particularly in the methodology and results sections.

Add statistical analysis to the antibacterial results and compare the findings to other studies for broader scientific relevance.

My decision

While the research presented in the manuscript is valuable and contributes to the growing field of green synthesis of nanoparticles, it needs significant improvement in terms of clarity, methodological details, and statistical rigor before it can be considered for publication. Therefore, based on the current version of the manuscript, **I recommend rejection but with the option for resubmission after major revisions**.