



Synthesis and Characterization of *Euphorbia hirta* based Zinc Oxide Nanoparticles and Investigation of their Antioxidant Properties

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WOUND HEALING IN DIABETES

- Chronic diabetic wounds heal slowly: high blood sugar, low oxygen, inflammation increase oxidative stress and disrupt normal wound repair.
- These wounds are also prone to bacterial contamination and biofilm formation, which prolong inflammation and delay healing.
- Plant-based ZnO nanoparticles are promising: combine antioxidant properties with the bioactive support of *Euphorbia hirta* phytochemicals.
- This study investigates the antioxidant potential of *Euphorbia hirta*-incorporated ZnO nanoparticles for diabetic wound healing.



EXPERIMENTAL WORKFLOW



Euphorbia hirta

Plant collection and preparation

Dried shoot extracts:
100% Ethanol
50% Ethanol
H₂O

NP Synthesis: 3 types
100 NP (using 100% ethanolic extract)
50 NP (using 50% ethanolic extract)
H₂O NP (using aqueous extract)

Antioxidant activity

- DPPH- radical scavenging activity - over time
- T₅₀ value comparison

NP Characterization

- UV/Vis
- FTIR
- XRD

RESULTS

UV/Visible analysis

- All three types of NPs showed characteristic absorbance peaks within 300-400 nm

XRD spectrum

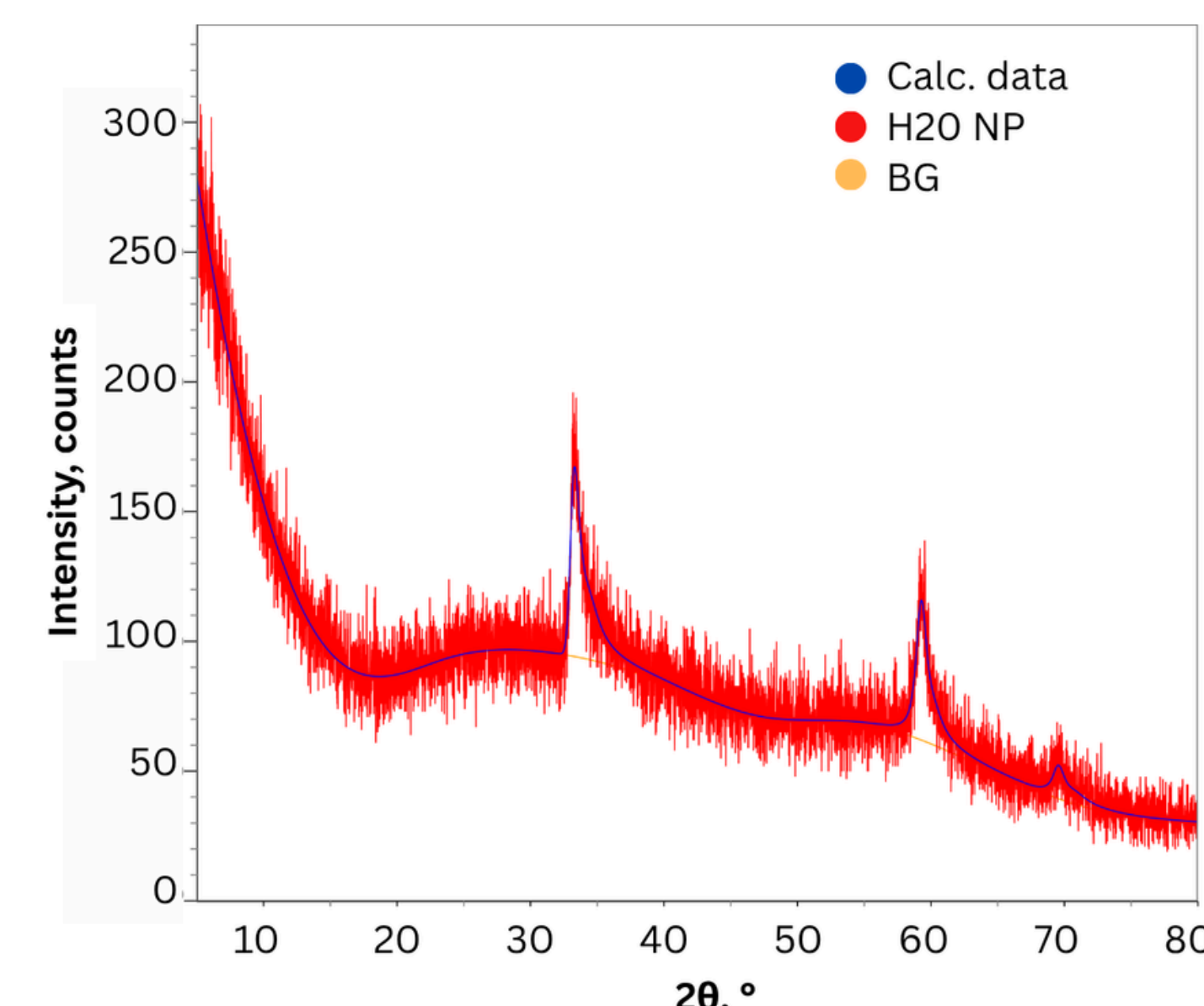


Figure 01: Graph of intensity vs 2θ of XRD spectrum for plant based ZnO NPs synthesized using aqueous extract

FTIR analysis

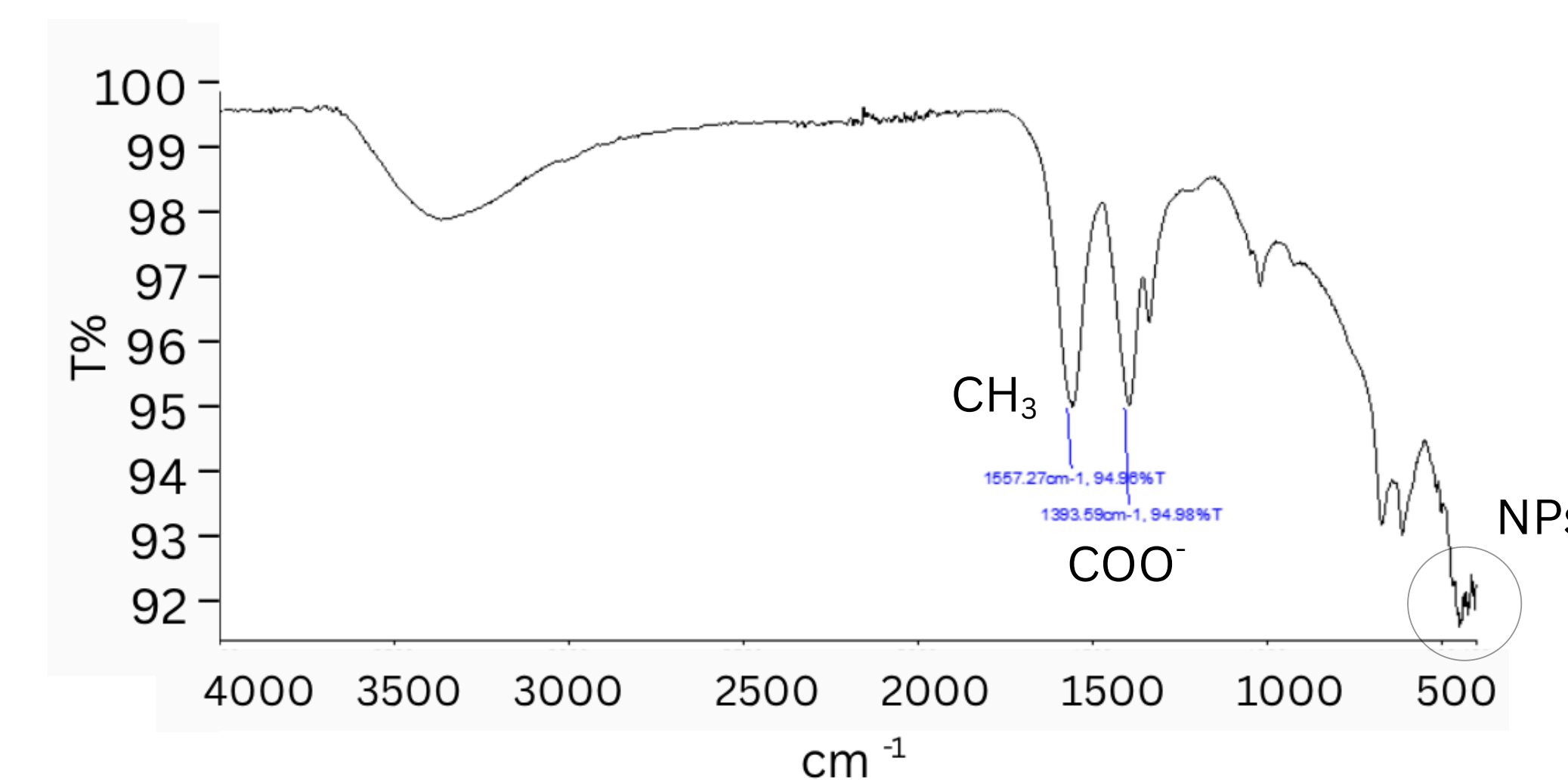


Figure 02: Graph of transmittance (T%) vs cm⁻¹ of FTIR spectrum for plant based ZnO NPs synthesized using aqueous extract.

DPPH Assay

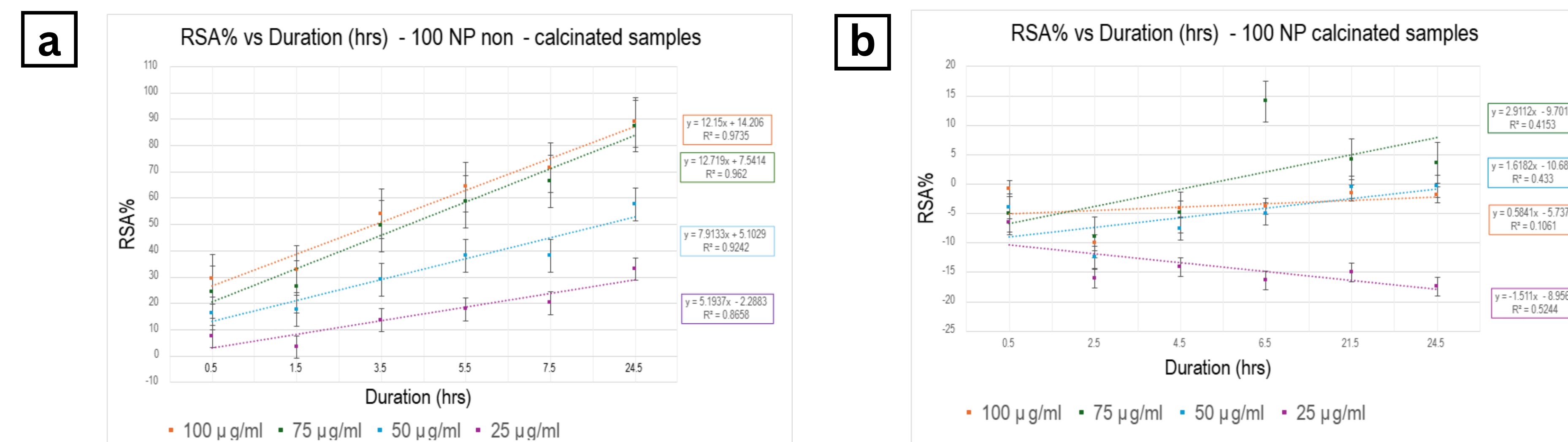


Figure 03: Graph of RSA% vs Duration (hr) against 4 different concentrations of non-calculated plant-based NPs (a) and calculated NPs (b) synthesized with aqueous plant extract (100 NP) (24hr duration) ; The NP concentrations are as follows: 100 µg/ml, 75 µg/ml, 50 µg/ml, 25 µg/ml

NP sample	Calculated T ₅₀ value (hrs)
100 NP	2.95
50 NP	3.51
H ₂ O NP	7.15

Table 01: Obtained minimum T₅₀ values for non-calculated plant-based NPs synthesized with 100% ethanolic extract (100 NP), 50% ethanolic extract (50 NP) and aqueous plant extract (H₂O NP) for 100 µg/ml samples

Calculated vs non-calculated samples

Involvement of plant compounds in radical scavenging

CONCLUSION

- The nanoparticles were successfully prepared using a sustainable method and showed potential antioxidant properties
- UV-Vis, FTIR and XRD analyses confirmed nanoparticle formation, bioactive compound incorporation, and crystalline ZnO structure in the nano range.
- DPPH assay results indicated notable free radical scavenging activity, with higher phytochemical content supporting stronger antioxidant performance.
- Overall, the findings suggest that *Euphorbia hirta*-based ZnO nanoparticles shows potential for developing biocompatible wound-healing systems.

FUTURE WORK

Perform antibacterial, anti-inflammatory tests to further assess plant incorporated NP properties

Perform comprehensive cytotoxicity and biocompatibility tests to identify safe and effective NP doses.

Evaluate NPs in more complex biological models: skin-equivalent tissues/animal wound models.

Design affordable and user-friendly wound dressings incorporating these delivery systems for practical diabetic wound treatment.

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