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Exploiting an Invasive Plant (*Tithonia diversifolia*) for Green Synthesis of CuO Nanoparticles: Petals vs. Leaves

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INTRODUCTION & AIM

Nanotechnology is a rapidly advancing field with diverse applications across areas such as the environment, agriculture, food, and medicine.

Nanoparticles, typically, 1–100 nm in size, exhibit unique mechanical, electrical, magnetic, optical, catalytic, and antibacterial properties due to their extremely small dimensions.

Why Green Synthesis?

Conventional nanoparticle synthesis is expensive, uses harmful chemicals, and requires harsh conditions, so safer and more sustainable methods are needed.

Why *Tithonia diversifolia?*

Rich in phytochemicals, it is a promising candidate for green synthesis.

Why Copper sulfate?

$CuSO_4 \cdot 5H_2O$ is a cost-effective precursor instead of noble metals like Ag and Au.

Aim of this study

This research compared the petals and leaves of *T. diversifolia* to determine the optimal source for green synthesis of copper oxide (CuO) nanoparticles.

Flowers of *T. diversifolia*

Leaves of *T. diversifolia*

METHOD

Plant extracts (dried, ground, and sieved petals and leaves) were prepared by dissolving the powders in distilled water [1:10 (w/v)], heated at 70 °C for 15 minutes, then centrifuged at 10,000 rpm. The supernatant was mixed with $CuSO_4 \cdot 5H_2O$ (0.5 M) and distilled water in a 1:1:1 ratio, heated to 70 °C for 15 minutes, and stirred at room temperature. A green-to-brown colour change indicated nanoparticle production. The solution was centrifuged at 10,000 rpm, washed three times with distilled water, dried at 60 °C, and characterized

Dried *T. diversofolia petals*

Ground powder of *T. diversofolia* petals

Dried *T. diversofolia* leaves

Ground powder of *T. diversofolia* leaves

20 g, powder

Separately dissolve in 200 ml of distilled water

Continuous stirring at 70 °C, for 15 min

Filtering

Leaf and petal extract solutions

70 °C for 15 minutes and Continuous stirring at room temperature for 1hr

$CuSO_4 \cdot 5H_2O$ (0.5 M)

Centrifugation

Pellet - CuO NPs

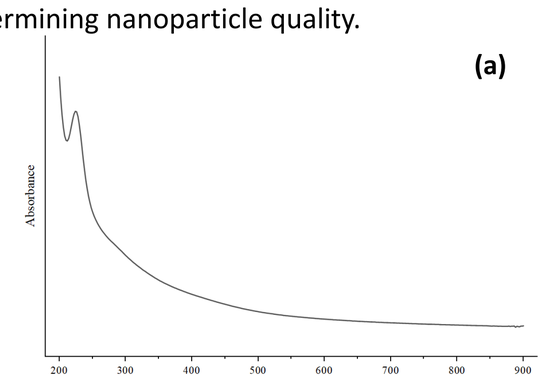
Dried CuO NPs

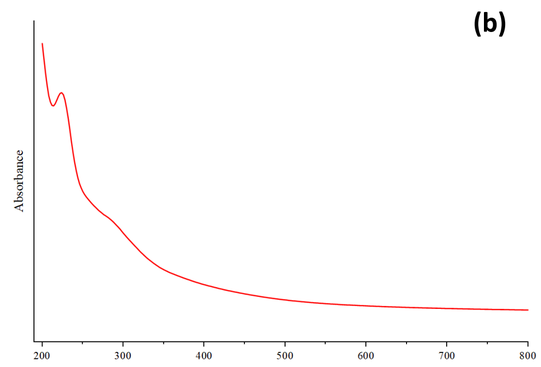
RESULTS & DISCUSSION

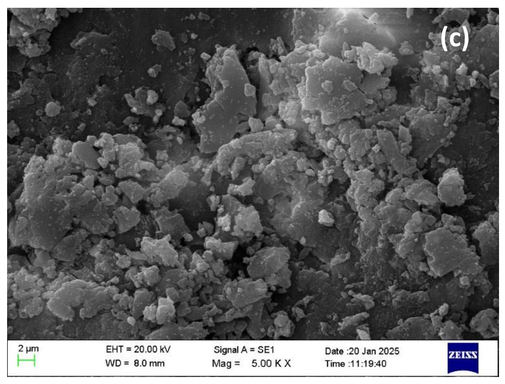
Table:1

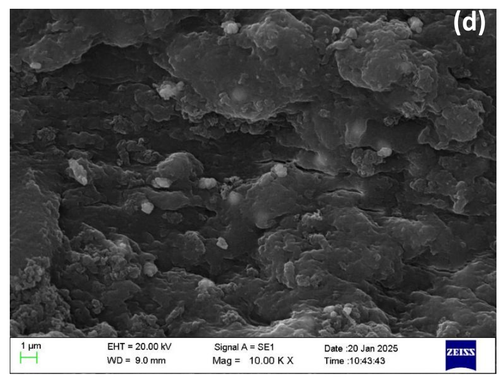
Parameter	Petal Extract	Leaf Extract
UV–Vis Absorbance Peaks	200–250 nm, 265–285 nm **(a)**	200–250 nm, 265–285 nm **(b)**
SEM Morphology	Spherical nanoparticles (20–50 nm) **(c)**	Flake-like structures (~100 nm) **(d)**
FTIR Findings	Cu–O bond at 500–650 cm^{-1} with phytochemical residues **(e)**	Cu–O bond at 500–650 cm^{-1} with phytochemical residues **(f)**
Zeta Potential	–0.2 mV **(g)**	–1.8 mV **(h)**
Hydrodynamic Diameter	262 nm **(i)**	385 nm **(j)**

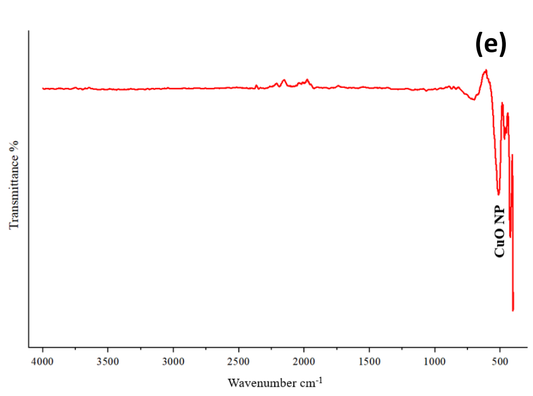
These findings suggest that while both plant parts can drive nanoparticle formation, the petal-derived CuO nanoparticles exhibit greater stability and more favorable physicochemical properties, indicating that specific phytochemical profiles may play a decisive role in determining nanoparticle quality.

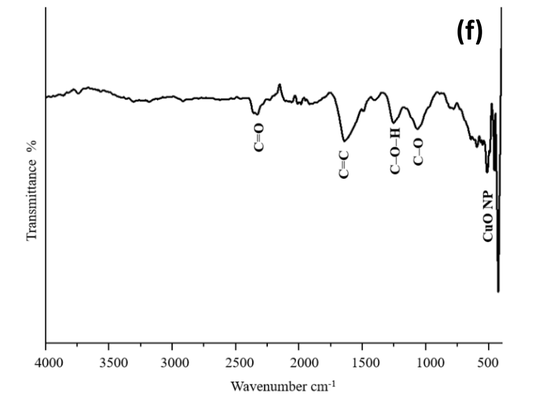


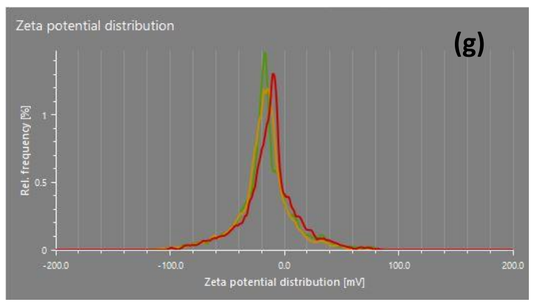


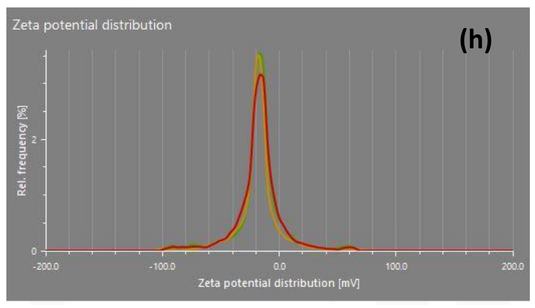












CONCLUSION

The study shows that both petals and leaves can successfully produce nanoparticles, with petals giving better results. Further work on purification and potential applications is recommended.

FUTURE WORK / REFERENCES

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