BOOK of ABSTRACTS

6th INTERNATIONAL CONFERENCE ON PLANT BIOLOGY

(25th SPPS Meeting)

5-7 NOVEMBER 2026
NOVI SAD, SERBIA



Serbian Plant Physiology Society

Institute for Biological Research "Siniša Stanković"
– National Institute of the Republic of Serbia, University of Belgrade

Faculty of Sciences, University of Novi Sad

University of Belgrade, Faculty of Biology

Institute for Multidisciplinary Research
– National Institute of the Republic of Serbia, University of Belgrade

Serbian Biological Society "Stevan Jakovljević" Kragujevac

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Synthesis, Structural, and Morphological Characterization of Copper Oxide Nanoparticles Obtained via *Melissa officinalis* Extract

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The growing demand for sustainable nanotechnology has positioned green synthesis of metal oxide nanoparticles as a compelling alternative to conventional chemical routes. In this work, copper oxide nanoparticles (CuO NPs) were synthesized through an eco-friendly, plant-mediated approach using an aqueous extract of *Melissa officinalis* L. (lemon balm), which served simultaneously as a reducing and stabilizing agent. The synthesis was carried out using $CuSO_4x5H_2O$ as the copper precursor combined with a 0.2% plant extract solution, under mild conditions of pH 5–6 and 50–60°C. Reaction progress was monitored in real time using UV–Vis spectroscopy, while the structural, chemical, and morphological features of the resulting nanoparticles were examined through Fourier-transform infrared spectroscopy (FTIR), and transmission electron microscopy (TEM). UV–Vis spectra displayed characteristic time-dependent shifts in absorbance within the 300–450 nm range, reflecting the gradual evolution of nanoparticle formation. FTIR analysis revealed distinct alterations in the functional groups of the plant extract, pointing to their active participation in nanoparticle nucleation and stabilization, alongside absorption bands in the lower wavenumber region attributed to Cu–O bond vibrations. TEM imaging revealed nanoscale particles with predominantly irregular to quasi-spherical/polygonal shapes, along with a notable tendency toward agglomeration. These findings underscore the promise of *M. officinalis* extract as a natural, low-cost mediator for the green synthesis of CuO nanoparticles, offering a simple, sustainable, and environmentally responsible synthetic pathway.

KEYWORDS: copper oxide nanoparticles; *Melissa officinalis*; plant extract; nanoparticle characterization

ACKNOWLEDGEMENT: This study was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Agreement No. 451-03-33/2026-03/200378).

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Synthesis, Structural, and Morphological Characterization of Copper Oxide Nanoparticles Obtained via *Melissa officinalis* Extract

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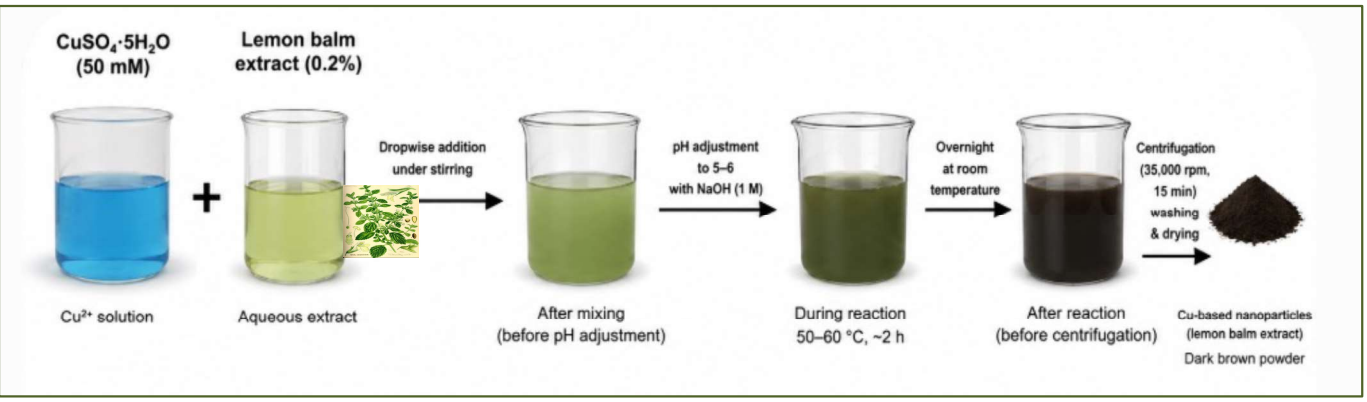
INTRODUCTION

- ✓ Green synthesis provides a sustainable alternative to conventional chemical routes for metal oxide nanoparticle production.
- ✓ Plant extracts contain bioactive compounds that can participate in nanoparticle formation and stabilization.
- ✓ *Melissa officinalis* L. represents a readily available natural source of phytochemicals potentially suitable for the green synthesis of CuO nanoparticles.



KEYWORDS:
- ✓ copper oxide nanoparticles;
- ✓ *Melissa officinalis;*
- ✓ plant extract;
- ✓ nanoparticle characterization

GREEN SYNTHESIS OF CuO NANOPARTICLES

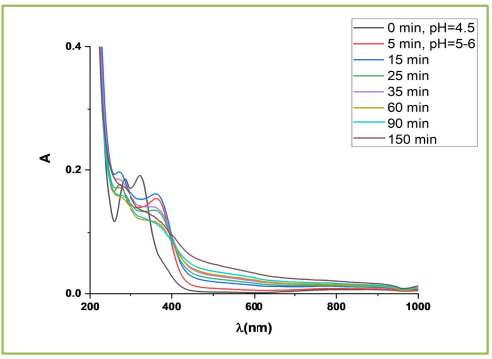


SYNTHESIS CONDITIONS

- ✓ $CuSO_4 \cdot 5H_2O$ precursor
- ✓ 0.2% plant extract
- ✓ pH 5–6
- ✓ 50–60 °C

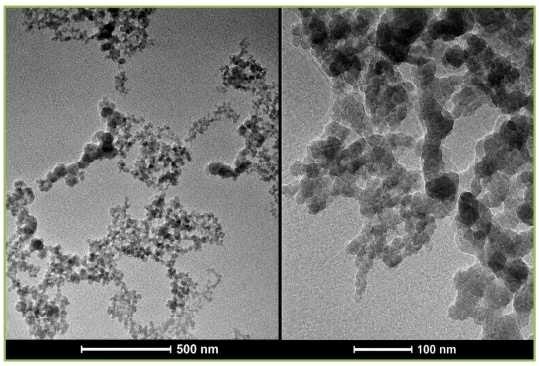
CHARACTERIZATION

UV–Vis spectroscopy



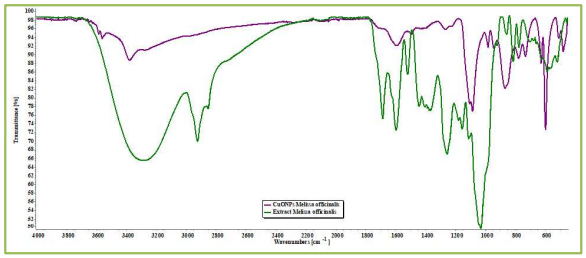
Time-dependent spectral changes indicate the progressive formation of CuO nanoparticles.

TEM



Nanoscale particles with predominantly irregular to quasi-spherical/polygonal morphology and a tendency toward agglomeration.

FTIR spectroscopy



Spectroscopic changes indicate plant-derived functional groups participate in nanoparticle formation and stabilization.

CONCLUSIONS

- ✓ *Melissa officinalis* extract successfully mediated the green synthesis of CuO nanoparticles.
- ✓ Spectroscopic changes indicated the involvement of plant-derived functional groups in nanoparticle formation and stabilization.
- ✓ TEM revealed nanoscale particles with irregular to quasi-spherical/polygonal morphology and a tendency toward agglomeration.

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M. officinalis represents a promising natural and low-cost mediator for the sustainable synthesis of CuO nanoparticles.