

**Preparation of mixed metal oxide nanoparticles (MgO, CuO, TiO₂) as heterogeneous catalysts using Portulaca oleracea L. leaf extract and evaluation of their antibacterial activity.**

**Mohammed Said Nedjimi a,**  **Mohammed Abdelkader Belalem1 b , Skander Abdelhalima and Mohammed taki eddine Mhiria**

 a Faculty of Mathematics and Material Sciences, Department of Chemistry, University of Kasdi Merbah Ouargla, 30000 (Algeria)

bSciences and Environmental Research Laboratory, Department of Material Sciences, Faculty of sciences and technology, University of Tamanghasset, 11000 Tamanghasset, (Algeria)

*nedjimi2011@gmail.com*

This study summarizes the preparation of mixed secondary metal oxide nanoparticles (MgO, CuO, TiO₂) using purslane (*Portulaca oleracea L*.) extract as a natural reducing agent, aiming to develop heterogeneous catalysts with antibacterial properties. The synthesized nanoparticles exhibited unique physicochemical characteristics, as revealed by analytical techniques (XRD, FT-IR, UV-Vis, SEM, TEM), demonstrating stable nanocrystalline structures and high surface area, which enhance their catalytic and biological activity.

The results showed significant antibacterial efficacy against both Gram-positive and Gram-negative strains, such as (Escherichia coli) and (Klebsiella pneumonia), with notable effectiveness against Gram-negative bacteria due to nanoparticle interactions with the cell membrane. The study also highlighted the importance of green synthesis methods in nanoparticle preparation, reducing reliance on toxic chemicals and simplifying experimental conditions.

These findings open new possibilities for medical and environmental applications, including water treatment and antimicrobial material development, while emphasizing the role of nanotechnology in addressing antibiotic resistance. Additionally, the research underscores the potential of integrating natural sciences with modern technologies to achieve sustainable solutions.

**Keywords:** *Nanoparticles ,Metal oxides (MgO, CuO, TiO₂) ,Portulaca oleracea L. Green synthesis ,Antibacterial activity*