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وزارة التعليم العالي والبحث العلمي
جامعة قسنطينة 1 – الإخوة منتوري
كليـــــــــة العلوم الد قيـقة

PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH
Constantine 1 University – Frères Mentouri
Faculty of Exact Sciences

ANNONCE DE SOUTENANCE

Conformément à la décision n° **89** du **05 Janvier 2026** autorisant la soutenance d'une thèse de doctorat, le Vice-doyennat chargé de la post-graduation, de la recherche scientifique et des relations extérieures, a n n o n c e la soutenance publique d'une thèse de doctorat en Sciences le :

Samedi 31 Janvier 2026 à 16H00

Lieu : Salle de conférences sise au Campus Chaab Erssas
Constantine 1 – Frères Mentouri
F i l i è r e : P H Y S I Q U E
Spécialité : Physique des Matériaux

Doctorant : **CHETTAH Khaled**

Sur le thème : « Synthèse écologique et applications des nanoparticules d'oxydes métalliques »

Devant le jury :

	Nom et prénoms	Grade	Etablissement d'appartenance
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Abstract

As part of this research, pure and copper-doped zinc oxide (ZnO) nanoparticles were manufactured using an environmentally friendly method that involves the use of Rosmarinus officinalis leaf extract as a reducing agent. Copper was incorporated as a dopant at concentrations of 3% and 5%. The catalysts responsible for initiating the reaction are zinc diacetate and copper acetate.

The synthesized samples were analyzed using several techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDX), Raman spectroscopy, UV-visible spectroscopy, and photoluminescence. XRD and Raman spectroscopy analyses validated the successful incorporation of Cu^{2+} ions into the hexagonal wurtzite structure of ZnO.

Scanning electron microscopy revealed a spherical morphology of the nanoparticles, while EDX analysis confirmed the presence of zinc (Zn), copper (Cu), and oxygen (O), thereby confirming the sample's purity. The UV-visible spectra showed a decrease in the optical band gap width with increasing copper concentration. The photoluminescence peaks observed at wavelengths of 383 nm and 565 nm are associated with electronic transitions from deep donor levels, primarily from Zn interstitials to Zn and oxygen vacancies.

The 5% Cu-doped ZnO nanoparticles exhibited the highest photocatalytic activity, achieving a 90% degradation of rhodamine B (RhB) dye in 135 minutes under UV irradiation. Furthermore, it was observed that the 5% Cu-doped ZnO nanoparticles demonstrate significant antibacterial activity, particularly against Gram-positive bacteria such as S. aureus, compared to Gram-negative bacteria like E. coli.