الجمهورية الجزائرية الديمقراطية الشعبية
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° **97/D3C/2026** du **06 Juillet 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 le :

Mercredi 08 Juillet 2026 à 16 HOO

Lieu : Salle de conférences de l'Audio visuel sise au Campus Chaab Erssas.
F i l i è r e : C H I M I E
Spécialité : Chimie Analytique

Doctorant : SAHRAOUI Abouelkacem

Sur le thème: « Preparation and characterization of eco-friendly semiconductors : application in photocatalytic degradation ».

Devant le jury d'examen :

	Nom et prénoms	Grade	Etablissement d'appartenance
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Abstract

Growing interest in sustainable materials chemistry has encouraged the development of environmentally benign synthesis routes for semiconductor photocatalysts. This thesis reports the preparation of titanium dioxide (TiO_2) nanoparticles using Eucalyptus globulus leaf extract as a natural reducing and stabilising agent, combined with titanium butoxide under mild thermal conditions. Four TiO_2 samples (S1–S4) were obtained by varying the thermal treatment protocol, enabling systematic examination of synthesis– property relationships. The biosynthesised nanoparticles were characterised using Fouriertransform infrared spectroscopy, diffuse reflectance UV–visible spectroscopy, Raman spectroscopy, X-ray diffraction, and scanning electron microscopy with energy-dispersive X-ray analysis. The analyses confirmed formation of nanocrystalline TiO_2 with predominantly anatase phase and uniform morphology. Phytochemical constituents of the plant extract contributed to Ti^{4+} reduction and nanoparticle stabilisation. Among the prepared materials, the sample subjected to double mild heat treatment (S3) exhibited enhanced crystallinity, reduced band gap energy, and structural characteristics closely comparable to commercial Degussa P25. Photocatalytic activity was evaluated through degradation of methyl orange (MO), acid orange (AO), and orange G (OG) under UV-A, UV-B, and simulated solar irradiation. All catalysts followed apparent pseudo-first-order kinetics (R^2 > 0.99). Relative photocatalytic performance decreased in the order P25 > S3 > S4 > S2 > S1. Sample S3 was selected for detailed investigation. Photodegradation efficiency showed strong dependence on pH, irradiation wavelength, and reactive oxygen species availability.

Acidic to near-neutral conditions favoured higher degradation rates. The reactivity sequence AO > OG > MO was consistently observed. Enhanced degradation rates were obtained under UV-B and solar irradiation compared with UV-A. Radical scavenging experiments identified hydroxyl radicals as the dominant oxidative species. Total organic carbon measurements revealed substantial mineralisation, although partially oxidised intermediates persisted, particularly for MO. Density functional theory calculations identified carbon atoms adjacent to the azo (–N=N–) linkage as preferential sites for hydroxyl radical attack, providing a molecular-level explanation for the experimentally observed reactivity order.

The findings confirm that TiO_2 nanoparticles synthesised via a plant-mediated route, combined with optimised mild thermal treatment, possess suitable physicochemical and photocatalytic properties for application in solar-assisted wastewater treatment and sustainable environmental remediation.