31º ENCONTRO DE QUÍMICA DA REGIÃO SUL
A QUÍMICA COMO PROPULSORA DE NOVOS ECOSSISTEMAS DE INOVAÇÃO
19 A 21 DE NOVEMBRO
Campus Toledo
Unioeste

Area: FIS

Development of ZnO, TiO_2 and ZnO/TiO_2-Based Nanomaterials for Enhanced Photocatalytic Removal of Tetracycline

María Fernanda Hernández Rodríguez (PG), Sergio Fernando Curcio (PQ), Eduardo Guilherme Cividini Neiva (PQ), Lizandra Maria Zimermann (PQ). *

mfhrodriguez@furb.br; *lmz@furb.br

Department of Chemistry, Universidade Regional de Blumenau (FURB), Blumenau, Brazil

Keywords: *ZnO, TiO_2, antibiotic, photocatalysis, nanocomposites, emerging contaminants.*

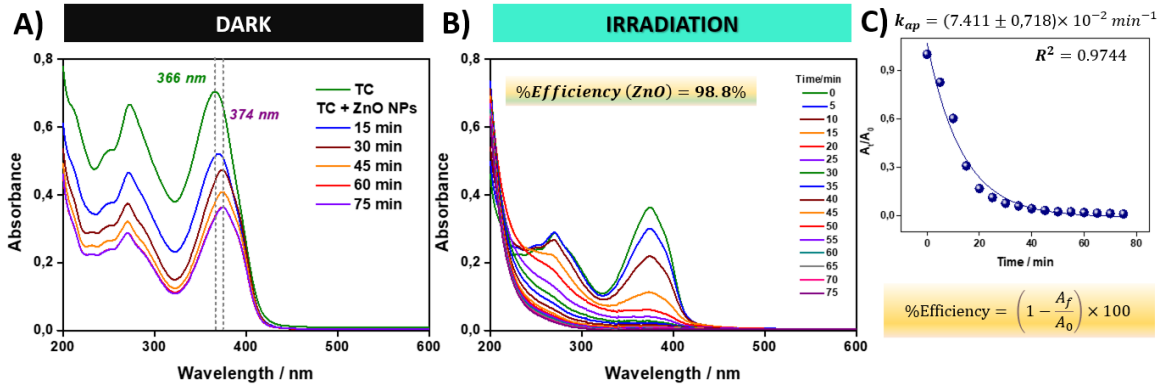
Highlights

- Green sol-gel synthesis of ZnO nanoparticles previously developed and validated, adapted to obtain TiO_2, and ZnO/TiO_2 nanomaterials through a green approach, with ongoing studies on reproducibility.
- Comprehensive characterization by various spectroscopic techniques to correlate structural, optical, and surface properties with photocatalytic performance.
- Physicochemical investigation of tetracycline degradation under UV and visible LED irradiation using a custom-built photoreactor.
- Mechanistic insights into tetracycline degradation pathways based on the physicochemical properties of the nanomaterials.

Abstract

Tetracycline (TC), an emerging antibiotic contaminant, is frequently detected in effluents due to its persistence and toxicity. In this work, ZnO, TiO_2, and ZnO/TiO_2 nanoparticles (NPs) were synthesized by the sol-gel method using absolute ethanol, zinc acetate dihydrate, and titanium isopropoxide (TTIP). The obtained NPs were characterized by various techniques (XRD, SEM, EDS, PZ, DLS, FTIR, UV-Vis), and their photocatalytic activity was evaluated in a custom-built chamber under UV (365 nm) and visible (465 nm) LED irradiation. ZnO showed the highest performance, achieving 98.8% TC degradation within 75 min, followed by ZnO/TiO_2 (93.7%), whereas pure TiO_2 (74.2%). Ecotoxicological and LC-Mass testing studies are being conducted to ensure the nontoxicity of the photocatalytic product. Additionally, preliminary studies are being conducted on the deposition of ZnO NPs onto ITO substrates for electrochemical characterization and initial investigations on electro-photocatalysis.

Figure 1. *Photocatalysis of tetracycline (25 mg L^{-1}) with 20 mg of ZnO NPs. A) Absorption in the dark (adsorption-desorption equilibrium). B) Degradation under UV over time. C) Nonlinear kinetic fitting of absorbance at 374 nm.*



Acknowledgments

The authors acknowledge CNPq, CAPES, FAPESC, GNEP, GQM-UFPR and FURB for their financial support, grants, and infrastructure assistance.