48ª Reunião Anual da Sociedade Brasileira de Química

Emergências Climáticas?
A Química Age e Reage!

ANAIS

08 a 11 de junho de 2025, Campinas, Expo Dom Pedro

Revisão textual e gramatical: Resposanbilidade dos respectivos autores.

Dados Internacionais de Catalogação na Publicação (CIP)
(Câmara Brasileira do Livro, SP, Brasil)

Reunião Anual da SBQ (48. : 2025 : Campinas, SP)
Anais da 48ª Reunião Anual da SBQ [livro eletrônico] / Sociedade Brasileira de Química. -- 1. ed. -- Campinas, SP : Aptor Software, 2025.
PDF

Vários autores.
Vários colaboradores.
Bibliografia.
ISBN 978-85-63273-70-3

1. Química I. Sociedade Brasileira de Química. II. Título.

25-282696 CDD-540

Índices para catálogo sistemático:

1. Química 540

Eliete Marques da Silva - Bibliotecária - CRB-8/9380

Área: AMB

Photoelectrocatalytic degradation of dexamethasone using $WO_3/BiVO_4$ electrodes

Roberta Y. N. Reis (PG),[1] Isabelle M. D. Gonzaga (PG),[1] Roger Gonçalves (PG),[1] Carlos H. M. Fernandes (PG),[2] Marcelo Assis (PG),[3] Lucia H. Mascaro (PQ).[1]*

robertayonara@gmail.com; lmascaro@ufscar.br*

[1]Department of Chemistry, UFSCar; [2]Chemistry Institute of São Carlos, USP; [3]Biomaterials and Tissue Engineering Laboratory, UNIFESP

Palavras Chave: Heterostructures; photoelectrocatalysis; dexamethasone; tungsten oxide; bismuth vanadate; toxicity.

Highlights

A $WO_3/BiVO_4$ electrode efficiently degraded dexamethasone by photoelectrocatalysis, achieving 100% DEX removal and 30% mineralization. The photoelectrocatalysis method results in less toxic products.

Resumo/Abstract

The contamination of water by dexamethasone (DEX) poses a global threat, highlighting the urgent need for effective and affordable removal strategies. Most existing studies on DEX degradation focus on photocatalysis and electrocatalysis, with limited research exploring its degradation mechanism through photoelectrocatalysis. As an efficient method, photoelectrocatalysis suppresses charge carrier recombination in semiconductors, making it a highly advantageous approach for DEX removal. This study presents the successful synthesis of a $WO_3/BiVO_4$ electrode, developed using a simple method, for the efficient degradation of dexamethasone. The formation of the $WO_3/BiVO_4$ heterojunction enhances charge separation and photoelectrocatalytic activity, inhibiting e^-/h^+ recombination and outperforming pure oxides. The electrode was characterized by XRD, Raman, XPS, FE-SEM, and UV-vis, while its electrochemical behavior was analyzed through LSV, chronoamperometry, and electrochemical impedance spectroscopy. The removal efficiency of 10 mg L^{-1} of dexamethasone was evaluated under different conditions: photolysis, electrocatalysis (EC), and photoelectrocatalysis (PhEC). The photoelectrocatalytic treatment at 1 mA cm^{-2} achieved 100% removal, significantly outperforming photolysis (54%) and EC (14.6%). During the process, short-chain acids (oxalic, succinic, glycolic, and adipic) were generated, with their presence varying depending on the treatment applied. A key innovation of this study is the excellent reusability of the electrode, maintaining its efficiency over five degradation cycles. Additionally, radical scavenger tests confirmed that $^{\bullet}O_2^-$ and $HO^{\bullet}$ reactive species play a crucial role in enhancing DEX degradation. Ecotoxicological assays with *Lactuca sativa* further demonstrated that the byproducts formed during the photoelectrocatalytic process are less toxic than those generated by other methods, reinforcing this approach as a promising alternative for wastewater decontamination.

Agradecimentos/Acknowledgments

Authors acknowledge the São Paulo Research Foundation (FAPESP, grants #2021/11326-0, #2020/15211-0, #2023/06558-5, #2017/11986-5, #2013/07296-2). Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brazil (CAPES). Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq). Financiadora de Estudos e Projetos FINEP grant number #01.22.0179.00. The authors also thank Shell for the strategic importance of the support given by ANP (Brazil's National Oil, Natural Gas, and Biofuels Agency) through the R&D levy regulation.