Chemosphere 296 (2022) 134030

Contents lists available at ScienceDirect

Chemosphere

journal homepage: www.elsevier.com/locate/chemosphere

Gadolinium sesquisulfide anchored N-doped reduced graphene oxide for sensitive detection and degradation of carbendazim

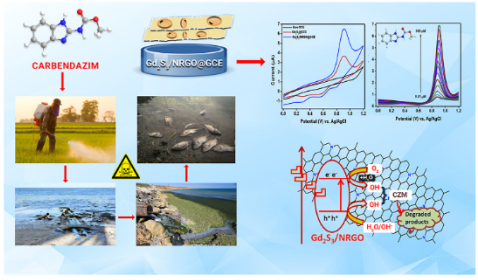
K. Yogesh Kumar [a], M.K. Prashanth [b], L. Parashuram [c], Baskaran Palanivel [d], Fahad A. Alharti [e], Byong-Hun Jeon [f,*], M.S. Raghu [c,**]

[a] Department of Chemistry, Faculty of Engineering and Technology, Jain University, Bangalore, 562112, India
[b] Department of Chemistry, BNM Institute of Technology, Banashankari, Bangalore, 560070, India
[c] Department of Chemistry, New Horizon College of Engineering, Outer Ring Road, Bangalore, 560103, India
[d] Department of Physics, King Engineering College, Sriperumbudur, Kancheepuram, 602117, India
[e] Department of Chemistry, College of Science, King Saud University, Riyadh, 11451, Saudi Arabia
[f] Department of Earth Resources and Environmental Engineering, Hanyang University, 222, Wangsimni-ro, Seongdong-gu, Seoul, 04763, Republic of Korea

HIGHLIGHTS

- Microwave assisted synthesis of orthorhombic Gd_2S_3/NRGO.
- Decrease in the bandgap of Gd_2S_3 upon NRGO decoration.
- Gd_2S_3/NRGO@GCE detects a wide range of carbendazim (0.01–450 μM).
- Efficient degradation of CZM under visible light (94%).
- Gd_2S_3/NRGO@GCE exhibited good sensitivity, selectivity and stability.

GRAPHICAL ABSTRACT



ARTICLE INFO

Handling Editor: Kamala-Kannan Seralathan

Keywords:
Gd_2S_3
NRGO
Carbendazim
Sensitive detection
Photocatalysis
Degradation

ABSTRACT

Agriculture is having a major role in solving issues associated with food shortages across the globe. Carbendazim (CZM) is one of the fungicides which is commonly used in agriculture to grow crops in large quantities and fast. Monitoring CZM content is in high demand for environmental remediation. The present work deals with the synthesis of gadolinium sesquisulfide anchored Nitrogen-doped reduced graphene oxide (Gd_2S_3/NRGO) through a simple microwave-assisted method. X-ray diffraction and morphological studies confirm the formation of the nanocomposite. Gd_2S_3/NRGO showed enhanced activity both in electrochemical detection and light-driven degradation of CZM compared to Gd_2S_3 and NRGO. Gd_2S_3/NRGO modified glassy carbon electrode (GCE) exhibit a wide linear range of 0.01–450 μM CZM with 0.009 μM LOD using differential pulse voltammetry (DPV). Gd_2S_3/NRGO@GCE showed good selectivity, stability, and recovery (98.13–99.10%) in the river water sample. In addition, Gd_2S_3/NRGO has been explored towards the visible-light-induced degradation of CZM. The reactions conditions were optimized to achieve maximum efficiency. 94% of CZM was degraded within 90 min in presence of Gd_2S_3/NRGO. Mechanism of electrochemical redox reaction and degradation of CZM in presence of Gd_2S_3/

* Corresponding author.
** Corresponding author.
E-mail addresses: bhjeon@hanyang.ac.kr (B.-H. Jeon), raghuhassan2009@gmail.com, dr.msraghu@newhorizonindia.edu (M.S. Raghu).

https://doi.org/10.1016/j.chemosphere.2022.134030
Received 17 December 2021; Received in revised form 29 January 2022; Accepted 15 February 2022
Available online 18 February 2022