Chemosphere 322 (2023) 138235

Contents lists available at ScienceDirect

Chemosphere

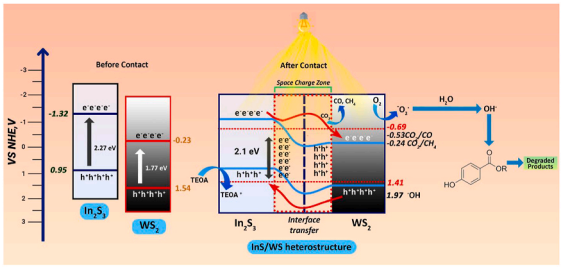
journal homepage: www.elsevier.com/locate/chemosphere

Fabrication of layered In_2S_3/WS_2 heterostructure for enhanced and efficient photocatalytic CO_2 reduction and various paraben degradation in water

Abdulrahman G. Alhamzani [a], Tarek A. Yousef [a,b], Mortaga M. Abou-Krisha [a,c], K. Yogesh Kumar [d], M.K. Prashanth [e], L. Parashuram [f], Byong Hun Jeon [g,*], M.S. Raghu [h,**]

[a] College of Science, Chemistry Department, Imam Mohammad Ibn Saud Islamic University, (IMSIU), Riyadh, 11623, Saudi Arabia
[b] Department of Toxic and Narcotic Drug, Forensic Medicine, Mansoura Laboratory, Medicolegal Organization, Ministry of Justice, Egypt
[c] Department of Chemistry, South Valley University, Qena, 83523, Egypt
[d] Department of Chemistry, Faculty of Engineering and Technology, Jain University, Bangalore, 562112, India
[e] Department of Chemistry, BNM Institute of Technology, Banashankari, Bangalore, 560070, India
[f] Department of Chemistry, Nitte Meenakshi Institute of Technology, Yelahanka, Bangalore, 560064 India
[g] Department of Earth Resources and Environmental Engineering, Hanyang University, 222, Wangsimni-ro, Seongdong-gu, Seoul, 04763, Republic of Korea
[h] Department of Chemistry, New Horizon College of Engineering, Outer Ring Road, Bangalore, 560103, India

GRAPHICAL ABSTRACT



ARTICLE INFO

Handling Editor. Elena Niculina Niculina Dragoi

Keywords:
CO_2 reduction
In_2S_3/WS_2 heterostructure
Paraben
Photocatalysis
Degradation

ABSTRACT

Because of the excessive use of fossil fuels, CO_2 emissions into the environment are increasing. An efficient method of converting CO_2 to useful carbonaceous products in the presence of light is one way to address the issues associated with energy and environmental remediation. In_2S_3/WS_2 heterostructure has been fabricated using the efficient hydrothermal method. The results of structural, morphological, optical, and photo/electrochemical characterization confirm the formation of a hierarchical, layered heterostructure of type-II. Enhanced photocatalytic activity is observed in InS/WS heterostructure compared to pristine In_2S_3 and WS_2. InS/WS heterostructure exhibit higher photocatalytic activity than pure In_2S_3 and WS_2. For 12 h, photocatalytic CO_2 reduction produces 213.4 and 188.6 μmol of CO and CH_4, respectively. Furthermore, the photocatalytic ability of the synthesized materials to degrade different parabens (Methyl: MPB, Ethyl: EPB, and Benzyl: BPB) under visible radiation was evaluated. Under optimized conditions, the InS/WS heterostructure degraded 88.6, 90.4, and 95.8% of EPB, BPB, and MPB, respectively, in 90 min. The mechanism of photocatalysis was discussed in detail. MCF-7 cell viability was assessed and found to exhibit low mortality in InS/WS treated MPB aqueous solution.

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

https://doi.org/10.1016/j.chemosphere.2023.138235
Received 17 November 2022; Received in revised form 31 January 2023; Accepted 22 February 2023
Available online 23 February 2023

Chemosphere

Supports *open access*

13.3
CiteScore

8.8
Impact Factor