International Journal of Hydrogen Energy • Volume 48, Issue 31, Pages 11695 - 11708 • 12 April 2023

Document type
Article
Source type
Journal
ISSN
03603199
DOI
10.1016/j.ijhydene.2022.12.073
Publisher
Elsevier Ltd
CODEN
IJHED
Original language
English
View less

Biohydrogen production with utilisation of magnetite nanoparticles embedded in granular activated carbon from coconut shell

Mohd Jamaludin, Nina Farhana[a]; Jamali, Nur Syakina[a] ; Abdullah, Luqman Chuah[a]; Idrus, Syazwani[b]; Engliman, Nurul Sakinah[c]; Abdul, Peer Mohamed[d]
Save all to author list

[a] Department of Chemical and Environmental Engineering, Faculty of Engineering, Universiti Putra Malaysia (UPM), Selangor, Serdang, 43400, Malaysia
[b] Department of Civil Engineering, Faculty of Engineering, Universiti Putra Malaysia (UPM), Selangor, Serdang, 43400, Malaysia
[c] Department of Chemical Engineering and Sustainability, Kulliyyah of Engineering, International Islamic University Malaysia (IIUM), P.O Box 10, Gombak, Kuala Lumpur, 50728, Malaysia
[d] Research Centre for Sustainable Process Technology (CESPRO), Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Selangor, Bangi, 43600, Malaysia

Funding details

Abstract

This study aims to utilize magnetite nanoparticles (MNP) embedded in granular activated carbon (GAC) originating from coconut shells as microbial support carriers in thermophilic biohydrogen production. MNP can facilitate intracellular electron transportation while providing essential nutrition for microbial growth. Response Surface Methodology (RSM) with a Central Composite Design was used to investigate the simultaneous effect of three variables; Ni:Fe (0.25–0.80), MNP:GAC (0.01–0.03) and type of GAC (GAC-O or GAC-C) on the hydrogen productivity rate (HPR). Biohydrogen content in the biogas to range from 22.25 to 64.71%. The quadratic model was well fitted (R-squared>0.80) with a confidence level higher than 90%. The optimum magnetite GAC was GAC-O as the preferred GAC at Ni:Fe (0.53) and MNP:GAC (0.02), with HPR of 20.33 ± 0.32 ml H_2/L.h. Magnetite GAC exhibited a better biohydrogen productivity rate by 63.99% compared to non-magnetite GAC. The developed magnetite GAC shown a high potential to improve biohydrogen production. © 2022 Hydrogen Energy Publications LLC

Author keywords

Biohydrogen production; Coconut shell; Dark fermentation; Magnetite granular activated carbon; Optimisation; Response surface methodology

Reaxys Chemistry database information

Substances

View all substances (1)

Magnetite

View details

Powered by Reaxys

Indexed keywords

Sustainable Development Goals 2023 New

SciVal Topics

Metrics

Funding details

References (67)

View in search results format >

All

CSV export Print E-mail Save to PDF

Create bibliography

1 Taherdanak, M., Zilouei, H., Karimi, K.

The effects of Fe^0 and Ni^0 nanoparticles versus Fe^{2+} and Ni^{2+} ions on dark hydrogen fermentation

(2016) *International Journal of Hydrogen Energy*, 41 (1), pp. 167-173. Cited 124 times.
http://www.journals.elsevier.com/international-journal-of-hydrogen-energy/
doi: 10.1016/j.ijhydene.2015.11.110

View at Publisher

2 Mohanraj, S., Kodhaiyolii, S., Rengasamy, M., Pugalenthi, V.

Phytosynthesized iron oxide nanoparticles and ferrous iron on fermentative hydrogen production using Enterobacter cloacae: Evaluation and comparison of the effects

(2014) *International Journal of Hydrogen Energy*, 39 (23), pp. 11920-11929. Cited 81 times.
http://www.journals.elsevier.com/international-journal-of-hydrogen-energy/
doi: 10.1016/j.ijhydene.2014.06.027

View at Publisher

3 Rambabu, K., Bharath, G., Thanigaivelan, A., Das, D.B., Show, P.L., Banat, F.

Augmented biohydrogen production from rice mill wastewater through nano-metal oxides assisted dark fermentation

(2021) *Bioresource Technology*, 319, art. no. 124243. Cited 78 times.
www.elsevier.com/locate/biortech
doi: 10.1016/j.biortech.2020.124243

View at Publisher

4 Zhao, X., Xing, D., Liu, B., Lu, L., Zhao, J., Ren, N.

The effects of metal ions and l-cysteine on hydA gene expression and hydrogen production by Clostridium beijerinckii RZF-1108 (Open Access)

(2012) *International Journal of Hydrogen Energy*, 37 (18), pp. 13711-13717. Cited 55 times.
doi: 10.1016/j.ijhydene.2012.02.144

View at Publisher

5 Gou, C., Guo, J., Lian, J., Guo, Y., Jiang, Z., Yue, L., Yang, J.

Characteristics and kinetics of biohydrogen production with Ni^{2+} using hydrogen-producing bacteria (Open Access)

(2015) *International Journal of Hydrogen Energy*, 40 (1), pp. 161-167. Cited 29 times.
http://www.journals.elsevier.com/international-journal-of-hydrogen-energy/
doi: 10.1016/j.ijhydene.2014.10.100

View at Publisher

6 Mullai, P., Yogeswari, M.K., Sridevi, K.

Optimisation and enhancement of biohydrogen production using nickel nanoparticles - A novel approach

(2013) *Bioresource Technology*, 141, pp. 212-219. Cited 154 times.
www.elsevier.com/locate/biortech
doi: 10.1016/j.biortech.2013.03.082

View at Publisher

7 Zhu, H., Seto, P., Parker, W.J.

Enhanced dark fermentative hydrogen production under the effect of zero-valent iron shavings

(2014) *International Journal of Hydrogen Energy*, 39 (33), pp. 19331-19336. Cited 24 times.
http://www.journals.elsevier.com/international-journal-of-hydrogen-energy/
doi: 10.1016/j.ijhydene.2014.06.055

View at Publisher