

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

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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 H₂/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.(c) 2022 Hydrogen Energy Publications LLC. Published by Elsevier Ltd. All rights reserved.

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