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Nickel-iron doped on granular activated carbon for efficient immobilization in biohydrogen production

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Abstract

Nickel-iron doped granular activated carbon (GAC-N) was used to enhance immobilization in biohydrogen production. The effect of the sludge ratio to GAC-N, ranged 1:0.5–4, was studied. The optimum hydrogen yield (HY) of 1.64 ± 0.04 mol H₂/mol sugar consumed and hydrogen production rate (HPR) of 45.67 ± 1.00 ml H₂/L.h was achieved at a ratio of 1:1. Immobilization study was performed at 2 d HRT with a stable HY of 2.94 ± 0.16 mol H₂/mol sugar consumed (HPR of 83.10 ± 4.61 ml H₂/L.h), shorten biohydrogen production from 66 d to 26 d, incrementing HY by 57.30 %. The Monod model resulted in the optimum initial sugar, maximum specific growth rate, specific growth rate, and cell growth saturation coefficient at 20 g/L, 2.05 h⁻¹, 1.98 h⁻¹ and 6.96 g/L, respectively. The dominant bacteria identified was *Thermoanaerobacterium* spp. The GAC-N showed potential as a medium for immobilization to improve biohydrogen production. © 2023 Elsevier Ltd

Author Keywords

Biohydrogen production; Cell immobilization; Metal-doped granular activated carbon; Sugar utilization by Monod model; Thermophilic dark fermentation

Index Keywords

Activated carbon, Cell immobilization, Cell proliferation, Granular materials, Growth kinetics, Iron, Nickel; Bio-hydrogen production, Granular activated carbons, Hydrogen yields, Immobilisation, Metal-doped, Metal-doped granular activated carbon, Monod model, Sugar utilization, Sugar utilization by monod model, Thermophilic dark fermentations; Hydrogen production; activated carbon, hydrogen, iron, nickel, carbohydrate, charcoal, hydrogen, iron, nickel; activated carbon, biofuel, cell, fermentation, immobilization, iron, nickel, sugar, thermophily; Article, Brunauer Emmett Teller method, cell growth, controlled study, energy dispersive X ray spectroscopy, fermentation, field emission scanning electron microscopy, growth rate, immobilization, immobilized cell, microbial identification, nonhuman, sugar intake, synthesis, *Thermoanaerobacterium*, vibrating sample magnetometry, X ray powder diffraction, X ray spectroscopy; Bioreactors, Charcoal, Fermentation, Hydrogen, Iron, Nickel, Sugars

Chemicals/CAS

activated carbon, 64365-11-3, 82228-96-4; hydrogen, 12385-13-6, 1333-74-0; iron, 14093-02-8, 53858-86-9, 7439-89-6; nickel, 7440-02-0; charcoal, 16291-96-6; Charcoal; Hydrogen; Iron; Nickel; Sugars

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