Influence of iron (II) oxide nanoparticle on biohydrogen production in thermophilic mixed fermentation

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Abstract

The effect of initial pH, metal oxide and concentration of nanoparticles (NP) on hydrogen production were investigated in batch assays using glucose-fed anaerobic mixed bacteria in thermophilic condition of 60 degrees C. Two type of metal oxide nanoparticles, iron (II) oxide and nickel oxide, were tested and both metal capable of increasing the hydrogen yield about 34.38% and 5.47% higher than the control test. The experiments on the effect of initial pH were done without adding the nanoparticles to determine the optimum pH for maximum hydrogen production, in which at pH 5.5, the maximum hydrogen yield has reached about 1.78 mol H2/mol glucose. However, at pH 5.5 and the optimal iron (II) oxide concentration of 50 mg/L, the maximum hydrogen yield has reached to 1.92 mol H2/mol glucose, and the hydrogen content was 51%. Furthermore, the analysis of metabolites has indicated that the hydrogen production follows the acetic acid pathway. In all experiments with metal oxide nanoparticles, the metal NP was not consumed by the microbes, and the amount of it at the end of the fermentation was similar to the starting amount, which can be concluded that it was acting as an enhancer to the system to improve the hydrogen production. These results suggest that the addition of iron (II) oxide nanoparticles in the system is the vital factor to enhance the hydrogen production. (C) 2017 Hydrogen Energy Publications LLC. Published by Elsevier Ltd. All rights reserved.

Keywords

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