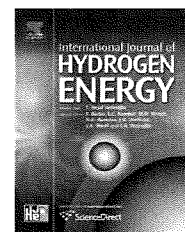


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Biological hydrogen production by *Anabaena* sp. – Yield, energy and CO₂ analysis including fermentative biomass recovery

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ABSTRACT

This paper presents laboratory results of biological production of hydrogen by photoautotrophic cyanobacterium *Anabaena* sp. Additional hydrogen production from residual *Cyanobacteria* fermentation was achieved by *Enterobacter aerogenes* bacteria. The authors evaluated the yield of H₂ production, the energy consumption and CO₂ emissions and the technological bottlenecks and possible improvements of the whole energy and CO₂ emission chain.

The authors did not attempt to extrapolate the results to an industrial scale, but to highlight the processes that need further optimization.

The experiments showed that the production of hydrogen from cyanobacteria *Anabaena* sp. is technically viable. The hydrogen yield for this case was 0.0114 kgH₂/kg_{biomass} which had a rough energy consumption of 1538 MJ/MJH₂ and produced 114640 gCO₂/MJH₂. The use of phototrophic residual cyanobacteria as a substrate in a dark-fermentation process increased the hydrogen yield by 8.1% but consumed 12.0% more of energy and produced 12.1% more of CO₂ showing that although the process increased the overall efficiency of hydrogen production it was not a viable energy and CO₂ emission solution. To make cyanobacteria-based biofuel production energy and environmentally relevant, efforts should be made to improve the hydrogen yield to values which are more competitive with glucose yields (0.1 kgH₂/kg_{biomass}). This could be achieved through the use of electricity with at least 80% of renewables and eliminating the unessential processes (e.g. pre-concentration centrifugation).

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1. Introduction

Biofuels are gaining attention worldwide as a way to reduce the dependence on fossil fuels. The 2003/30/EC European

directive aims at promoting the use of biofuels or other renewable fuels to replace diesel or petrol for transport purposes in each Member State, with a view to contributing to objectives such as meeting climate change commitments,

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