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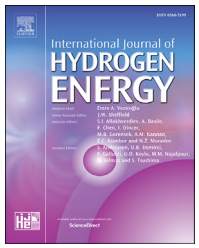

Assessment of the adequacy of different Mediterranean waste biomass types for fermentative hydrogen production and the particular advantage of carob (*Ceratonia siliqua* L.) pulp

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ABSTRACT

The conversion of agro-industrial byproducts, residues and microalgae, which are representative or adapted to the Mediterranean climate, to hydrogen (H_2) by *C. butyricum* was compared. Five biomass types were selected: brewery's spent grain (BSG), corn cobs (CC), carob pulp (CP), *Spirogyra* sp. (SP) and wheat straw (WS). The biomasses were delignified and/or saccharified, except for CP which was simply submitted to aqueous extraction, to obtain fermentable solutions with 56.2–168.4 g total sugars L^{-1}. In small-scale comparative assays, the H_2 production from SP, WS, CC, BSG and CP reached 37.3, 82.6, 126.5, 175.7 and 215.8 mL (g biomass)$^{-1}$, respectively. The best fermentable substrate (CP) was tested in a pH-controlled batch fermentation. The H_2 production rate was 204 mL (L h)$^{-1}$ and a cumulative value of 3.9 L H_2 L^{-1} was achieved, corresponding to a H_2 production yield of 70.0 mL (g biomass)$^{-1}$ or 1.6 mol (mol of glucose equivalents)$^{-1}$. The experimental data were used to foresight a potential energy generation of 2.4 GWh per year in Portugal, from the use of CP as substrate for H_2 production.

Introduction

Global warming and issues of national security due to dependence on oil and gas imports have increased the renewable energy research at an unprecedented rate during the last decade [44]. Regarding biomass use for biofuels, efforts based on the rational use of waste, crop leftovers and agro-industrial byproducts must be undertaken, to avoid any competition between food and energy production [17]. Any analysis concerning the production and conversion of biofuels must take into consideration which renewable resources are available at a local and regional level, therefore depending on geographic location, climate specifications and biomass availability [55], while ensuring their possible exploration preserves the natural biodiversity, and soil, fodder and water

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