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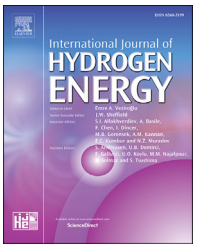

Assessment of the adequacy of different Mediterranean waste biomass types for fermentative hydrogen production and the particular advantage of carob (*Ceratonia siliqua* L.) pulp

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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.

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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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