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Palestra 9

BIOLOGICAL HYDROGEN PRODUCTION AND ITS INTEGRATION WITH THE AGROINDUSTRY AND BRAZILIAN BIOFUELS PRODUCTION CHAIN

PRODUÇÃO BIOLÓGICA DE HIDROGÊNIO E A SUA INTEGRAÇÃO COM A AGROINDÚSTRIA E COM A CADEIA DE PRODUÇÃO DE BIOCOMBUSTÍVEIS NO BRASIL

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Hydrogen (H_2) is an attractive and valuable gas that might be employed in different industries, as reactant or fuel. H_2 combustion produces water as its only product and generates 142 $kJ.g^{-1}$, which is almost three-fold higher than fossil fuels. Moreover, H_2 production from renewable and residual resources guarantees the sustainable cycle of production and prevents environment contamination. There are several processes to obtain hydrogen, amongst which biological production can be highlighted, as it is carried out at atmospheric pressure and room temperature. Another important advantage of this process is the use of industrial residues in order to generate biogas. Brazil is the second and third largest producer of ethanol and biodiesel in the world, respectively. Expressive amounts of agroindustrial residues are generated as a consequence of the relevant position of Brazil in agroindustry and biofuels production. Therefore, the exploitation of these residues for energy and chemicals production has been studied. The major residues from ethanol production are sugarcane bagasse and straw, a lignocellulose material made up of aromatic compounds and carbohydrate polymers that contains C5 and C6 sugars. Glycerin is a byproduct from biodiesel production process, a three carbon alcohol easily assimilated by bacterial cells during anaerobic fermentation. Palm oil industry is also growing in the last few years in Brazil, resulting in huge quantities of POME (palm oil mill effluent), which is a complex raw material, particularly rich in oleic and palmitic acids. Hemicellulose fraction derived from lignocellulosic biomass (C5 fraction), POME and residual glycerin from biodiesel production are industrial wastes, produced in large quantities that have been considered promising materials for H_2 production via anaerobic fermentation. Therefore, these three different waste materials were tested for biological hydrogen ($BioH_2$) production, using pretreated anaerobic sludge from a municipal sewage treatment plant as inoculum (35°C, pH 6.5). The yields of $BioH_2$ obtained were: 4.45 $mol_{H2}/mol_{carbohydrate}$, 2.39 mol_{H2}/g_{COD} and 2.20 $mol_{H2}/mol_{glycerin}$, for C_5 fraction, POME and residual glycerin, respectively, after 24 h of anaerobic fermentation. These yields were obtained after a series of optimization processes, which also increased the productivity by 174%, 93% and 30%, respectively. These results show that the use of waste materials allows promising yields

of hydrogen, leading to renewable energy production, feedstock cost reduction and waste accumulation avoidance.