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Bioglycerine, from a Waste to a Renewable Fuel

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The main technological transition in the transport field will be from combustion engines to electric engines [1]. Therefore, the production of electricity to supply the batteries of electric vehicles has gain importance in the last years. The production of electricity could be carried out with fuel cells that can produce electricity with a conversion of fuel to electric energy with high efficiencies. The technology most employed with these devices is the proton exchange membrane (PEM) fuel cell and its operation is through to hydrogen fuel [2].

Therefore, hydrogen could be significant in the future power generation and transportation energy sectors [3]. The main traditional production of hydrogen gas involves syngas generation from fossil fuels [4]. The conversion of carbon fuels into hydrogen syngas products generally is carried out in the following ways: steam reforming (SR), partial oxidation (POX), auto thermal reforming (ATR), dry reforming (DR) or a combination of two or more [5]. Generally, the production of hydrogen by reforming techniques is carried out using hydrocarbons and alcohols as feed [6]. Otherwise, as an alternative to the traditional production through carbon fuels, the electrolysis of water is being employed, however this process need the contribution of electric energy in order to achieve its operation.

On the other hand, the use of biofuels to fuel motor combustion engine (MCE) vehicles is also increasing. The development of biodiesel industry has led to an increase in the production of crude glycerol [7]. The aim of this work is to present the "bioglycerine" or glycerine obtained as waste of biodiesel production as a fuel source in reforming reactors.

Bioglycerine could be selected as fuel based on the current energy situation, since it is obtained as a byproduct in the transesterification process of vegetable oils for biodiesel production [8]. Due to increasing demand and production of this biofuel, the progression of production of this compound is rising, and it has not an energy practical application. The transformation of glycerol into biofuel in the form of hydrogen is possible, and therefore it is postulated as an alternative to be considered.

For this purpose, it is proposed a first stage of hydrogen production by reforming of bioglycerine. At this stage, it is included the study of the different parameters which influence the process to achieve higher conversions and a level of purity enough to be used in fuel cell systems [9]. The most important parameters are the ratio steam/carbon (S/C), catalyst type, and the presence of carbon monoxide and carbon dioxide in the output current.

The hydrogen obtained by reforming contains impurities such as monoxide carbon that can poison the catalyst of the fuel cell, affecting its performance. To purify the obtained hydrogen, it is necessary to carry out a carbon monoxide oxidation with a water shift reactor followed by gas-absorption of generated carbon dioxide [10]. Moreover, this stage allows to decrease the gas temperature until the operating range of fuel cell. Then, in a second stage, the purified hydrogen will be stored in metal hydrides and used in a polymer electrolyte membrane (PEM) fuel cells.

Therefore, hydrogen is presented as a strong candidate towards the evolution from MCE into electric motors, not as a fuel in itself, but rather as an energetic vector. Moreover, the production of hydrogen could be considered as a renewable if the raw material is based in a waste of a production of a renewable fuel as the biodiesel (bioglycerine). The technique of steam reforming seems to be suitable for the transformation of bioglycerine into hydrogen.

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