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Production of Green Hydrogen by Pyrolysis

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Abstract : Hydrogen plays an important role in transitioning to a low-carbon economy as an alternative to fossil fuels. However, to become competitive, hydrogen must overcome technical and economic barriers: production costs, storage, transportation, and large-scale production from renewable sources. Due to its low cost, steam reforming of natural gas is the most used route for hydrogen generation. However, besides not reducing the dependence on fossil fuels, the process presents the inconvenience of GHG emissions. This work evaluates the economic feasibility and emissions of different hydrogen production routes from methane, which can be obtained from biogas, a renewable fuel. Three routes for hydrogen production were compared: steam reforming, catalytic pyrolysis, and plasma pyrolysis. The results analyzed CO_2 emissions and hydrogen production costs. Steam reforming presented hydrogen production costs ranging from R$ 20.08 to R$ 22.70/kgH_2 and pyrolysis from R$ 34.18 to R$ 36.74/kgH_2. However, considering the commercialization of carbon black, a byproduct of pyrolysis, the hydrogen production cost can be reduced from R$ 25.26 to R$ 27.72/kgH_2. Regarding emissions, values for steam reforming range from 1.39 to 6.75 kg CO_2/kgH_2, considering CCS technologies, and those for pyrolysis range from 0.18 to 1.19 kg CO_2/kgH_2.

Keywords : hydrogen, pyrolysis, plasma reforming, methane, decarbonization
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