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Simulation of a unit of hydrogen production through reforming of biogas

HÉCTOR NAPOLEÃO COZENDEY DA SILVA

Universidade Federal Fluminense
hncsilva@id.uff.br

LISIANE VEIGA MATTOS

Universidade Federal Fluminense
lisiane@vm.uff.br

DIEGO MARTINEZ PRATA

Universidade Federal Fluminense
diegoprata@gmail.com

GILSON BRITO ALVES LIMA

Universidade Federal Fluminense
gilson@latec.uff.br

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SIMULATION OF A UNIT OF HYDROGEN PRODUCTION THROUGH REFORMING OF BIOGAS

Contextualização:

The emission of the biogas to the atmosphere may contribute to the greenhouse effect. A solution to this problem would be the development of low-cost and high efficiency processes for converting biogas into energy and higher value-added products (1). An efficient technology for the use of biogas for electricity generation would be its use in the production of H₂ for the Proton Exchange Membrane (PEM) fuel cells.

Objetivos:

To simulate a unit of hydrogen production through reforming of biogas obtained from the Jardim Gramacho - RJ landfill for the energy generation using PEM fuel cells.

Metodologia:

The UniSim Software has been used for the simulation of the production of H₂ from the effluent, which has the installed capacity for the annual production of 70.000.000 m³. In this approach, the biogas is converted to syngas (H₂ + CO) in a reformer (820°C and 21,3 bar), followed by steps of hydrogen purification: Water Gas Shift - WGS (350°C and 21,3 bar) and Pressure Swing Absorption - PSA (30°C and 21,3 bar).

Fundamentação Teórica:

The use of biogas increases energy efficiency, helping reach the use of resources in a sustainable way, without harming the economic growth. The use of these efficiency technology can generate positive impacts on the environment, public health and economy. Studies (2) estimate the possibility of having an installed capacity of generation of 311 MW of energy, which could supply a population of 5,6 millions of habitants.

Resultados e Análises:

The results showed that it is possible to produce more than 742 kg/hr (17,500 kg/day) at 37.8°C and 354.6 bar. This amount is enough to generate more than 10.3 MW of energy (considering 0.8 Nm³/h de H₂/kWh of produced energy as reference to describe the cell performance of the PEM fuel cell).

Considerações Finais:

Considering the average domestic consumption of electric energy of 0.25kW, the generated hydrogen from the reforming of biogas provided from the Jardim Gramacho RJ landfill would be enough to supply more than 41,000 residencies as an efficient and promising process to energy generation

Referências:

1. P. Piroonlerkgula; N. Laosiripojanab; A. A. Adesinac; S. Assabumrungrata; Chem. Eng. Process 48 (2009) 672.



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2. PROGRAMA DAS NAÇÕES UNIDAS PARA O DESENVOLVIMENTO, Atlas do Desenvolvimento Humano no Brasil.In.PNUD. Disponível em: <http://www.pnud.org.br/IDH/Atlas2013.aspx?indiceAccordion=1&li=li_Atlas2010>. Acesso em 28 de agosto de 2013.

Palavras-chave:

Landfill biogas reforming

Hydrogen

Dry reforming

Steam reforming

Sustainable resources

Atenção:

- Adotar os tópicos acima para a redação do resumo do Pôster.
- O uso do template é obrigatório. Este modelo já possui a formatação solicitada pelo congresso. Utilize-o para escrever o resumo do seu pôster.
- Texto justificado, fonte Times New Roman, corpo 12, espaçamento simples (entre caracteres, palavras e linhas).