A sequential process for hydrogen production based on continuous HDPE fast pyrolysis and in-line steam reforming

Itsaso Barbarias, Gartzen Lopez, Jon Alvarez, Maite Artetxe, Aitor Arregi, Javier Bilbao, Martin Olazar

PII: S1385-8947(16)30343-6
DOI: http://dx.doi.org/10.1016/j.cej.2016.03.091
Reference: CEJ 14942

To appear in: *Chemical Engineering Journal*

Received Date: 21 December 2015
Revised Date: 16 March 2016
Accepted Date: 20 March 2016

Please cite this article as: I. Barbarias, G. Lopez, J. Alvarez, M. Artetxe, A. Arregi, J. Bilbao, M. Olazar, A sequential process for hydrogen production based on continuous HDPE fast pyrolysis and in-line steam reforming, *Chemical Engineering Journal* (2016), doi: http://dx.doi.org/10.1016/j.cej.2016.03.091

A sequential process for hydrogen production based on continuous HDPE fast pyrolysis and in-line steam reforming

Itsaso Barbarias, Gartzen Lopez*, Jon Alvarez, Maite Artetxe, Aitor Arregi, Javier Bilbao and Martin Olazar

Department of Chemical Engineering University of the Basque Country UPV/EHU, P.O. Box 644 - E48080 Bilbao (Spain). gartzen.lopez@ehu.es

Abstract

A continuous process has been developed consisting in the flash pyrolysis (500 ºC) of high density polyethylene (HDPE) in a conical spouted bed reactor (CSBR) followed by steam reforming in a fluidized bed reactor (Ni commercial catalyst). The effect reforming temperature in the 600-700 ºC range, space time from 2.8 to 20.8 g_{cat} min g_{HDPE}^{-1} and steam/plastic ratio between 3 and 5 have on product yields and gas composition has been studied. The continuous pyrolysis-reforming process performs well, with no operational problems and attaining complete HDPE conversion. Under the optimum conditions, i.e., 700 ºC, space time 16.7 g_{cat} min g_{HDPE}^{-1} and steam/plastic of ratio 5, the H_2 yield was 92.5 % of that corresponding to stoichometry, which accounts for a H_2 production of 38.1 g per 100g of HDPE in the feed.

Keywords: hydrogen; pyrolysis; reforming; plastic waste; conical spouted bed; Ni catalyst