Petrochemistry and Refining in a Changing Raw Materials Landscape
DGMK Conference October 9 – 11, 2017 in Dresden, Germany

Hydrogen production by Steam Reforming of Bio-ethanol: Catalytic Tests and Process Design

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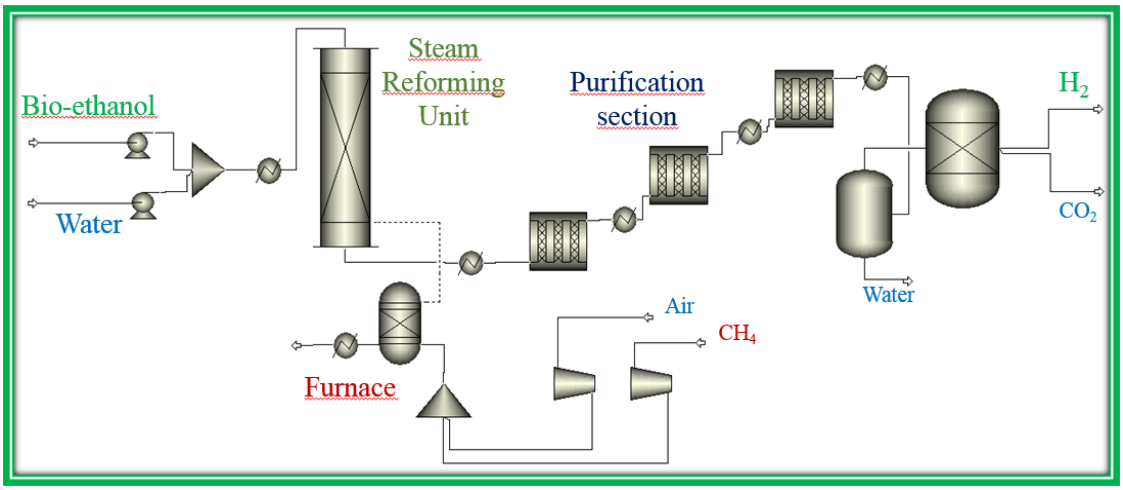
Abstract

2nd generation bioethanol was considered as raw material for the sustainable hydrogen production by catalytic steam reforming. An experimental kinetic investigation has been carried out selecting different catalysts synthesized by Flame Spray Pyrolysis, a one step high temperature synthesis able to impart strong metal-support interaction, besides high thermal resistance [1]. Ethanol conversion, selectivity to the main possible byproducts and the CO/CO_2 ratio, as a measure of the contribution of the water gas shift reaction, were correlated to the temperature, water/ethanol ratio and space velocity in a central composite experimental design [2]. Two different bioethanol samples, 50 and 90 vol%, produced and supplied by a company (Mossi&Ghisolfi), have been used at each temperature. Attention was paid to the catalyst resistance towards deactivation by coking.
The kinetic expression was implemented in a process simulation software (Aspen Plus), designing a high pressure reactor. A successive process design was investigated considering the hydrogen purification section as well and evaluating the economic feasibility of different plant configurations and operative conditions. Net plant efficiencies and total capital investment will be estimated as well as internal rate of return and payback period.



[1] M. Compagnoni, J. Lasso, A. Di Michele, I Rossetti*, *Cat. Sci. & Tech,* **6** (2016) 6247
[1] M. Compagnoni, A. Tripodi, I. Rossetti*, *App. Cat. B:Environ.,* **203** (2017) 899–909