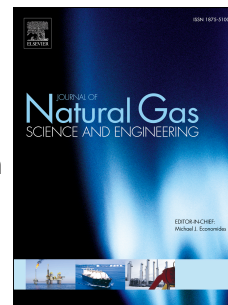


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Investigating the Potential of Carbon Dioxide Utilization in a Gas-to-Liquids Process with Iron-based Fischer-Tropsch Catalyst

Hadi Fazeli¹, Mehdi Panahi^{1,*}, Ahmad Rafiee²

¹ Chemical Engineering Department, Faculty of Engineering, Ferdowsi University of Mashhad, Mashhad, Iran

² Cardiff School of Engineering, Cardiff University, Queen's Buildings, The Parade, Cardiff CF24 3AA, UK

Abstract

A Gas-to-liquids (GTL) process with two different synthesis gas (syngas) production configurations including steam methane reformer (SMR) and auto-thermal reformer (ATR) was optimized to maximize wax production rate and carbon efficiency. The kinetic model used was the one given by Van Der Laan for an iron-based Fischer-Tropsch (FT) reactor (Van Der Laan and Beenackers, 2000). In this paper, Wang's correlation (Wang et al., 2003) was used to calculate chain growth probability (α). It was assumed that there exists a 300 MW coal-fired power plant with a downstream post-combustion CO₂ capturing unit nearby the GTL plant and all the captured CO₂ is available to be utilized in the GTL process. The optimization results suggested that the ATR- and SMR-based GTL processes could produce 68.17 and 101.4 tons/h of wax, respectively. Furthermore, about 166.4 tons/h of CO₂ was optimally imported from the power plant to the SMR, while there was no potential for CO₂ utilization in the ATR-based configuration. The GTL process with either SMR or ATR reformers is net CO₂ emitter and respectively releases ca. 194.1 and 131.3 tons/h of CO₂ to the atmosphere.

Keywords: Gas-to-liquids (GTL), Fischer-Tropsch (FT), Iron-based catalyst, Steam Methane Reforming (SMR), Auto-Thermal Reforming (ATR), Chain growth probability (α), CO₂ utilization.

* Corresponding author: Dr. Mehdi Panahi (mehdi.panahi@um.ac.ir)

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