Mary Kay O'Connor
Process Safety Center
2011 International Symposium
http://process-safety.tamu.edu

Safety and Techno-Economic Analysis of Solvent Selection for Supercritical Fischer-Tropsch Synthesis Reactors

Natalie A. Hamad[a,#], Nimir O. Elbashir[b,*] M. Sam Mannan[c], Mahmoud M. El-Halwagi[a]

[(a)] The Artie McFerrin Department of Chemical Engineering, Texas A&M University College Station, TX 77843, USA
[(b)] Chemical Engineering Program, Texas A&M University at Qatar PO Box 23874, Doha, Qatar
[(c)] Mary Kay O'Connor Process Safety Center, The Artie McFerrin Department of Chemical Engineering, Texas A&M University, College Station, TX 77843-3122, USA
[#]Speaker
*Corresponding author. e-mail: nimir.elbashir@qatar.tamu.edu

ABSTRACT

Fisher-Tropsch synthesis (FTS) is a primary pathway for gas-to-liquid (GTL) technology. In order to overcome commercial problems associated with reaction and transport phenomena, the use of supercritical media has been proposed to increase chemical conversion and improve temperature control. One of the major challenges in designing the supercritical FTS systems is the solvent selection. Numerous alternatives exist and should be screened based on relevant criteria[1]. The main aim of this paper is to identify an optimal supercritical solvent or a mixture of solvents that minimizes the cost while satisfying safety constraints. Hydrocarbons from C_3 to C_9 were identified as feasible solvents for FTS purposes. The choice of these solvents is dependent on their mixture critical temperature and pressure requirements that need to be satisfied upon entry into the FTS reactor. A safety metric system was developed in order to compare the risk issues associated with using different solvents. The identified safety concerns of using the solvents were incorporated into the safety metric. In addition, an economic analysis of using the different solvents is performed. Finally, a case study is solved to illustrate the use of the proposed metrics and the selection of solvents based on safety and techno-economic criteria.

1. Elmalik E., Tora, E., El-Halwagi M. M., Elbashir N. O. (2011) "Solvent Selection for Commercial Supercritical Fischer-Tropsch Synthesis Process" *Fuel Processing Technology*