



METHANOL REACTOR MODELS – PROGRESS AND CHALLENGES

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Abstract

The increasing dependency and subsequent demand of petroleum and its byproducts revolutionized the world; but at the same time, this rapid industrialization caused many environmental hazards. The world oil resources are depleting; global warming and the recent alarmingly high prices of oil have augmented the need for environment friendly alternate energy sources. Among these methanol is a critical chemical and has a pivotal role. The industrial scale methanol synthesis processes have improved over the decades, yet several commercial scale problems are still unsolved. The objective of this paper is to review the existing commercial processes(s) and the recent efforts in the field of modeling and simulation, carried out for the manufacture of methanol. Recent research history indicates many a options including membrane, fluidized or three phase reactors but their commercial versions are either at infancy level or at the developing stage.

Keywords: Methanol, Conversion Technologies, Modeling, Optimization, Catalyst Deactivation

1 Introduction

Fossil fuels remained the basic source of global energy demand for centuries, which has increased many folds during the last century. The increasing dependency and subsequent demand of petroleum and its byproducts revolutionized the world; but at the same time, this rapid industrialization caused many environmental hazards as well. The world fossil fuel resources are depleting and the cautions issued by Environmental Protection Agencies (EPA) around the globe have stricken energy-famished nations. The oil crisis of 1970s not only paved way for alternate energy sources but also stressed on the need of effective utilization of available resources [1, 2].

Alarmingly high prices of oil marked the start of this century. Having touched a lower mark in 2008, inevitable economic recession has severely affected, if not devoured, the economy of almost all countries. Worldwide GDP growth rate, fancied an average annual value of 4.9 % during 2003-2007, declined by an estimated 2.9 % in 2009. It is so feared that the future capital investments in energy sector may show some downward trends. Almost 30% (27% in 2007)[3]

of the world's total delivered energy is utilized in transportation sector, mostly as liquid fuels. According to International Energy Outlook 2010 (IEO2010) by U.S. Energy Information Administration, the share of renewable fuels especially of natural gas to liquid (GTL) technologies may increase substantially.

GTL process converts natural gas (NG) to high quality liquid synthetic fuels (synfuels). A route map of possible options for GTL is illustrated in Fig. 1. Several factors have contributed towards renewed interest in GTL processes[4], namely:

- (i) Increase in global energy demand
- (ii) Existence of large volumes of stranded natural gas in remote and inhospitable areas
- (iii) High price of crude oil which improved the economic viability of GTL process, that has the drawback of very high investment costs