UNIVERSITI TEKNOLOGI MARA

EFFECT OF DIFFERENT TEMPERATURE USING ENERGY ANALYSIS FOR POWER TO METHANOL PRODUCTION PLANT

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ABSTRACT

Methanol is one of the valuable chemical that has a high demand all over the world due to its various purposes and usage. Mostly, the large production of methanol are using natural gas as raw material. Lately, the issues of global warming has arising thus it is believed the accumulation of CO_2 (carbon dioxide) in the atmosphere is one of the factor that lead to the problem stated. Therefore, one of the way to reduce the CO_2 impact to environment is by capturing CO_2 from the environment and produce a product which is methanol. As for now, there are no evaluation of energy along with high selectivity and conversion for methanol plant. Usually, the previous researcher only do a research for a higher selectivity but did not including the energy consumption for methanol plant. Therefore, in this paper, the design and simulation of methanol plant also analysation of the energy consumption using energy analysis is being conducted. There are two objective in this research. First, to design and simulate methanol power to methanol plant using different temperature in the reactor. Second, to analyse the energy consumption of methanol plant using energy analysis by manipulating temperature in the reactor. 3 condition (reactor feed) of methanol plant are simulated using aspen HYSYS V8.8 which are plant 1(442 bar, 280˚C), plant 2(76 bar, 280˚C) and plant 3 (442 bar, 210˚C). The energy is calculated by manual calculation according to standard formula of each equipment and being compared with HYSYS value. From the calculation, it is proven that plant 3 is the least energy required followed by plant 1 and plant 2. For plant 3, the overall energy required is 7,235.992kW that costs RM 256,877.716. Next, plant 2 required 38,655.44kW that costs RM 1,372,623.12 while plant 1 required 10231.1kW that costs RM 363,204.05. Therefore, plant 3 is the least energy and costs required with feed of reactor condition (442 bar, 210˚C).

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

Methanol is a liquid chemical with chemical formula CH_3OH and often abbreviated as MeOH. Methanol is a highly demand chemical because of its properties and characteristic. The global methanol production currently about 45 million metric ton per year which the major producer of methanol is China with the plant capacity of producing 5,000-6,750 ton per day. This large plant capacity are followed by the Middle East, Russia and Trinidad and Tobago. Methanol are essential to economy growth and basically methanol is the precursor of the other chemicals such as Formaldehyde, Dimethyl ether, Acetic Acid, Methyl tertiary Butyl ethylene (MTBE), Methylamine, Methane oxide and many more. Approximately 45 % of methanol is converted to formaldehyde and the other is to make a diverse plastics, plywood and permanent press textiles.

Nowadays, most of methanol plant around the world is using syngas method to produce a large production of methanol. Syngas means the raw material to produce methanol is natural gas. However, there are other ways to produce methanol which is CO_2 capture. CO_2 capture is still a new technology and not commercially used. This is because more research needed to determine the viability of the technology in order to produce large production of methanol.

The idea of capturing CO_2 arising when there a lot of problem related to emission of CO_2 to the environment. On the other hand, the increasing CO_2 concentration in the atmosphere is indicated as the main cause of the green-house effect on the planet with consequent climate change (Barbarossa, Vanga, Viscardi, & Gattia, 2014). The CO_2 emission are mostly comes from industrial activity as they release a significant amount of CO_2 during process in their plant. Nowadays, industry and petroleum refineries are responsible for nearly 40% of the global energy demand and around one-third of the world anthropogenic CO_2 emission (Berghout, Kuramochi, Broek, & Faaij, 2015) . Due to a huge release and global warming contribution,