UNIVERSITI TEKNOLOGI MARA

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

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ABSTRACT

Emission of carbon dioxide to the atmosphere can cause a global warming. Global warming is the increasing of the earth's atmosphere overall temperature in which it is contributed by the greenhouse gas (GHG) emission such as carbon dioxide, methane and nitrous oxide. The main contributor to the emission of the carbon dioxide into the atmosphere is the industry of power plant in which it contributed 40% of carbon dioxide emissions into the atmosphere. The term of carbon dioxide captured is used to separate carbon dioxide from the fuel gas. The configuration of technology for capture carbon dioxide is post-combustion by using an absorption method using monoethanolamine (MEA). Methanol is a main product of carbon dioxide utilization in this research in which it can be produced by capturing carbon dioxide with hydrogen gas and it can be used in many products such as fuels application. The aims of this research are to design and simulate power to methanol plant by using different volumetric flowrate and to analyse energy consumption using energy analysis by manipulating different volumetric flowrate. The method used to simulate the methanol plant by using carbon dioxide and hydrogen as a raw material is the Aspen Hysys software. The energy consumption analysis was investigated by using effect of volumetric flowrate of carbon dioxide which is 1595.5 and 49577.5 m^3/h and also hydrogen which is 158.2 and 4959.02 m^3/h. The other fixed variables are temperature which is 210^0C, pressure at 75.7 bar and reactor volume at 45 m^3. Three plants are simulated in the Aspen Hysys and the energy consumption duty was analysed. The total energy duty for plant 1 is 146775 kW in which it cost about RM 59,713.14 meanwhile for plant 2, the total energy duty is 3510 kW and has a cost about RM 2,003.87. Lastly, the total energy duty for plant 3 is 393789 kW in which it is cost RM 191,876.35. Therefore, it can conclude that the plant that has the lowest cost is plant 2 with the cost of RM 2,003.87 per month compared to plant 1 and 3. The reason is because of the low volumetric flowrate enters the plant in which it contributes a small amount of energy duty that only consumes 3510 kW compared to the other plants and thus, it can be stated that the lower volumetric flowrate for feed, the smaller amount of energy it will be used and thus used a low cost for the production.

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CHAPTER ONE

INRODUCTION

1.1 Background of Study

Carbon dioxide is one of the important gaseous needed in the world as much as oxygen gas. All of the plants in the world are needed carbon dioxide to make a photosynthesis process in which that process will produce oxygen gas. This process is important because humans need oxygen gas to survive and live. The emission of carbon dioxide to the atmosphere is very important to the survival of the humanity but if it is only emits into the atmosphere in the lower quantity. Excessive emission of carbon dioxide to the atmosphere will make the planet suffering a dangerous climate change. In the other word, the natural or anthropogenic emission of carbon dioxide into the atmosphere will make the temperature increase and thus create a global warming (Ghommem, Hajj, & Puri, 2012). Global warming is the increasing of the earth's atmosphere overall temperature in which it is contributed by the greenhouse gas (GHG) emission. The main contributor to the greenhouse gases is carbon dioxide (CO_2). Other than carbon dioxide, the other gases are water vapour (H_2O), methane (CH_4), nitrous oxide (N_2O) and fluorinated gases (Freije, Hussain, & Salman, 2017).

There are several sources that contribute to the emission of the carbon dioxide into the atmosphere such as industry and agriculture which is come from the waste management, power plant, refineries and paper mills. Next, buildings also can emits carbon dioxide such as the particular residences, offices and malls and lastly, from the vehicles. Railways, aircraft and roadstead can also emit carbon dioxide into the atmosphere and causes a global warming (Ioan & Amelitta, 2015). From all of these sources, the main contributor to the emission of the carbon dioxide into the atmosphere is the industry of power plant in which 40% of carbon dioxide emissions is come from the power plant (Van-Dal & Bouallou, 2013). Power plant is basically used to generate the electricity from fuels. There are two types of fuels