UNIVERSITI TEKNOLOGI MARA

INVESTIGATION ON THE PERFORMANCE OF AMINE-BASED ABSORPTION AND ITS BLEND FOR THE REMOVAL OF HIGH CO_2 CONCENTRATION USING HYSYS

MUHAMAD RASHDAN BIN ABD HALIM

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Faculty of Chemical Engineering

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ABSTRACT

Removal of CO_2 from natural gas is currently a global issue. Apart from meeting the customer's product specifications; it is also a measure for reducing the damage to pipeline and equipment system. Those problems arised when the CO_2 removed is insufficient or still not enough to reduce the effect of CO_2 from becoming acidic and corrosive because it forms carbonic acid by reacting with water vapour. This research aims to determine the optimum ratio of diisopropanolamine (DIPA) and sulfolane for the removal of high CO_2 concentration and optimizing the performance of amine based absorption and its blend for the removal of high CO_2 concentration by using different values of operating conditions. A standard base case of typical CO_2 removal process was prepared first using Aspen HYSYS V8.8 process simulation tool. Then, the optimization of the conditions was done using Response Surface Methodology (RSM) analysis by controlling and modifying the parameters and conditions to improve process performance. The tool used was Minitab 18. To conclude the analysis, it can be said that the optimum ratio of DIPA and sulfolane is nearing 1:1, although the result shows that DIPA has a slightly bigger role in the removal of CO_2 as compared to sulfolane. For the effects of temperature and pressure, the analysis states that the temperature effect is greater than pressure. The mole fraction of CO_2 in sweet gas is lowest (less than 0.0005) at temperature approximately between 33℃ and 49℃ and pressure of 6780 kPa to 7300 kPa.

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CHAPTER ONE
INTRODUCTION

1.1 RESEARCH BACKGROUND

Natural gas (NG) is basically shaped from the disintegration of living matters, for example, plants, creatures and microorganisms that lived more than a huge number of years prior and turned into a lifeless blend of gases, as other non-renewable petroleum derivatives. There are a number of types of formation that refer to different types of NG namely thermogenic, biogenic and abiogenic methane. All of the stated types of NG are unique in their own ways, which are different by means of how they are formed and at what depth they forms (Shimekit and Mukhtar, 2012).

In every parts of the world including Malaysia, NG is viewed as a perfect, proficient and solid fuel utilized in power generation, enterprises, transportation, business and private. Malaysia's gas assets is roughly 100 trillion standard cubic feet (tscf). The origin of NG in Malaysia started way back in 1984, with the Peninsular Gas Utilisation (PGU) project was developed to further add worth to Malaysia's gas resources. Petronas Gas Berhad and Gas Malaysia Berhad are the two main organization for gas transmission and distribution pipelines. Most importantly, NG is used as a feedstock for most processing plants that are producing fertilizer, ammonia, methanol etc.

NG have distinctive scope of structure contingent upon category, depth and area of the underground reservoirs of permeable sedimentary accumulation and the zone's geography. The parts of NG incorporate hydrocarbons (C_1-C_8), nitrogen (N_2), hydrogen sulfide (H_2S), carbon dioxide (CO_2) and water (H_2O). CO_2 which is the main pollutes in NG feeds must be expelled as it is likely to lessen the gas' energy content and influence the offering value of the product. Besides, it ends up containing high acidity and destructive within the sight of H_2O that can possibly harm the pipeline and the equipment system. Meanwhile in Liquefied Natural Gas (LNG) handling plant, while refrigerating the gas to a lower temperature, the CO_2 can be solidified and upset pipeline