AUTHOR'S DECLARATION

"I hereby declare that this report is the result of my own work except for quotations and summaries which have been duly acknowledge"

Muhammad Ridhauddin bin Mohd Said 24 July 2017

2014863002

ACKNOWLEDGEMENT

I really wanted to express my gratitude to several important people that give as strong support all the way from nothing until the research done. This report cannot be completed without the help and guidance from those important people that do not hesitate in giving help when needed.

Firstly, I would like to give a big thank and acknowledgement to my supervisor, Dr Azil Bahari Alias for every single guidance, help and motivation he has given to me. Also, I would like to express a gratitude to the lecturers of the Faculty of Chemical Engineering for their guidance in completing the final year project.

Next, I would like to thank the lab assistants who guide me during my time in the laboratory. Last of all, I want thank to all of my friends who had help me a lot from start to finish.

ABSTRACT

Nowadays, great effort has been done on the finding of the utilization of coal fly ash. This is because the amount of coal fly ash generated annually is enormous and has become quite a concern because if it is not disposed properly it might bring a lot of problem to the environment. The objectives of this study were to produce hydrogel biochar coal fly ash (HBC-CFA), study the characteristics of the hydrogel produced, study its efficiency on H2S removal and compare it with hydrogel produced from the biochar of empty fruit bunch. The HBC-CFA was prepared by using several materials which were acrylamide (AAm) as the monomer, N, N'- Methylenebisacrylamide (MBA) as the crosslinker and Ammonium Persulphate (APS) as the initiator and raw coal fly ash itself. Analysis equipment that were used in the characterization of HBC-CFA were Thermogravimetric Analyzer (TGA) to study the proximate properties, Elemental Analyzer (EA) to study the ultimate properties, Brunaeur-Emmett Teller (BET) to study the surface area and Scanning Electron Microscopy (SEM) to study the morphology. For the study on its efficiency of H2S removal two parameters have been chosen which were the effect on bed loading and the effect of wetness. The number of bed used for adsorption was varied from 1 to 3 to study the effect of loading while 3 wet beds loading have been used to study the effect of wetness. For the study on bed loading, 3 beds loading recorded the most H2S gas adsorption with 209ppm adsorption value while for the study on wetness, wet bed recorded the most H2S gas adsorption with 241ppm adsorption value. The study on the comparison on chracteristics between HBC-CFA and HBC-EFB showed that the HBC-CFA has higher surface area, pore volume and smaller pore diameter which were a good characteristics for and adsorbent. However, HBC-EFB has higher efficiency in H2S removal than HBC-CFA. The recorded value for 3 beds loading for HBC-EFB is 241ppm while for wetness is 262ppm. Both values are higher compared to HBC-CFA. The percent of H2S removal were ranging from the lowest which was 46% to the highest which was 66%.

CONTENTS

CHAPTER 1

INTRODUCTION

1.1 Research Background

Coal fly ash also known to be involved in the production of low cost adsorbent. Coal fly ash are cluster of spherical particles with a diameter ranging from 1 to 100μm and typically grey in colour, quite abrasive and mostly alkaline in nature (Lee, Soe, Zhang, Ahn, Park, & Ahn, 2017). This ash produced as a waste product during the combustion process of coal in generation of electricity. The quantity of coal fly ash generated annually is quite enormous due to large quantities of coal power plant worldwide. According to (Sun, Luo, Fan, & Lu, 2017), the amounts of coal fly ash generated per year in China alone continuously increasing from 155 million tonnes in 2002 to 620 million tonnes in 2015. The enormous quantity of coal fly ash produced can lead to several problems such improper disposal and air pollution.

Fortunately nowadays, most countries begin to utilize the coal fly ash. India utilize 38% of generated coal fly out of 112 metric tonnes while some Europe countries such as Denmark, Italy and Netherlands utilize 100% of the coal fly ash produced (Gupta, Gedam, Moghe, & Labhasetwar, 2017). Fly ash is widely known as its usage as a raw feedstock in the production of cement and ceramic material. This is because, coal fly ash made up by components such as silicon oxide, aluminium oxide, iron oxide and calcium oxide which is which is quite similar to ceramic material in terms of their chemical