CHAPTER I

INTRODUCTION

The greenhouse gas (GHG) emission in the world has been increasing significantly due to the energy industry and the transportation sectors. It is widely accepted that carbon dioxide (CO_2) is the most important greenhouse gas with the largest impact on climate change (Shafeeyan *et al.*, 2010). Carbon dioxide is not the gas that gives the most severe global warming impact among the greenhouse gases, but it has the highest annual emission into the atmosphere which makes it the most unavoidable anthropogenic GHG (Lee *et al.*, 2012).

In order to reduce the greenhouse gas emission to the atmosphere, carbon capture and storage (CCS) strategy has been introduced. There are four main approaches to capture CO_2, including cryogenic distillation, membrane purification, absorption with liquids, and adsorption using solid. A widely developed technology to separate CO_2 from flue gas and natural gas stream is based on absorption using liquid amine. Piperazine is diamine which has been studied as a promoter for amine system because it gives highest absorption rate of all alkanolamines (Cullinane and Rochelle, 2006). However, gas absorption using liquid amine has been used for CO_2 scrubbing on industrial scale for decades and with the numbers of shortcomings, such as severe corrosion to equipment and regeneration of amine solution is highly energy intensive (Sayari *et al.*, 2011). To overcome their limitations, adsorption is considered as one of the potential options because of the low energy requirement, cost advantage, and ease of applicability over a wide range of temperature and pressures (Shafeeyan *et al.*, 2010). There are numerous materials that could be developed for CO_2 adsorption with respect to their differences in advantages and drawbacks, such as activated carbon, zeolite, mesoporous silicates, and metal oxides. Previous work studied on the synthesis and characterization of modified biopolymer with piperazine derivative for CO_2 adsorption (Saiwan *et al.*, 2012). In this work, activated carbon impregnated with piperazine was studied. In this study, the adsorbent was modified with piperazine to improve the adsorption capacity.