CHAPTER I

INTRODUCTION

Normally, flue gas released into the atmosphere from most industries, including petrochemical industry, contains approximately 80 % N_2, 15 % CO_2, and 5 % O_2, as well as 500 ppm SO_2, 100 ppm CO, and 50 ppm CH_4. These gases produced by combustion of fossil fuels are regarded as greenhouse gases. Among them, CO_2 has the most adverse impact and causes approximately 55 % of the currently observed global warming. The increasingly accumulated CO_2 in the atmosphere has become a worldwide concerned problem. Therefore, people around the world need to protect the environment and slow down the climate change by reducing emission of CO_2 (Zhang *et al.*, 2008).

To reduce greenhouse gas emission, CO_2 separation and capture technologies are of growing importance. There are four main widely used commercial CO_2 removal processes. They are absorption, adsorption, membrane, and cryogenic processes. However, the most important commercially applied technology for CO_2 removal is the absorption process, which can be called extraction process, by using a liquid solvent.

Liquid solvents used in CO_2 absorption can be divided into two categories: chemical and physical solvents. The processes using amine-based solutions, such as alkanolamines, that chemically react with dissolved CO_2 are commonly used to enhance gas absorption rate and capacity and to improve selectivity. Monoethanolamine (MEA), diethanolamine (DEA), and methyldiethanolamine (MDEA) are some important amines, which are widely used. However, the conventional primary and secondary alkanolamines exhibit a relatively low maximum capacity for CO_2 capture. Moreover, there are other amines, i.e. piperazine (PZ, a diamine), that have been considered as a promoter for amine systems to improve absorption kinetics, such as MEA/PZ and MDEA/PZ blends, and to increase the concentration of PZ in solution allows for increased solvent capacity and faster kinetics (Freeman *et al.*, 2009).

The purposes of this research were to investigate the performance of hybrid solvents blended between primary, secondary, or tertiary amines and PZ for CO_2 removal from flue gas in terms of CO_2 absorption capacity, and to examine the solvent regeneration temperature to evaluate the solvent performance for reuse in CO_2 removal from flue gas.