CHAPTER I
INTRODUCTION

Greenhouse effect has become a serious environmental problem for human beings. Greenhouse gases that come from many sources such as burning of fossil fuels and industrial processes are considered to be the main reasons for global warming and carbon dioxide is one of the major greenhouse gases. The total carbon dioxide emission into the atmosphere has been increasing year by year since the industrial revolution resulting in the increasing in the earth's surface temperature (Chatti *et al.*, 2009).

To tackle this problem, many strategies of carbon capture and sequestration have been proposed by the scientific community. There are several feasible techniques such as absorption, membrane separation, cryogenic separation, and adsorption (Chatti *et al.*, 2009). Nowadays, the commercial carbon dioxide capture is chemical absorption with alkanolamine but many limitations have been found e.g., it is very difficult to regenerate the solvent and alkanolamine is corrosive (Xu *et al.*, 2009).

Recently, adsorption is believed to be one of the most reliable methods to capture carbon dioxide. Many researchers have developed novel adsorbents to make carbon dioxide separation more effective (Chatti *et al.*, 2009; Somy *et al.*, 2009; Kim *et al.*, 2010). Surface area and pore size distribution are the crucial properties for the adsorbents. Moreover, a suitable adsorbent should have high selectivity, adsorption capacity, and high adsorption/desorption kinetics for carbon dioxide. Activated carbon, silica, carbon molecular sieves and zeolite are porous materials that can be used as an adsorbent. Yet, the higher adsorption capacities can be achieved by modifying the surface of those materials with metal oxide or amine groups. Hydrotalcite is another material used as an adsorbent to capture carbon dioxide from combustion of fossil fuel and steam reforming process at high temperatures (Lee *et al.*, 2007).

To improve carbon dioxide adsorption capacities, many researchers modified activated carbon by several functional groups. Guo *et al.* (2006) used ethylenediamine and ethanol, and KOH. Somy *et al.* (2008) used Cr_2O and Fe_2O_3. Kim *et al.* (2010) used copper oxide. As reported, carbon dioxide adsorption capacities of modified adsorbent were higher than activated carbon alone. In the work of Sanz *et al.* (2010), SBA-15 mesoporous silica was modified by polyethyleneimine (PEI) and the highest carbon dioxide capacity was 95.4 mg/g at 75 °C and 5.5 atm. Chatti *et al.* (2009) synthesized novel adsorbents by immobilizing several amines (MEA, ethylenediamine, and isopropanol amine on 13X zeolites and the adsorption capacity of zeolite modified by isopropanol amine was the highest at 22.78 mg/g. According to that, the use of amino groups modified to a solid support considerably enhances carbon dioxide adsorption capacities.

In this work, activated carbon was modified by N-methylethanolamine and monoisopropanolamine, piparazine, and K_2CO_3 by impregnation method and used as an adsorbent. To characterize the novel adsorbent, XRD, BET, and TGA were used to confirm the formation of amines on the activated carbon. The amount of carbon dioxide adsorption was measured and also the effects of adsorption temperature and the amount of amine loading were studied. In addition, the comparison of CO_2 adsorption capacity between two different types of amines was made.